PROCEEDING

THE POWER OF LOCAL KNOWLEDGE

IN INCREASING FOOD BUSINESS COMPETITIVENES

TUESDAY, 4th DECEMBER 2012

THE 1ST INTERNATIONAL 12TH NATIONAL

STUDENT CONFERENCE

FOODTECH UNIKA

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PREFACE

National Student Conference on food science technology has become the identity of Department of Food Technology, Soegijapranata Catholic University. Since 2000, this annual event had discussed various topics related to food science and businesses with recognized experts in their fields are cordially invited as keynote speakers. And thanks be to God, in this year, we can make these conferences as the 1st International Student Conference and 12th National Student Conference.

The theme of this year conference is "The Power of Local Knowledge in Increasing Food Business Competitiveness". This year theme was selected as a support towards local knowledge in creating a food business. Therefore with this conference, participants are expected to contribute in developing their own local knowledge to create food products that have more selling points. In addition, the conference is expected to be the place for student of food technology and other related sciences, food industry practitioners, and food scientists to share knowledge and innovative ideas for the development of the food in the future.

Lastly, I would like to give my sincere gratitude to all the honorable keynote speakers, sponsors, presenters, and participants for the valuable contribution and support for this conference. Also, I would like to give my gratitude to the committee members that has been work hard in order to make this conference happen. As this was our first time to hold the international conference, on behalf of the committee, I would like to apologize for our shortcoming. We always welcome any critics and suggestion for betterment of the next International and National Student Conference. I hoping all of you can enjoy the conference.

Have a nice conference!

Chairperson,

Nawang Sari Adhiyanti Muljo Kusumo

FOOD BUSINESS AND MANAGEMENT

FOOD PROCESSING AND ENGINEERING

FOOD MICROBIOLOGY AND BIOTECHNOLOGY

FOOD QUALITY AND SAFETY

HERBAL FOOD AND BEVERAGE

EXPLORING THE PROBLEM SOLUTIONS AND BUSINESS POTENTIALS OF NUTMEG AS INDONESIAN LOCAL COMMODITY

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ABSTRACT

Nutmeg (*Myristica fragrans* houtt) is an Indonesian local indigenous commodity which is originated from Indonesia. Nowadays, it becomes one of the main agricultural products of the country, as Indonesia is currently the world largest nutmeg producer, covering about 60% of world nutmeg demand, and this production number is still increasing over years. Nutmeg itself has a wide range of functionalities and high economic value. However, despite of the potentials of Indonesian nutmeg, there are several main problem occurred, such as low quality product, inoptimal utilization, and proper export handling. Therefore, this paper will explain further about the obstacles related to nutmeg in Indonesia, and also ideas to address these problems. In addition, this paper will also explain about the potential of Indonesia to boost not only its dominance in the world nutmeg production, but also to optimally utilize the potentials of nutmeg, in order to increase the business competitiveness and economic development. One of the most significant alternatives is by developing various kind of potential nutmeg based food and beverage products to increase food business competitiveness in Indonesia.

Keywords : *nutmeg, oil, food business, mace, global market*

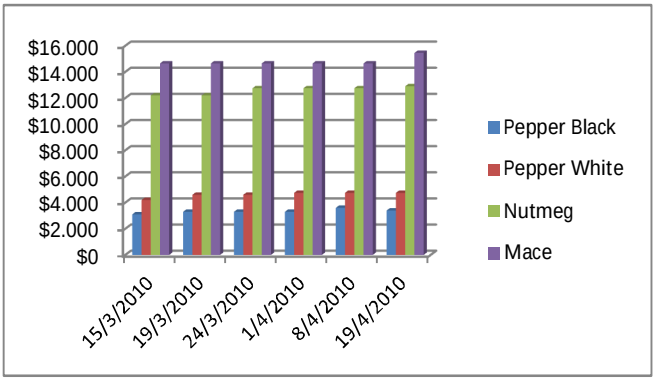
BACKGROUND

Spices are a group of local commodity which has a long history of interests. During imperialism and colonialism era, westerners considered spices are unusually effective as medicines and disease preventives. Besides, they were also burned as incense in religious rituals and distilled into perfumes and cosmetics. Prized as consumer goods by the affluent, spices were symbols of material comfort and social prominence (Anonymous, -).

Through generations, spices are still becoming one of the important needs for human life due to its multi functionality, such as for food additives, medicine, cosmetics, and many more. In Indonesia, one of the most distinguished kind of spices is nutmeg. Nutmeg is peach-like fruit contains a nut, enveloped by a hard shell, which is covered by sharply red coloured mace. When the fruit is ripe, it bursts open ("explodes"), revealing the red colourful mace. Nutmeg (*Myristica fragrans*) is an indigenous spices commodity originated

from the Moluccas (Maluku), a group of islands in eastern part of Indonesia (Purseglove *et al.*,1995).

From the data showed at Graph. 1 (which shows the price comparison in 2010 of nutmeg and mace, another products from nutmeg plant, compared to black pepper and white pepper), it can be concluded that nutmeg and mace are commodities with a high economic value among other spices. Besides of its high economic value, nutmeg is highly regarded due to multi-functionality, since every part of the fruit could be utilized in various kinds of manufacturing industries. Seeds, mace, and nutmeg oil is the main export commodities which are commonly used in food and beverages industries.



Graph 1. Price comparison of nutmeg, mace, and pepper (black, white) in 2010

In addition, the importance and potentials of nutmeg in Indonesia become very significant, as Indonesia is currently the world largest producer and exporter, by covering 60-75% of global demand (Nurdjannah, 2007). The future potential of nutmeg as Indonesian commodity is also showing an increasing trend during the period of 1999-2004 (Table 1.).

Table 1. The volume and value of Indonesian nutmeg export and import.

Year	Export		Import	
	Volume (ton)	Value (x 1000 US$)	Volume (ton)	Value (x 1000 US$)
1999	9.625	49,124	44	80
2000	10.808	58,249	104	152
2001	8.465	36,151	41	100
2002	10.411	39,528	23	77
2003	11.377	41,038	56	152
2004	15.194	50,831	79	827

With the combination of high number of nutmeg production in Indonesia and the various potentials of nutmeg itself, Indonesia could become the world leader in terms of nutmeg products and derivatives.

However, the problem occurred in Indonesia is that the utilization and processing of nutmeg are still not optimal yet, and can still be further explored.

NUTMEG AS MULTI- FUNCTIONAL COMMODITY

For most of indigenous Indonesian people, nutmeg, which is commonly called "pala", is just used for cooking and making traditional herbal drinks and medicines. However, nutmeg functionality is actually far beyond these, as many kinds of products and derivatives can be manufactured from many parts of the fruit. Nutmeg fruit consists of approximately 77,8% fruit pulp, 4% mace, 5,1% shell, and 13,1% seed. (Rismunandar, 1990).

The fruit pulp is the largest proportion of nutmeg, and has many advantages to human health, as it can reduce insomnia, cough, and help digestion.

However, nutmeg seed and mace are commercially the most important part, because they can be processed into essential oil and oleoresin which have a high economic value. Besides, they can also processed into nutmeg butter, the raw ingredients for edible oil and cosmetics manufacturing (Somaatmaja, 1984).

Oleoresin and nutmeg oil are two main products produced from nutmeg seed and mace. Oleoresin is thick liquid product manufactured from spices. This product is obtained by extracting nutmeg seeds or mace using organic solvents such as alcohol, methanol, acetone or hexane. Residual pulp from refining that still contains nutmeg oil is only used as a fertilizer and mostly discarded.

Figure 1. Nutmeg oleoresin

In the other hands, nutmeg oil is oil product from nutmeg which is extracted by using steam extraction and distillation. In perfume industries, nutmeg oil is used for substance used in perfume and room freshener. It also used in pharmaceutical industries such as stomachache, dysentery, and bronchitis. Nowadays, the development of nutmeg oil is used as the raw material for aromatherapy making. The main compound of nutmeg and mace is *myristicin*, *elemicin* dan *iso-elemicin*, which can decrease the stress level. In other form, nutmeg oil can be utilized to make *potpourri*, fragrance wax, *atomizer* and other fragrance products.

Figure 2. Nutmeg oil

In addition, the seed of nutmeg and mace were also important part in Indonesian history and considered as local knowledge richness. This is because local indigenous people already recognized the functionality of the seed and mace as pain reliever, also as medicine to cure cold, stomachache, and intestinal disorder, and use them as one of the important part of their lives.

INOPTIMAL UTILIZATION AND EXPORT HANDLING OF NUTMEG IN INDONESIA

But, despite of the recognized multi-functionality and also the potentials of Indonesian nutmeg, there are several major problems occurred, which caused the utilization of nutmeg potentials have not been optimal yet.

The first problem is that the exporting handling of Indonesian nutmeg is the lack of export mechanism, as many neighboring countries can take economic advantages from Indonesia's nutmeg production. For example, Singapore and Vietnam bought raw nutmeg from Indonesia and re-exported the nutmeg in a significantly higher price, after applying slight processing, and sometimes without any processing applied (they just re-exported it in a whole raw form). The other example is India, which imported the defective nutmeg from Indonesia and then extracted them, and then re-exported the extracted materials to Europe and America. (ITC Grenada, 2010).

This problem can be caused by combination of many factors, such as improper nutmeg exporting, lack of technological advance, and also the inoptimal utilization by Indonesian local people.

The second problem is that the quality of Indonesian nutmeg is considerably lower than the competitors, i.e. Grenada. This is because the processing and selection of nutmeg in Grenada is much more careful in Indonesia. In Indonesia, careless processing procedure resulted in more defected nuts, which means lower quality (ITC Grenada, 2010). The other important factor could be the lack of knowledge of nutmeg farmer regarding to the proper agricultural practices.

ADDRESSING THE PROBLEMS

In order to address the problem related to the improper export handling, low quality of Indonesian nutmeg, and also inoptimal utilization of nutmeg potentials, there are three main steps that should be taken by both the government and also the people, which are : 1) nutmeg quality improvement; 2) proper export handling; 3) nutmeg-based product innovation to generate business competitiveness, especially for food and beverages SMEs (Small and Medium Entrepreneurs)

Nutmeg Quality Improvement

In order to improve the Indonesian nutmeg quality, the government should support the nutmeg agricultural sector in Indonesia, by providing a comprehensive counseling about good agricultural practices, especially in terms of nutmeg plantation. Then, the government should further support the farmer by providing infrastructures, such as irrigation, fertilizer, prime quality seeds, and more importantly, the proper distribution of harvested nutmeg from farm to the logistic depository.

The second step to increase the nutmeg quality is by technological advancement. By applying proper processing with a proper technology, especially for nutmeg oil and oleoresin, it can be generated a better yield and quality of nutmeg oil and oleoresin. By doing so, the quality of Indonesian nutmeg will be significantly increased and can meet the quality demand of international market.

Proper Export Handling

Then, the government should improve the export handling of nutmeg in Indonesia, so that the revenue of nutmeg production in Indonesia can be increased significantly. This could be done by initiating a proper distribution and export handling to main importing countries, especially in the Western Europe and American region. Besides, Indonesia can boost its own manufacturers, especially for nutmeg oil-based medicine, perfume, and cosmetics producers. Therefore, Indonesia can fully utilize its potential as the world's leading nutmeg producer, and can generate more revenue, to increase its economic development.

Generating Food Business Competitiveness

It already stated above that approximately 77,4% of nutmeg fruit is the pulp, and the pulp can be processed into many kind of potential food and beverage products. In addition, the pulp also contains several functional compound which can promote health.

Judging the world recent food trend which already shifted from "delicious food" to "smart food" (smart food means food which is not only delicious, but also have functional effects), nutmeg based food and beverage products could become potential functional foods which are favored by people.

In addition, the innovation and development of nutmeg food and beverage producers, it can boost the number of either SMEs (Small and Medium Entrepreneurs) or large companies to increase food business competitiveness in Indonesia.

POTENTIAL NUTMEG BASED FOOD AND BEVERAGE PRODUCTS

Several type of potential food products from nutmeg are nutmeg kickshaw, dodol, jelly/ jam, while several potential beverage products from nutmeg are “sari pala”/ nutmeg extract beverage, instant nutmeg, and cider.

Nutmeg kickshaw

There are two kind of nutmeg kickshaw, which are dried nutmeg kickshaw and wet nutmeg kickshaw. Generally, the bigger sized nutmeg are used for making dried nutmeg kickshaw, and the smaller sized nutmeg for making the wet ones.

Kickshaw is made by soaking the pulp with sugar solution with addition of preservatives (i.e. sodium metabisulphite) for 24 hours, and then dried either in sunlight or oven before packed.

Figure 3. Nutmeg Kickshaw

Dodol

Dodol is semi-solid food made from a mixture of glutinous rice, nutmeg pulp, and coconut milk. Nutmeg dodol can be made either from the nutmeg fruit pulp or the remaining pulp filter residue in the manufacturing process of nutmeg syrup or jelly.

The making process of nutmeg dodol is by soaking the pulp in lime water, then continued with blanching and blending with glutinous rice flour. The mixture is then put into the cooked coconut milk and added with cane sugar and palm sugar. After that, the mixture is continuously stirred while cooked until form an elastic semisolid gel.

Figure 4. Nutmeg Dodol

Nutmeg jelly/ jam

Nutmeg jelly/ jam is semi solid food made from nutmeg fruit extract. The important compound of this process is pectin. More pectin inside, better nutmeg jelly product. Ripened nutmeg is the best choice to make the jam with the best characteristic, due to its high content of pectin and starch. Pectin and starch content is one of the most

important factor in determining the quality of nutmeg jam produced.

The making process of nutmeg jam/ jelly is including slicing, blending, heating, filtering of nutmeg to extract the essence of fruit pulp. Then, the extract is added with sugar and cooked until it formed a jelly-like thick solution.

Figure 5. Nutmeg jelly/ jam

Nutmeg fruit extract

Due to its typical aromas and taste of nutmeg pulp, extract of nutmeg fruit pulp can also be processed into beverage. However, bitter and tangy taste from tannin levels contained in the fruit reduces the level of consumer acceptance. Then, in order to relieve tangy taste can be done by immersing the fruit pulp in a 5% salt solution or 2% lime solution for 12 hours (Djubaedah et al. 1995). Syrup obtained from nutmeg pulp can be stored up to 6 weeks without any mold growth and reduced levels of sugar. The overall making process are soaking with saline solution (lime or salt solution), extraction, and addition of sugar solution. The extract solution is ready to bottled or packed. (Djubaedah *et al*., 1995)

Figure 6. Nutmeg fruit extract

Instant Nutmeg drink

Slightly the same with nutmeg fruit extract, but it is powdered. The making process of this product is including the soaking of nutmeg fruit pulp with saline solution, extraction, sugar addition, and spray drying to yield instant nutmeg powder drink.

Nutmeg Cider

Cider is form of fermented fruit extract. Nutmeg can be an alternative raw materials for cider because it has 10,9% carbohydrates contain.

The making process of nutmeg cider is quite the same with common cider production, which including the soaking in saline solution, dilution with water, blending, addition of sugar solution, sterilization, inoculation of starter *S.cereviceae*, incubation, purification, and packaging.

Figure 7. Nutmeg cider

CONCLUSION

Indonesia is the world largest producer of nutmeg in the world, by covering 60-75% world production. Nutmeg itself is a type of spice which has a various utilization and high economic value in international market.

However, the problems occurring in Indonesia is that the utilization and handling of nutmeg, either in terms of production, processing, and distribution (including exporting) have not been optimal yet.

Therefore, the solution should be done by three steps, which are quality improvement, proper export handling, and generating food business competitiveness. Quality improvement will be encouraged by the government through counseling, technology improvement, and infrastructure provision, while proper export handling will be done by initiating a proper distribution, directly to the main importing countries, especially for developed countries in the Western Europe and America.

Then, the last step to increase the economic value and boost Indonesian economic development is by generating nutmeg based- food and beverage manufacturing businesses, either in the level of SMEs, or large companies.

Food and beverage sectors are regarded as the potential area for nutmeg product development, as nutmeg pulp have not been optimally utilized, and also the functional benefit of this the fruit pulp can also become an additional value for nutmeg based food and beverage products.

By doing so, Indonesia not only become the world leading nutmeg producer, but also can be able to utilize this opportunity to boost the business competitiveness, especially in the area of food and beverage.

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BIG (BUBUR INSTAN GEMBILI) AS INNOVATIVE SOLUTION TO TACKLE DOWN FOOD SECURITY BASED ON LOCAL FOOD

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ABSTRACT

Gembili or Asiatic yam (*Dioscorea esculenta* L.) is one of tubers which are available on the village area. Recently, Asiatic yam has been planted by traditional farmers on the yard and upland. Asiatic yam is utilized generally as food barn with simple process by steaming. The innovative idea that we purpose on Asiatic yam process is the Asiatic instant puree having food criteria which should be fulfilled for making this instant food product. The criteria that should be had the food material to be made instant food product i.e. a). Having hydrophilic, character that is easy to absorb water, b). Not having impermeable gel layer before used to inhibit the speed of wet material, and c). Rehydracy of final product does not produce the settle and wrinkled products. The idea about utilization of Asiatic yam as instant food, hoped is able to give the innovative solution in order to increase food diversity by improving the local food so the food security will be achieved.

Keyword: *Asiatic yam (Dioscorea esculent* L.*), instant food, food security.*

CHAPTER 1. INTRODUCTION

1.1. Background

Food security is an important thing for a Nation in general, especially Indonesia. In Indonesia, about thirty percent of households of their consumption are below the proper consumption. More than a quarter of children less than 5 years old have a weight below the standard, of which 8% were in very bad condition. Even before the crisis, about 42% of children under 5 years old have symptoms of stunting; a long-term indicator is good enough to measure malnutrition. Poor nutrition can hamper the normal growth of children, endangering the health of mothers and reduce the productivity of the worker. It also reduces the body's resistance to disease in people who are in poor health and in poverty. (Anonymous, 2011).

Dependency rate of Indonesian on rice consumption as a staple food has reached harming levels. Rice has become a major supplier for the majority of carbohydrates almost all Indonesian people. Indonesian people's dependence on rice has become an issue of sustainable food. Public perception that we have not eaten yet if we do not consume rice, even stomach filled with

other food. Perception has become an ingrained concept of distorted thinking.

The Indonesia Government together scientists are now working hard to find new sources of food because of the Indonesian community dependency to one source of carbohydrate. Indonesia's population growth very quickly causing level of rice consumption Indonesia's population continues to increase significantly each year. The problem that occurs is the increase in rice consumption is not matched by an increase in the amount of rice produced by the Indonesia government. At the same time the existence of a variety of local food sources of carbohydrates are forgotten. It is a major cause of rice imports by Indonesia each year to meet the demand for the Indonesian community.

The Indonesian government is trying to be dependency of Indonesia population to rice can be reduced. Many other food resources but potentially underutilized as a food staple allows diversification efforts can be realized. Agricultural commodities that can still be developed and used more widely are cereals (maize), root crops (sweet potato, cassava, potato, and taro) and other plants).

Gembili or Asiatic yam (*Dioscorea esculenta* L.) is a kind of tuber that there are many rural regions. At this time Asiatic yam already widely grown by rural people generally planted in the yard and moor, Asiatic yam commonly used as a food granary with simple processing by steaming. Besides agriculture Asiatic yam at home farming community just considered, because the planting is done in the community is still small scale and for personal consumption or sold directly without treatment. Though Asiatic yam including local crops easily cultivated. Asiatic yam still considered less economically by the majority of people that have yet to be developed on a large scale. Asiatic yam commonly consumed by rural communities and not as a staple food.

Asiatic yam usually treated with boiled, fried, or steamed. Food security can be done by increasing public knowledge about the importance of a healthy diet, in addition to rice as a source of carbohydrate but by utilizing a variety of other types of local food such as Asiatic yam. Perception society today regarding Asiatic yam just as food consumed by the rural lower classes. In fact, in terms of nutrition, including functional foods Asiatic yam with high carbohydrate content and the content of probiotics are good for children's health (Huda, 2010).

Therefore, it is need for innovation to process Asiatic yam that are not only considered lower class food, but it can be consumed by all people, especially children who are vulnerable to disease. So the need

for a new food product based Asiatic yam to increase the economic value of Asiatic yam because it is as one alternative to rice. One form of processed foods that are easily consumed is instant porridge (puree). Porridge has a soft texture and a little liquid (not solid) making it easy for consumers to enjoy. New product development in the form of pulp (puree) with instant ingredients Asiatic yam done as a form of alternative processing Asiatic yam be as fast food.

Innovation we provide to address food security and processing Asiatic yam is BIG (Asiatic yam Instant Porridge). Porridge is a food product that most favored of all levels, age, health, and economic levels. BIG can also be an alternative solution of food for children who are not perfect in consuming solid food (rice). BIG innovation is expected to be an alternative solution to keep healthy and nutritious food security.

Asiatic yam have good production potential for cultivated in Indonesia and the absence of comprehensive information about asiatic yam bulbs as a solution to food security in Indonesia, so that innovation asiatic yam processing into instant powder is very important to do. Thereby increasing the economic value of asiatic yam plants and enhances food security, especially for the food industry in Indonesia.

1.2. Objectives

The purpose of this paper is as follows:

a) Creating an innovative food that is safe, healthy and nutritiou by utilizing asiatic yam.
b) Developing porridge as new food products based on the asiatic yam.
c) BIG as an alternative staple food.
d) To assess consumer acceptance of the BIG.
e) Increasing productivity asiatic yam as an effort to improve Indonesia's food security.

1.3. Benefits

The benefits of writing of this paper are:

a) The output of food products as innovative and alternative solutions to ensure food security in Indonesia.
b) Promoting asiatic yam as foodstuffs potentially replace rice.
c) Improve the efficiency bulbs asiatic yam.
d) Improving the economic value asiatic yam tuber (Dioscorea esculenta) as an alternative food.
e) Development of food products based asiatic yam in the form of instant porridge.

f) Recognize the importance of local food consumption based asiatic yam for health.

g) Provide alternative staple food dry and practically so easy in distribution, storage and supply.

CHAPTER 2. LITERATURE REVIEW

2.1. Diversification of Food

Diversification interpreted as an attempt to diversify the food consumption patterns in order to improve the nutritional quality of food consumed, which in turn will improve the nutritional status of the population. Promote food is very important to avoid reliance on a single type of food, such as rice. Utilization of natural resources of diverse species contributes to improving the welfare of the community (Hendy, 2007).

The diversification of food encourages the idea of replacing the staple food rice with other food ingredients which can also serve as a source of carbohydrate. Some food products that may replace the rice are asiatic yam, yams, taro, and other root crops. Food items have not yet been fully utilized for public consumption. The obstacles encountered are food is not durable and should be processed further in order to extend shelf life. In addition, the perception of the public that says if you eat foods other than rice is considered less prestigious than the pathetic even if eats rice.

According Soenardi cited by Hendy (2007)) states that to change the habit of eating rice with other foods is not easy. Moreover, if only the rice is replaced with other materials while the side-pauknya still like to accompany rice. It would certainly be rejected by the community because the habit of side dishes tastes better when eaten with rice. But if the food is processed in another form even mix lauknya using traditional tastes or who have been hit on the tongue certainly will be more readily accepted because it is a new recipe with new tastes. Assessment of the habits of consumption or consumer acceptance of the new food product can be done by interview or by questionnaire. Collecting the results of a survey of people's consumption habits through questionnaires is more effective because of bias reach many respondents in a relatively short time compared with the interviews one by one (Astutik, 2008).

2.2 Asiatic yam Plant (*Dioscorea esculenta* L.)

Scientific Classification Asiatic yam

Kingdom : Plantae
Sub kingdom : Tracheobionta
Super Division: Spermatophyta
Division : Magnoliophyta
Class : Liliopsida
Sub class : Liliidae
Order : Dioscoreales
Family : Dioscoreaceae
Genus : Dioscorea

Species : *Dioscorea esculenta* L. (Riawan, 2007).

Asiatic yam is a plant tuber that are now difficult to find in the market. Planting is still fairly widespread in rural areas are still threatened though kelestariaanya. Asiatic yam produces edible tubers. Bulbs are usually boiled and chewy texture. Asiatic yam tuber similar to bulbs gembili, but smaller beukuran (Astutik, 2008).. Asiatic yam is a type of bulb-growing vine with green leaves and stems rather prickly. Asiatic yam plant vines and knocks to the right (clockwise when viewed from above). The fruit resembles a sweet potato as big as an adult fist and brown with a thin skin. Bulbs are usually cooked by boiling (Ichwanudin, 2010).

Raising asiatic yam done as sweet potato cultivation, i.e. above gundulan. Seed tubers form of medium or small size. The seed is a crop that farmers usually have just done this bulb will save a cool place and avoid direct sun. Ahead of the rainy season, usually tuber asiatic yam buds will begin to emerge. At the time it was raining and gundulan ready, umbipun bias planted immediately. How to sowing planting ridges to form a hole. Is inserted into the hole in the form of seed tuber has buds reveal. Planting hole is then covered with soil. Within 1 week of sd. 10 days, the plants will asiatic yam sticking out of the planting hole. That's when the farmers have set up in the form of parts of bamboo stakes or wooden branches 3 meters. This marker is usually mounted sideways tilted up along the ridges in sebalahnya stake, will form a triangle (Huda, 2010).

Bulbs asiatic yam relatively bannyak containing mucus, has a unique texture and is viscous. Component of the mucus uatama dioskorea are polysaccharides and proteins, interactions between polysaccharides and proteins in the mucus to determine viscosity and shows hydrocolloid properties, hydrocolloid ability to form a gel can be used widely in the food industry as a water binder, gelling agent, texture formation, thickening, stabilizing the emulsion , prevent syneresis and prevent crystal formation. Besides the Dioscorea mucus containing low starch-converting enzyme inhibitors have activity angiostensin so it is very useful in netraseutical industry (food with nutrient source) (chang et al, 2004; Choi et al, 2004; Fu et al, 2006; Myoda et al , 2006).

According setiawati et al, cited by Huda (2010) said the bulbs asiatic yam is a material rich in carbohydrates and generally contain polysaccharides. In histology, polysaccharides in the cell can be found in the plastid often called amipolast or chloroplasts. The chemical composition of fresh asiatic yam bulbs can be seen in Table

Table 1. Chemical Composition of Fresh Bulbs Asiatic yam.

No	Type Nutritional	Amount
1	Calori (cal)	97
2	Protein (g)	1.5
3	Fat (g)	0.1
4	Carbohydrates (g)	22.4
5	Calcium (mg)	30
6	Phosphorus (mg)	30
7	Iron (mg)	1
8	Vitamin A (SI)	0
9	Vitamin B-1 (mg)	0.02
10	Vitamin C (mg)	0
11	Water (g)	75.1

2.3. Polysaccharides

Polysaccharides are condensation products of more than 10 monosaccharide units, for example, rice and dextrin. Polysaccharides are also classified into heksosan and pentosan, depending on the type of the resulting monosaccharides when hydrolysis. In general, the polysaccharide molecules have larger and more complex than mono-and oligosaccharides. Polysaccharide molecule made up of many monosaccharides mmolekul. Polysaccharide consisting of only one kind of monosaccharide called heteropolysaccharide. Generally polysaccharide form abwwerwarna senyyyaw white and crystalline form, does not have a sweet taste and has no reducing properties. The molecular weight polysaccharides varied from a few thousand to over a million. Polysaccharides are water-soluble colloidal solution will mebentuk. Some of them are important polysaccharides starch, glycogen, dextrin and cellulose (Anonymous, 2009a).

Polysaccharides are also called glikan. Based on its constituent units, glikan divided into two groups and heteroglikan homoglikan. Homoglikan glycosylation consists of all the units that have the same type of monosaccharides eg cellulose, starch and amylopectin, whereas heteroglikan composed of two or more different monosaccharides Algin example, guar gum, galaktomanan (Huda, 2010).

2.4 Water Soluble Polysaccharides (PLA)

Water-soluble polysaccharides (PLA) is a water-soluble dietary fiber that is defined as components in plants that are not degraded enzymatically into sub-sub-unit unit that can be absorbed in the small intestine and dilambung. PLA also called hidrkoloid, nowadays a lot of use in the food industry, in order to achieve the expected quality, in terms of viscosity, stability, teklstur, and performance (Chan and Albert, 2008).

PLA of the main Dioscorea polysaccharides containing glucomannan, glucomannan hydrocolloid is a polysaccharide having a molecular weight between 200000-2000000 unit composed of D-mannose and D-glucose by the ratio of 1.6: 1 tied together in the bonds of β-1 , 4. Glucomannan has some special physical properties, among others the development of glucomannan in water can reach 138-200% and occurs rapidly to form viscous mucus in the same dengaqn arab 4% sugar solution. Glucomannan a very dilute solution (0.0025%) can agglomerate colloidal suspension. Glucomannan solution were poured over the glass sheet and dried to form a thin layer (film) that can be removed from the sheet of glass and has translucent properties (transparent, elastic, and can melaru kat back when dissolved in water (YIS's Food, 2009).

The addition of 0.1% xanthan polysaccharide in the form of frozen bread dough pad will minimize free water content, prevent the migration of water in the dough, increase volume of bread rolls and slow drying. Polysaccharides mobolitas modify and control the water in the food system, and the water has an important role in influencing physical and chemical properties of polysaccharides. Polysaccharides along with the water control many lpangan physicochemical properties including texture, this is due to hydration water alai bound by hydrogen bonds in the polysaccharide molecule so water will not freeze (Dodic, 2007).

2.5. Glukomannan

Glucomannan is a polysaccharide composed of units of D-glucose and D-mannose. The results of the analysis by hydrolysis of the glucomannan produced a asetolisis trisakarida composed by two D-mannose and D-glucose one. Therefore, in one molecule of D-mannose glucomannan contained a 67% D-glucose and a 37%. Forms that make up polymeric glucomannan bond is a bond β glycosides and β 1.6 1.4 glycosides (YIS's food, 2009). Glikomannan is one of the important chemical components contained in the bulb Asiatic yam. If the slices were observed under a microscope bulbs will look largely composed bulbs glukomannan cells. The cells consist of a single grain glucomannan glukomannan (YIS's food, 2009).

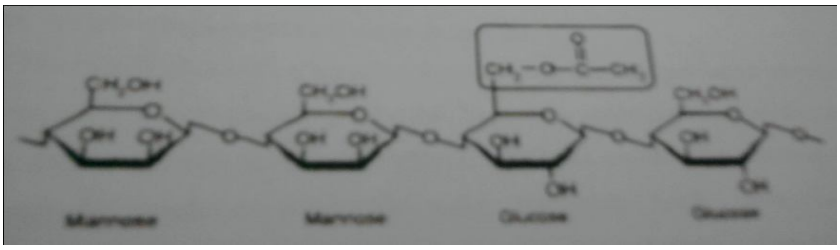

Figure 1. Structure Glukomannan

Sources: YIS's food (2009)

In contrast to starch and cellulose, glucomannan soluble in cold water to form a thick mass. Meanwhile, when the mass is heated until it becomes a thick gel, it glukomannan insoluble in water again. glukomannan solution in water has a viscosity, but when added acetic acid or in general, the viscosity will disappear altogether. The solution can glukomannan endapkan by recrystallization by ethanol and the crystals formed can be dissolved again with dilute hydrochloric acid. Occurring crystalline form with a crystalline form glukomannan mixed with alkaline solutions (especially Na, K, and Ca), it will soon form a new crystalline form of mass or gel. The new crystals are not soluble in water (although up to a temperature of 100 0C) or a dilute acid solution. Similarly, the lead II acetate (cupriettilediamin), the solution precipitates a white glukomannan stable (Yi's food, 2009).

2.6. Interaction Protein Polysaccharides

The interaction of proteins and polysaccharides play an important role in shaping the structure and stability of food products and chemical properties such as fisko-solubility, foaming power, power of the emulsion, and the ability to make a gel. (Wey et al., 2007).

Polysaccharide protein interactions are non-specific interaction of groups, but the type of the type of interactions that may occur is between different types of polymers in solution. Estimated mixing protein-polysaccharide in food technology became interesting discussion today (Tamtarini, 2006).

Protein-polysaccharide have different charges so that mixing of the two components will form the protein-polysaccharide complexes are soluble and insoluble, depending on the total charge. If muatanya value equal to zero, then the protein-polysaccharide complex tebentuk not larur and precipitation occurs. Meanwhile, if the value muatannyatidak equal to zero, then the protein-polysaccharide complex will dissolve. Mixing process is exothermic, the reaction

is more mixing between the protein-polysaccharide will involve direct formation of covalent protein and polysaccharides. In a food system, covalent bonds between proteins and polysaccharides are important in the formation of bonds texture characteristics (Wey et al., 2007). Polysaccharide-protein interactions can occur when a mixture of both polymers below the isoelectric point of proteins. According to Damodaran cited, by Huda (2010) types of interactions that can occur is shown in Figure 2.

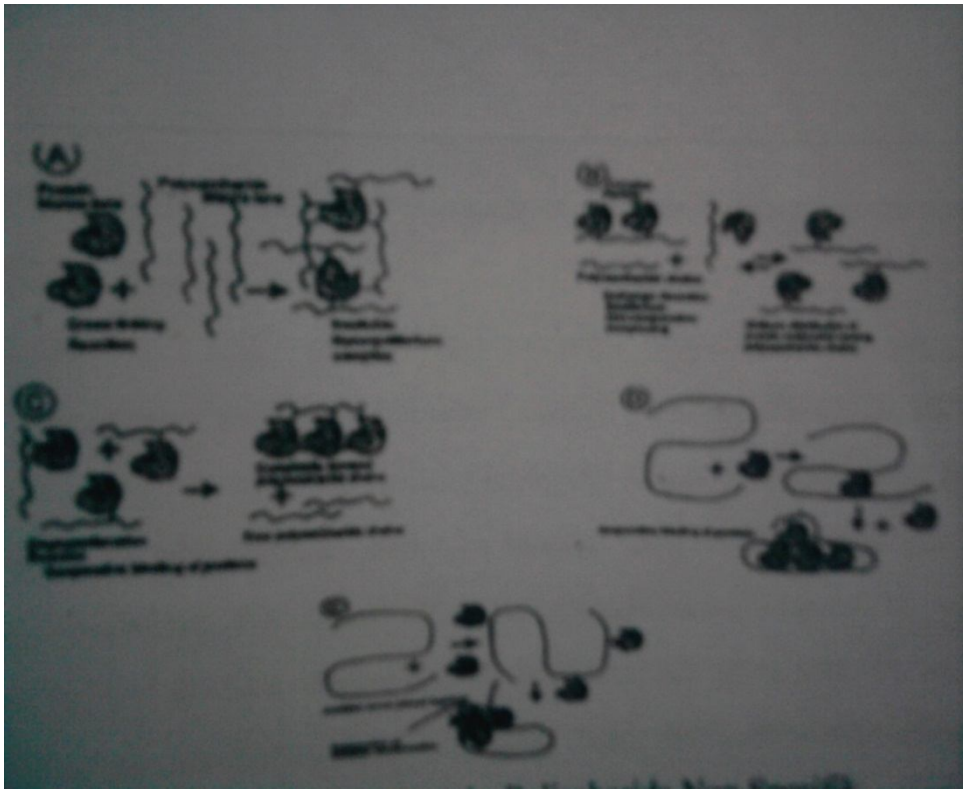

Figure 2. Polysaccharide-protein interactions Non Specific

Source: Huda (2010)

In Figure 2. A indicates an imbalance in the complex, where the interaction of biopolymer elektrostatiknya strong due to the crosslinking of protein molecules were to act as an agent for the formation of crosslinks with polysaccharides. This interaction forms a complex three-dimensional network.

In Figure 2. B shows the balance between protein-polysaccharide complex. But biopolymernya elektrostatiknya weak interactions because this time there was an increase of pH, the pH increased to above point isoelektik protein (pH> 4.5). Carboxyl bonding interactions of complex molecules containing polysaccharides that relative

excess anionic polysaccharide that causes the formation of uniformity of distribution of the bond between the protein molecule polysaccharides.

In Figure 2. C indicates the formation of protein-polysaccharide complex soluble. The formation of this complex is due to hydrophobic and electrostatic bonding. Some parts of the chain polysaccharide molecules tend to bind all of the protein, while the other does not dissolve completely and free from protein.

In Figure 2. D showed bonding protein molecules crosslinked with segments of the anionic polysaccharide chain. Cooperative ties occur in proteins, forming protein-protein complexes in anionic polysaccharides.

In Figure 2. E showed a weak electrostatic interaction biopolymer. Deviation zone formed from the interaction of protein-polysakarida have a lower hydrophobicity than the dissociated state.

Proteins and polysaccharides have different charges, so that when done mixing the protein-polysaccharide to form an insoluble complex, depending on the total charge. If the total charge is zero mak tebentuk protein complex polysaccharides are insoluble, but settles. Meanwhile, if the total charge is not zero then the protein-polysaccharide tebentuk late. Anionic polysaccharides interact strongly with proteins at pH values below the isoelectric point of the protein (Wey et al., 2007).

2.7. Water Soluble Polysaccharides Extraction

PLA can dilakukkan Extraction with water because it is soluble in water. Extraction procedure of PLA plant tissue can generally be done by breaking down the cell walls pemblenderan. Untu get the optimal extraction, the extraction conditions are required to support such a ratio between the material extracted by solvent extractors and extraction temperature. According to Brown (1978) when the concentration of the solution and the material extracted pengestrak reaches equilibrium, the solution pengektrak no longer able to extract bahanyang extracted, the higher the extraction temperature will accelerate the contact between the material extracted by solvent extraction extractors so the road faster. Optimal conditions to extract from the root of Sophora suprostrata PLA is the ratio between the material and 1:4 distilled water at room temperature (Wei et al., 2007).

Ethanol is an organic solvent most widely used precipitation u lo PLA. Ethanol alcohol included into a single chain, with the chemical formula C2H5OH and empirical formula C2H6O. ethanol is a

colorless volatile liquid with a distinctive aroma. He burns with a smokeless blue flame that sometimes can not be seen in ordinary light. Physical properties of ethanol mainly influenced by the presence of hydroxyl groups and short chains of carbon ethanol. Hydroxyl group can participate into hydrogen bonds, thus making it difficult liquid evaporates from the other organic compounds with the same molecular mass. Ethanol is a versatile solvent, soluble in water and other organic solvents, including acetic acid, acetone, benzene, carbon tetra chloride, chloroform, diethyl ether, ethylene glycol, glycerol, nitromethane, pyridine, and toluene. Ethanol is also soluble in aliphatic hydrocarbons are mild, such as pentane and hexane, and soluble in aliphatic chlorides such as trichloroethane and tetrakloroetilena (Myoda, et al., 2006).

Mixture of ethanol and water has a smaller volume than the sum of the two fluids separately. Mixture of water and ethanol with the same volume will result in a mixture that volume only 1.92 times the initial volume. Mixture of ethanol and water to form azeotropic ratio of approximately 89% ethanol and 11% mol mol of water. This comparison can also be expressed as 96% by volume of ethanol and 4% by volume of water at normal pressure and T = 351 K. hydrogen bonding causes pure ethanol is very higrokopis, sedemikianya it will absorb water from the air. Polar nature of the hydroxyl group causes soluble ionic compounds, primarily sodium chloride, potassium hydroxide, magnesium chloride, calcium chloride, ammonium chloride, ammonium bromide, and sodium bromide. Sodium chloride and potassium chloride is slightly soluble in ethanol. Because ethanol also has a nonpolar carbon chain, it is also soluble in non-polar compounds include most oil asitri and many flavorings, colorings, and medicines. The addition of the percent ethanol in water will lower the surface tension of the water dramatically. Mixture of ethanol with water more than 50% ethanol are flammable and combustible. The mixture is less than 50% ethanol (Myoda, et al., 2006).

2.8. Properties Water Soluble Polysaccharides

2.8.1. Viscosity PLA

PLA's most prominent trait is due to form a viscous solution (viscous) in water. According to Einstein's law, the viscosity of the solution is affected by the dispersed phase (disperse phase) in the solution, and not influenced by the molecular structure of the branch chain or straight-chain. Factors arrives mempengsruhi PLA is an inorganic salt, PLA penccampuran with others, and changes in pH, pre-treatment, the effects of temperature and light. PLA viscosity will decrease, if the solution is mixed with PLA

anorganok other. PLA viscosity of acidic or basic, sensitive to changes in pH. This is due to the carboxyl group (COOH) in the molecule PLA. PLA viscosity will decrease if the contact with strong alkaline solution, caused by the destruction of proteins that form complexes with PLA. Pretreatment process such as drying PLA extraction, extraction temperature can reduce the viscosity value because it will damage the integrity of the PLA molecular chains. In addition, some types of PLA such as gum arabic and tragacanth when heated will be degraded molecules so will result in the reduction of sugar or acid that causes a decrease in viscosity (Ichwanudin, 2010).

2.8.2. Power PLA Emulsion

According Sugiyanto and Manulang, cited by Hendy (2010) Emulsion is a thermodynamic system is unstable, the solution consists of two immiscible (immiscible). Dispersed phase is called the internal phase or phase to another phase dispersed medium called phase dispersed or internal phase. Power Traffic PLA emulsion was untukmembentuk emulsion and maintaining the stability of the emulsion. These properties are very dipengaruhhhi by grade polysaccharide and polysaccharide-protein interactions in the material. Emulsifier emulsion stability is important because it depends on the ability to maintain the emulsion system when experiencing cooking or heating (Artika and safithri, 2010).

Liquid emulsion stability can be damaged in case of heating, centrifugation process, cooling, addition of electrolyte, and the destruction of the emulsifier. Cream or creaming or sedimentation can be formed in this process. Making cream can Kiata encountered in oil-in-water emulsion, where the stability of the emulsion is broken, the particles of oil will rise up and form a cream. While gterjadi sedimentation in water-in-oil emulsion, where the stability of the emulsion is broken then the water particles will fall. Contih use of this process is the use demulsifikasi process with the addition of electrolyte to separate the rubber in latex is done by the addition of formic acid (CHOOH) (Anonymous, 2006b).

2.8.3. Power scum PLA

Power froth Water Soluble Polysaccharides (PLA) is influenced by the interaction between the polysaccharide-protein contained in the PLA. The ability of proteins to form froth caused by protein characteristics that are typical of the lining of the two phases (air and water) so as to have the power as a surfactant, which lowers the surface tension. Establishment of froth from the interaction of protein-polysaccharide polymer blends can occur both under the isoelectric point (Chan and Albert, 2008).

2.8.4 .Oil Holding Capacity (OHC) PLA

The ability of the oil binding capacity is influenced interactions between protein-polysaccharide in the PLA. Complex protein binding hydrophobic polysaccharide that can perform the binding of fat. Oil absorption is influenced by temperature, particle size materials and types of proteins that bind. Pritein ability to absorb oil dependent existence of non-polar groups of the protein where the nonpolar groups will bind with the oil. Binding properties of this oil is strongly linked to the ability of the protein to form an emulsion.

2.9. Additional Materials

2.9.1. CMC (Carboxy Methyl Cellulose)

Forms of Carboxy Methyl Cellulose (CMC) is widely used as a filler in the food industry are salt Na-CMC. CMC has a white color, no smell, no taste and no toxic (Kirk and Othmer, 1952). CMC can be prepared by reacting NaOH with pure cellulose is accompanied by the addition of Na-Khloroasetat. CMC has a carboxyl group so that the viscosity of the CMC is affected by the pH of the solution. CMC has a pH optimum of about 5 and when the pH is less than 3, the CMC will settle (Witono, 2010).

CMC is one of many excipients used in the manufacture of food products. CMC as a filler, added in food products with the goal of increasing total dissolved solids (TPT) and increase the viscosity products. Glicksman (1968) states that the CMC has also been used in some soft drinks products, and has been proven effective as a colloidal stabilizer in the emulsion flavor soft drinks. In the food industry, the nature of the CMC which increases its commercial value is its ability to thicken the liquid, the water acts as a binder, and improve the texture on a variety of food products. An example is the Na-carboxy methyl cellulose in pure form called cellulose gum. Cellulose Gum physically inert and contains no calories because it can not be metabolized by the human digestive system. In the extrusion industry, CMC acts as a binder (binder), helps stabilize the emulsion, and inhibit sugar crystallization. Some types of food products using such CMC dehydrated products, canned food, freeze dried products, and processed meats. In products such as dried fruit and vegetable powder or instant soups CMC functions simplify the process of reconstitution and improve the texture during reconstitution (Hakim, 2008).

2.9.2. Dextrin

According to Caesar, quoted by Astutik (2008). Dextrin is a component resulting from the modification of starch by acid hydrolysis catalysts, enzymatic and heating dry starch. Starch Modified starch is treated with specific aims to produce better

properties to improve the properties of the previous or to change some of the other properties. Modified starch is starch hydroxyl groups have been modified through a chemical reaction (esterification or oxidation) or by disrupting the structure of origin. Dextrin having the chemical formula (C6H10O5) n and has a molecular structure that is more branched than starch. The structure of this shorter dextrins have resulted in water soluble nature.

Dextrin is formed naturally in corn, arrowroot, asiatic yam, and so on. In general, dextrin produced by heating dry starch together a number of catalyst. Dextrin is a product that is formed in the process of hydrolysis of starch breakdown. Dextrin is also the first time a substance formed when the hydrolysis process to achieve a certain degree of branching. Dextrin widely applied in the packaging and paper industry mainly as an adhesive. In the food industry, dextrin can be used to improve the texture of food. Based on research Bahriye (2005), the addition of 15% dextrin to produce instant grits product quality characteristics (texture) the product received by consumers in organoleptic (Astutik, 2008).

2.10. Drying

One form of technology applications in food processing is most often done is drying. According to Pramod, cited by Hendy (2007). Drying is the process of heat transfer and water content simultaneously. Hot air dryers carried by the media will be used to evaporate the water contained in the material. Water vapor from the material will be removed from the surface of the material to air dry. Drying basically aims to reduce the water content of the dried material. The drying process provides several advantages, such as a dry product shelf life longer, for grain crops, seed viability is more assured, and minimize and alleviate the volume of the product, making it easier for the handling, storage, and transportation. Classification consists of drying using air drying in direct contact with the material, drying with conduction system, using radiant energy drying and freeze drying (freeze drying). In addition, the drying process can also be classified based on the heat energy sources, namely natural drying with the aid of sunlight, artificial drying with the help of air or electrical energy. The drying process of food made with the help of a dryer. There are several types of dryers are classified based on the principle of drying. Dryers are commonly found among other drum dryer, spray dryer, freeze dryer, tray dryer, and a fluidized bed dryer.

2.10.1. Cylinder Hair Tool (Drum Dryer)

Dryer cylinder is one of the dryer with conduction system. The dryer drum or

cylinder works on the principle of drying products in direct contact with the surface of the drum (cylinder) rotating at a speed that has been set. Drum rotates on a horizontal axis and internally heated with steam or other heating medium. Material attached to the drum (cylinder) slowly turn into dried products. After ¾ rounds, the product will dry scraper scraped off with a knife so that the piece is separated into coarse (Brennan et al., 1974). The product is dried with a dryer cylinder varying quality. There are four variables that affect the quality of the product dried drum dryer drying results with the steam pressure and temperature of heating medium, the cylinder rotation speed, the distance between the drum (cylinder), and the condition of food. Vapor pressure and medium temperature determines the temperature of the drum or cylinder will be in contact with the product. Drum rotation speed determines the contact time between product surface and hot drum. The distance between the drum will determine thickness of the final product is formed. Food conditions will determine the rotation speed and the distance between the drum to be used (Moore, 1995). There are several advantages to the dryer drum drying is to save the use of heat (is economical) for high-speed drying, can increase the digestibility, and can preserve the product. But there are also disadvantages that a limited range of products that can be dried. Use the dryer drum is limited to products in the form of porridge or pasta (products with high viscosity or viscous) and food that withstand high temperatures in a short time (Khoidharoh, 2007).

CHAPTER 3. METHODOLOGY OF WRITING

3.1. Overview of Library

Writing a literature review is based on literature review and decision on the journals, as well as searching on the internet. Search data is how to apply the content, properties, and processing asiatic yam.

3.2 Discussion

The discussion in the writing of instant porridge asiatic yam include: comparisons between literature and ideas that we offer the instant processing into pulp asiatic yam asiatic yam.

3.2.3 Implementation Techniques

Implementation techniques that we offer based on our analysis if those ideas are applied.

CHAPTER 4. DISCUSSION

4.1 Instant Food

Today, many food products are marketed in the form of instant food. The development of instant food product is aimed to facilitate the public while consuming it. Instant food product is very easy to prepare in a

relatively short time. Instant foods are in the form of dry or concentrate, easily soluble so it is easy to present that just by adding hot or cold water. Instant food products is growing rapidly following the development of the era where people demand food products consumed easy, nutritious, and easy in its presentation. Definition of instant food in the Big Indonesian Dictionary (1989) means the direct or no longer cooked, edible or drinkable. Instant term has encompassed a variety of treatments, whether chemical or physical that would improve the hydration characteristics of a food product in the form of powder (Johnson and Peterson, 1971). According Hartomo and Widiatmoko (1992), instant food is food that is undergoing a process of draining the water, so the soluble and easy to prepare just add hot water or cold water. Australian Academy of Technological Sciences and Engineering (2000) gives the definition of instant food as a food product that in the presentation involves mixing water or milk and proceed with the cooking process.

4.2 Properties of Instant Food

There are several criteria that must be met for food in the manufacturing of instant food products. According Hartomo and Widiatmoko (1992) criteria should be established in order groceries instant food products such as a) a hydrophilic properties, ie properties easily bind water, b) do not have an impermeable layer of gel before use can inhibit the rate of wetting, and c) the final product rehydration not produce agglomerate and settle.

4.3 Instant Porridge

The term instant porridge better known as pure (words of English origin that is puree). Pure understanding by Big Indonesian Dictionary (1989) is a food or food ingredient softened. Porridge is one simple form of processed food consumed by the public. Porridge has a texture that is soft and easy to digest. Porridge is not only made of rice alone but can also be made from green beans, brown rice, or some mixture of the constituent. In processing, cooking porridge made with water as the building blocks of rice porridge, mix coconut milk like green bean porridge, or by mixing milk, known as milk porridge. The times cause the public demands everything fast-paced and practical. Similarly, in terms of food, people tend to prefer the form of instant food products. Instant porridge is porridge that has undergone further processing so that the presentation is not required cooking process. Presentation of instant porridge can be done simply by adding hot water or milk, according to taste (Hendy, 2007). Instant porridge has the composition as well as porridge. Porridge has become (cook) experience instant process. Instant food is done by cooking porridge compiler

components that have shaped flour until a thick dough. The dough is dried using a drum dryer and then crushed to form a fine powder 60 mesh size. Powdery material obtained has to be instant and packaged into instant porridge (Wicakso, 2008).

4.4 Preparation of Pure Asiatic yam

Gelatinization is a process of water absorption by starch granules resulting in irreversible swelling followed by an increase in viscosity due to the provision of heat on starch suspension (Winarno, 1997). By reason of this, the scale of the fire is being determined (medium) so that the staining process not too long but not too quickly puree thickens. When the process of staining is done, stirring constantly to prevent sticking and scaling (hardening) at the base of the pan cooker.

Pure asiatic yam desired instant is brightly colored so that the next process, asiatic yam be soaked in water first for 15 minutes before steaming. The use of 15% dextrin refers to the results of previous researchers. According Bahriye (2005) 15% dextrin concentration is the concentration that produces instant grits most optimum. The use of CMC is typically in small amounts (<1%). Based on the results of Trial and Error was found that the use of 2% CMC can not dissolve completely in the manufacture of pulp asiatic yam. Clumps ¬ CMC-clot formed by the CMC that does not dissolve completely. In the next process using CMC> 1% and dextrin of> 15% is not possible in the manufacturing process so that the slurry asiatic yam maximum concentration used was 1% to 15% for CMC and dextrin. The addition of CMC and dextrin made during demolition (blending) gradually to avoid clumping and can be mixed evenly.

The drying process has ditanak pure asiatic yam done with drum dryer. Drum dryers used can be seen in Figure 4. Reasons to use a dryer cylinder (drum dryer) than the other are a hair thickening product compatibility level to be drained and form the desired end result. Cylinder drier is suitable for drying products that have a viscosity such as porridge or pasta (Brennan et al., 1974). The final result (output) of the hair is a mixture of powder and sheets of smooth instantaneous (easily dissolved). Process of pure cassava instant due to gelatinization process is followed by the drying process. In the process of gelatinization, starch granules absorb water. Water that previously were free to move outside of granule and is now in starch grains and can not move freely anymore because it has been established that irreversible matrix (can not get back into shape). By the time the water evaporates leaving the dried matrix components that are porous and can easily absorb water again (Winarno, 1997).

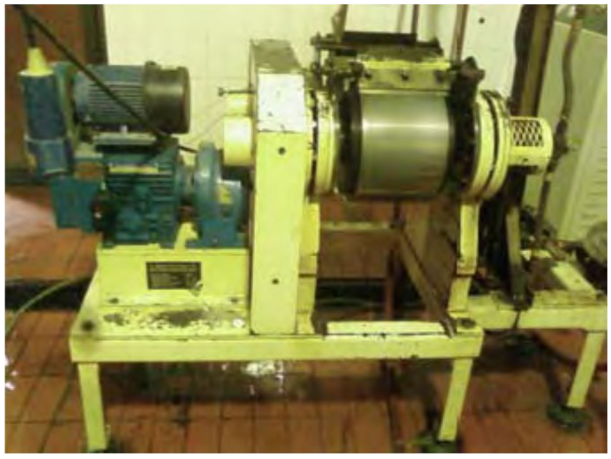

Figure 3. *Drum Dryer*

Before the drying process is done, set the process parameters that influence the characteristics of the final product produced. This arrangement aims to maximize the yield of dried so not much is wasted and dried the resulting optimal pure. The parameter set is the temperature (pressure) boiler and a rotation speed of cylinder (drum) hair. Drum dryer cylinder temperatures are influenced by pressure boiler. The higher the boiler pressure, the higher cylinder temperatures. This condition causes the products became increasingly quickly become dry and scorched. Based on the results of Trial and Error in the testing phase, it was found that the dry product produced in the pressure range of 3-5 bar, equivalent to 40-60 lbf/in2. The relationship between the pressure and the steam temperature where the higher the pressure will be the higher the temperature of the steam. 3-5 bar pressure equivalent to a temperature of 130-145 ° C. If the pressure used <3 bar then the product will be wet and not dry completely so that the results are less than optimal. Conversely, if the pressure> 5 bar then the product will be scorched (brown). In addition to temperature, speed dials also affect the final results obtained. The more slowly the longer the round cylinder means of contact between the cylinder products. The duration of contact with hot product cause the product to quickly become dry and scorched (brown).

Conversely, if the cylinder is too fast round the thermal contact between the products with less so that the product is still not perfectly dry (wet). Proper cylinder rotation speed to pressure 3-5 bar (40-60 lbf/in2) is 5-6 rounds per minute (rpm). Porridge asiatic yam have been made with water, dried comparison with the dryer drum set

pressure and velocity. The resulting final dried product tested hydration power. Hydration time measurements performed with the addition of 50 ml of pure water to 5 g dried up all the pure dried perfect flooded (form a slurry). The water used is hot water (60-70 ° C). that content is not damaged. After brewing with hot water slurry mixed with desired seasonings. Final product of porridge is ready to eat.

3.5. The Parties Assist in implementing Ideas

Some of those who helped in the implementation of the idea:

1. Government, the author recommends writing to the Government especially the local government and agricultural agencies in an effort to policies that support food diversification and supports in the form of special education programs and Asiatic yam crop cultivation and utilization.

2. Intellectual groups, students, faculties, researchers, and commentators agriculture is the people who are competent to carry out further research.

3. People as the main actors in this idea. People as consumers of BIG, which is one form of food diversification.

4. PTPN, state plantation companies can asiatic yam competent in developing large-scale production.

5. The food processing industry as developers asiatic yam on instant porridge packaging

3.6. Steps to Implement Ideas

This idea is not only limited to research and scientific study alone but hopes to continue in the application in order to achieve the larger goal is development of local food crops as an alternative solution to tackle the problem of food security in Indonesia. Thus it is necessary for coherent stages to achieve that goal. The initial step of the stage is the publication of a scientific study that can be used for further research. Both socialization and education asiatic yam planting and processing plants to the communities, especially in rural areas. Conducting field work that demonstrated how the use and processing plants as Asiatic yam Instant porridge. This paper can also be recommended to industry-related food industry with the development of BIG. PTPN a state company that is engaged in agriculture may be the asiatic yam as crops to increase production asiatic yam as raw material in the manufacture of BIG. All that the support from both the

government as well as material support in the form of another in order to achieve maximum results.

CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

From the discussion and telaan literature concluded that:

a. The creation of innovation asiatic yam food that is safe, healthy, tasty and nutritious.

b. Able to increase the new food products based asiatic yam

c. With the new instant porridge products asiatic yam, will provide new alternatives to basic snacks.

d. With the creation of instant porridge asiatic yam is much preferred by all people, would increase local food production, especially asiatic yam.

e. BIG (Asiatic yam Instant Porridge) is a food-based powder or flour asiatic yam a fast food simply by adding warm water or room temperature water. BIG made with asiatic yam composition, water, CMC and dextrin. BIG-making process includes stripping the skin, washing, soaking, steaming, crushing and mixing (blending), steaming, cooling, and drying.

5.2. Suggestion

Some suggestions from authors and other parties that are expected to be input or consideration in order to improve product quality and enhance instant mashed asiatic yam:

a. Presented in the form of packing with vacuum packaging or packaging with aluminum foil.

b. Seasoning of Asiatic yam presented together with packing of BIG.

c. Need to diversify taste.

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THE USE OF GEMBILI FLOUR SUBTITUTION (*Dioscorea esculenta*) IN "BROWNERGEN" AS AN EFFORT FOR FOOD DIVERSIFICATION WITH USES OF LOCAL FOOD MATERIAL

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ABSTRACT

Nowadays, healthy food products such as those providing high calories with low glycemic index which are ready to eat are highly popular. Considering the recent trends, BROWNERGEN was made from lesser yam flour in order to nourish the energy by replacing the needed nutrients through easy consumption. Lesser yam (*Dioscorea esculenta*) known as *gembili* in Indonesian, is one kind of tuber that has potential source of carbohydrate, protein, low fat, calcium, phosphorus, potassium, iron, dietary fiber, vitamin B_6, and vitamin C. It also has low glycemic index (GI) and low sodium content. The objective of the research was to know the effect of *gembili* flour substitution towards the chemical characteristics and taste of "BROWNERGEN" related to the consumers' demand. The substitution of *gembili* flour towards wheat flour used were 30%, 40%, and 50%. Hedonic test was performed to know the acceptance of the final products to the consumers. The result showed that the higher the concentration of the lesser yam will decrease the acceptance among panelist. Hence, lesser yam flour can be used to substitute wheat flour in brownies making until the concentration of 30%.

Keywords*: Brownergen, gembili, lesser yam flour, substitution, recent trends*

INTRODUCTION

Brownies are usually classified as a cake or a dessert which are made from wheat flour, sugar, egg, chocolate and fats or oils. In making these brownies, the cassava used are lesser yam (*gembili*) or *Dioscorea esculenta*. Lesser yam has nearly the same nutritional composition even better when compared to rice or wheat. The glycemic index values were also lower than the flour, so it does not rapidly increase blood sugar. Lesser yam can be processed into flour because it has a bland taste that can be used as an ingredient in the manufacture of substituents flour brownies. Nowadays, people tend to consume ready to eat food products that provide high energy which is easily consumed in short time when they

have no time to eat meals. Moreover, instant life style has become a trend among the people due to busy schedule. Eventually, it increases the tendency of people to eat less fiber due to instant foods consumed. As a result, "BROWNERGEN" might be the answer to this challenge by giving new concept of dried brownies in the form of energy bar which is ready to consume anytime to nourish the energy required.

"BROWNERGEN" is a product development of brownies made from lesser yam flour as the main ingredient, bananas and peanuts as an ingredient added, then shaped bar and dried. Carbohydrate content in lesser yam consists of sugar, amylose and amylopectin. Bananas are added as a source of vitamins, minerals, and fiber, while a source of peanut protein, which in turn will make "BROWNERGEN" such as high-energy food and a nutritious complete practical for consumption.

MATERIALS AND METHODS

Materials and equipment

The materials needed in this experiment are lesser yam, banana, peanut, margarine, eggs, low protein wheat flour, sugar, cocoa powder, vanilla, 0.3% sodium metabisulphite, and water. The equipments used in this experiment are knife, basin, analytical balance, tray, cabinet dryer, dry blender, sieve shaker 60 mesh, graduated cylinder, cutting board, and baked sheet.

Lesser Yam Flour Processing

The lesser yams were cleaned and peeled and are immediately put in the water. The peeled yams are thinly sliced with knife, and are soaked in the 0.3% sodium metabisulphite solution. The soaking process was done for 6 hours, and then the yams are drained. The sliced yams were put on a tray, followed by the drying process using a cabinet dryer at 60^{o}C for 24 hours. The dried yams were milled by using dry blender, then were sifted by using sieve shaker 60 mesh.

Preparation Banana Processing

The skin from *pisang tanduk* was skinned. Banana was cut into slices and were then weighed 50 grams. Bananas that have been weighed ready to be blended with water 50 ml. Once blended, it was cooked until thick banana jam formed and ready to use to mix the dough.

"BROWNERGEN" Processing

All of the ingredients were weighed according to the basic formulation. Eggs were beaten using a mixer until fluffy (± 5 minutes) at high speed. Sugar, flour lesser yam, wheat flour, cocoa powder, and vanilla that has been put in dry mix were added into the egg until well blended (± 2

min). Bananas that have been thickened after heating were mixed into the dough using a mixer. Melted margarine was mixed into the batter. Peanuts were mixed into the batter until homogenous. The dough was placed on a baking sheet and was baked using the oven at a temperature of 180^0C for ± 30 minutes. "BROWNERGEN" was removed from the pan and cut the size of ± 8cm x 2cm x 1cm. Results from BROWNERGEN pieces were placed in the pan to dry again using the oven for 1 hour ± temperature of 120^0C.

RESULTS AND DISCUSSION

Lesser Yam Flour Processing

According to Alsuhendra and Ridawati (2010), a mature yam is better to be used for flour processing because it contains high amount of starch and less mucus. Less mucus will make the yams easier to be processed into flour.

The lesser yam flour processing starts with the peeling and soaking process of the yams in water. The soaking process is done to avoid contact with air and to remove the dirt and other contaminants in the yams. Besides, this process will also cause the mucus to be extracted since the water pressure increases against the yam cell wall. It is shown by the changing color of water from clear to cloudy because the mucus separates from the cell wall into the water. The peeled yams are sliced with a knife and should be immediately put in the 0.3% Na-metabisulphite solution to prevent a browning reaction to occur during drying process. The Na-metabisulphite will form a reaction with reduction sugars producing hidrosulphonate acids, and therefore the browning reaction can be prevented. This process also gives bright color to the yams (Alsuhendra and Ridawati, 2010).

The drying process uses cabinet dryer at 60^oC for 24 hours. According to Alsuhendra and Ridawati (2010), during this process, various compounds that can produce distinct odor, such as alcohol, aldehyde, and ketone, will be lost because they are volatile. This is advantageous because the lesser yam flour will have an acceptable aroma for the consumers.

The dried yams then is crushed by using dry blender and is sifted by using sieve shaker 60 mesh, to produce the desired flour. In this experiment, the yield of the lesser yam flour is 24.72%. The result is not much different with Richana and Sunarti (2004), who found the yield to be 24.28%. Moreover, it is also stated that the yield of the lesser yam was found to be the highest among other yams, which are *ganyong* (11.43%), *suweg* (18.42%), and *ubikelapa* (23.93%). Therefore, it can be said that

lesser yam has a potential to be processed into flour.

Brownies Processing

Brownies contain high of fat. The first step in brownies processing is whisk eggs until fluffy. Eggs act as emulsifier and for developer of dough. After that, put all dried ingredient and mixed together to form dough. Put the bananas which are already thickened and mixed together until the dough smooth. After that, put the melted margarine which aims to enhance tenderness and flavor. The next step is that the dough was put into baking sheet and already to bake to produce the brownies with temperature 180^0C for ± 30 minutes. The last step after the brownies baked is the removal of the heat (cool down) and cut into a piece with size ± 8cm x 2cm x 1cm and put again into baking sheet and baked again until the brownies dried for 1 hour ± temperature of 120^0C.

Product Definition

"BROWNERGEN" is a food product in the form of energy bars brownies that get extra from the banana and peanut. Flour in making brownies is also substituted by lesser yam flour has a high carbohydrate content, but low glycemic index (Bekti, 2008). Banana that high in carbohydrate can give additional energy and other nutrition. Chocolate also serves as a source of fat besides as a flavor and colour. Peanut aims to provide additional fat and protein content that will provide additional energy and nutrition as well.

The aims about making "BROWNERGEN" is to give additional energy which high a nutrition from mixed are lesser yam, chocolate, banana and peanut. "BROWNERGEN" can be consumed in easy way when hunger comes. The ingredients for making "BROWNERGEN" are aimed to support food diversification with uses of a local food material. The concept about "BROWNERGEN" is making brownies in energy bars form and dried which a right formulation and contain nutrition.

Characteristics of Product

According to Bekti (2008), the protein content in brownies made from lesser yam flour will have lower value than the one without flour substitution. The decrease in protein content might be due to lower protein content of lesser yam flour than wheat flour (about 4.25% less than wheat flour).

The higher the substitution level in the brownies will have higher fiber content since lesser yam flour has higher fiber content of 3.56% than wheat flour, which is only 2.56% (Bekti, 2008).

Tubers are foods that have high carbohydrate content in which *gembili* is also known as tuber that has high carbohydrate and starch content. Therefore, the higher the substitution level of lesser yam flour will increase the carbohydrate content in "BROWNERGEN" (Bekti, 2008).

As for the fat content, the use of lesser yam flour will have higher fat content than the one without using it. The reason is that the increase of starch content in the dough will be easier to bind the lipid since amylose is easy to be bound with lipid. Hence, the starch will form complex with various compounds. On the other hand, the use of wheat flour might have lower fat content as gluten (matrix of protein) will inhibit the absorption of lipid (Bekti, 2008).

However, in this paper the carbohydrate and protein content analysis of the product was not conducted due to the acceptance of consumer is more concerned in determining the best formulation. Although the higher substitution level will have better quality of product, the acceptance of consumer is more important for choosing the best formulation in which the product is to be sold in market. Hence, the protein and carbohydrate content were not performed since consumer's acceptance is the main objective in developing the product.

Sensory Evaluation of Brownies

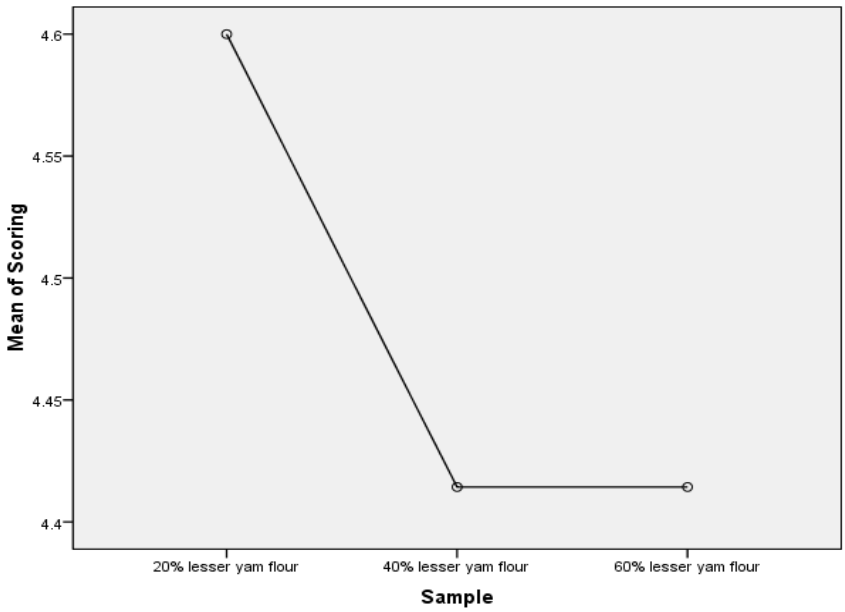
Hedonic test was performed to know the acceptance of the final products to the consumers. Three coded samples were given to the panelists and the panelists were asked to determine the level of acceptance of each sample, from extremely dislike (1) to extremely like (7). The data then was analyzed by using Analysis of Variance (ANOVA) with the significant level of 95% ($\alpha = 0.05$).

The null hypothesis of this experiment is that there is no significant difference in term of acceptance between three samples, while the alternative hypothesis states that there is a significant difference in terms of acceptance between three samples. The test is two-sided since the panel leader could not predict the level of acceptance of each sample from each panelist.

Table 1 shows the mean value from each formulation. The 30% substitution of *gembili* flour results in the highest mean value. Meanwhile, the 40% and 50% of substitution have the same value which is lower than 30% substitution.

Table 1 Mean sensory value of samples

Treatment	Mean Sensory Value
30% lesser yam flour	4.60
40% lesser yam flour	4.41
50% lesser yam flour	4.41



Graph 1 Mean plot of sensory value of the samples

From the result of ANOVA, it is found that the significant value is 0.578, which means higher than the significant level of 0.05. Therefore, the null hypothesis is failed to reject means that there is no significant difference in the sensory value in term of acceptance between three samples at significant level of 95% ($\alpha = 0.05$). Since there is no significant difference between samples, no post hoc test is required.

From the Graph 1, it can be seen that at the concentration of 30% lesser yam flour, the highest sensory value is obtained. It means that lesser yam flour can be used until the concentration of 30% to substitute wheat flour in making brownies to give the best acceptance among panelists. Nevertheless, the concentration of 40% and 50% still can be used to substitute wheat flour since the sensory value between three treatments does not give a significant difference. However, it is suggested to use the least concentration as it gives similar response towards consumer's acceptance with the higher concentration.

CONCLUSION

"BROWNERGEN" " is the result of product development considering the recent trends of consuming high energy food which is ready to eat in short time, associated to the busy schedule in work field area.

Lesser yam flour has a potential to be processed into flour and can be used to substitute wheat flour in brownies making. The use of lesser yam flour, banana, and peanuts can provide energy nourishment in

consuming the product. With a dry form, it will make brownies more efficient to be carried anywhere, and people can eat it immediately when they are hungry. Overall, lesser yam flour can be used to substitute wheat flour in brownies making until the concentration of 30%. At this level, the brownies product still can be accepted by consumers.

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SORGHUM COOKIES AS POTENTIAL LOCAL FOOD

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ABSTRACT

Sorghum is one of the local types of cereals that has been known in Indonesia. Yet, its development is still slow through it is very suitable to be cultivated in Indonesia. The average production of sorghum in Indonesia is approximately 25,500 tons / year. It then make sorghum potential to be developed and as one of the way to support Indonesian local food diversification. One of the food that can be used as the medium to develop the potential of sorghum is by using sorghum flour as the substitute for wheat flour in cookies. The easiness of processing steps and wide variety of colors, shapes, and flavors, make cookies as a popular type of biscuit. The main raw material in the manufacture of cookies is soft wheat flour. Soft wheat flour has a starch content of 78.74% and 8% protein. The use of wheat flour as a raw material can be replaced with sorghum flour as wheat flour is still imported today. Sorghum flour composition has similarities to soft wheat, especially at the protein level, namely 7.26% and the starch content of 80.42%. However consumer acceptance of sorghum floured-cookies is lower than wheat floured-cookies. Sorghum floured-cookies are also low in lysine content. These problem can be overcome by adding soybean protein concentrate (SPC), which can improve lysine content and sensory properties of cookies. Improving the quality of cookies can also be done by using appropriate grinding technique during sorghum flour making so that the flour has low tannin content. Thereby increasing consumer acceptance.

Keywords: *sorghum, cookies, diversification, local food, substitution*

INTRODUCTION

Sorghum is one of the local types of cereals that has been known in Indonesia. Yet, its development is still slow through it is very suitable to be cultivated in Indonesia. The average production of sorghum in Indonesia is approximately 25,500 tons / year. It then make sorghum potential to be developed and as one of the way to support Indonesian local food diversification. This will improve Indonesia's food security because more local food alternatives that can be used and reduce imported materials.

One of the food that can be used as the medium to develop the potential of sorghum is by using sorghum flour as the substitute for wheat flour in cookies. The easiness of processing steps and wide variety of colors, shapes, and flavors, make cookies as a popular type of biscuit.

The main raw material in the manufacture of cookies is soft wheat flour. Soft wheat flour has a starch content of 78.74% and 8% protein. The main function of chemical components of wheat flour is forming network and framework of cookies. The use of wheat flour as a raw material can be replaced with sorghum flour as wheat flour is still imported today. Sorghum flour composition has similarities to soft wheat, especially at the protein level, namely 7.26% and the starch content of 80.42%.[11]

Studies on the manufacture of sorghum floured cookies needs to be done to determine characteristics of cookies.

DISCUSSION

Sorghum is classified into two types based on the content of tannin, which contains high tannin sorghum (high tanins type) and low tannin sorghum (low tanins type). Sorghum with high tannin content or brown sorghum has contains low nutritional value and can grow well because agronomic advantages, including resistance to the birds and damage from wind, rain, and mildew. Low tanins type is considered as a non-tannin sorghum because it does not contain condensed tanins.The content of tannins in sorghum related with the poor utilization of protein. All tannins belongs to a group of polyphenols, but not all of the polyphenols present in sorghum is a tannin.[4]

Sorghum is rich in insoluble fiber with a relatively small amount of soluble fiber. The content of protein and starch are there in the endosperm of sorghum layers are slower digested by the body than other types of cereals. Low value digestibility of sorghum products can be useful for diabetics.[11]

Sorghum has a high carbohydrate content making it possible to be used as raw material for flour. Sorghum flour contains glutenin and gliadin so it can be used asa an ingredient in manufacture of bread.[9] Besides containing carbohydrate and protein, sorghumflour also contains fat, ash, calcium, and some other ingredients. The chemical composition of sorghum flour can be seen in Table 1. The process manufacture of sorghum flour can be seen in Figure 1.

Table 1. Chemical Composition of Sorghum Flour in 100g

Component	Jumlah
Calorie	320 kalori
Protein	8,0 gram
Fat	2,3 gram
Carbohydrate	72,1 gram
Ash	2,3 gram
Calcium	33mg
Thiamin	0,56mg
Niacin	4,9mg
Riboflavin	0,08mg

Source: Perisse, et al in Hulse, et al (1980)[7]

Lysine level in wheat flour (0,38%) is higher than in sorghum flour (0,16-0,18%). Lysine is one of essential amino acid and affect the value of gluten forming.[11]

All types of cookies have the same terms. Quality requirements must be considered in making cookies in order to qualify good quality cookies. Quality requirements of cookies can be seen in Table 2. Manufacture cookies in this study using a simplified single stage mixing method, which means that all the ingredients are mixed at a certain time. Simplified single-stage method has a more practical process, has aromas and flavors that can be durable in comparison with other methods and weight loss is relatively small. The process manufacture of cookies can be seen in Figure 2.

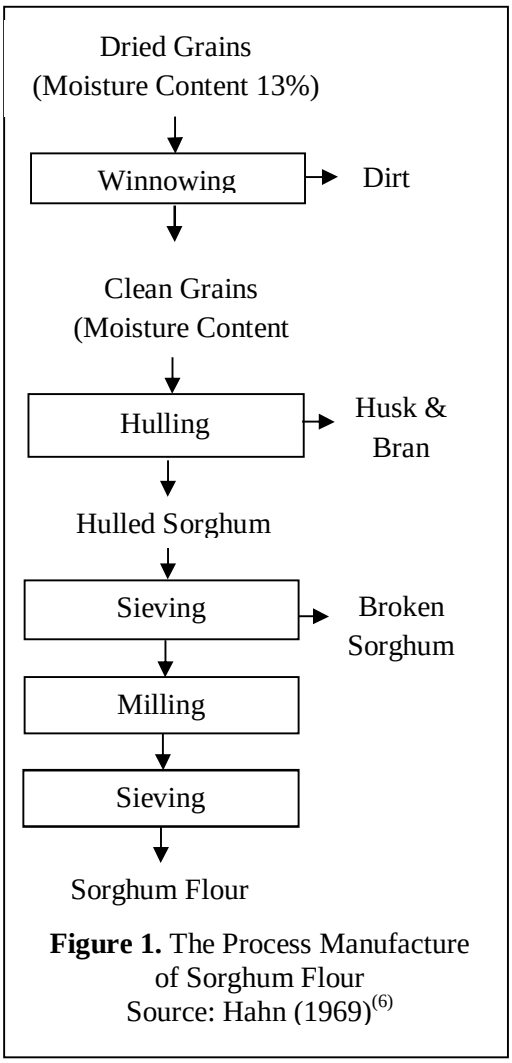


Figure 1. The Process Manufacture of Sorghum Flour
Source: Hahn (1969)[6]

Table 2. Quality Requirements of Cookies

Criteria	Requirements
Water	Maximum 5%
Protein	Minimum 9%
Fat	Minimum 9,5%
Carbohydrate	Minimum 70%
Ash	Maximum 1,5%
Metals	Negative
Crude Fiber	Maximum 0,5%
Calorie (Cal/100g)	Minimum 400
Smell and Taste	Normal, not rancid
Color	Normal

Source: Departemen Perindustrian RI (2004)[3]

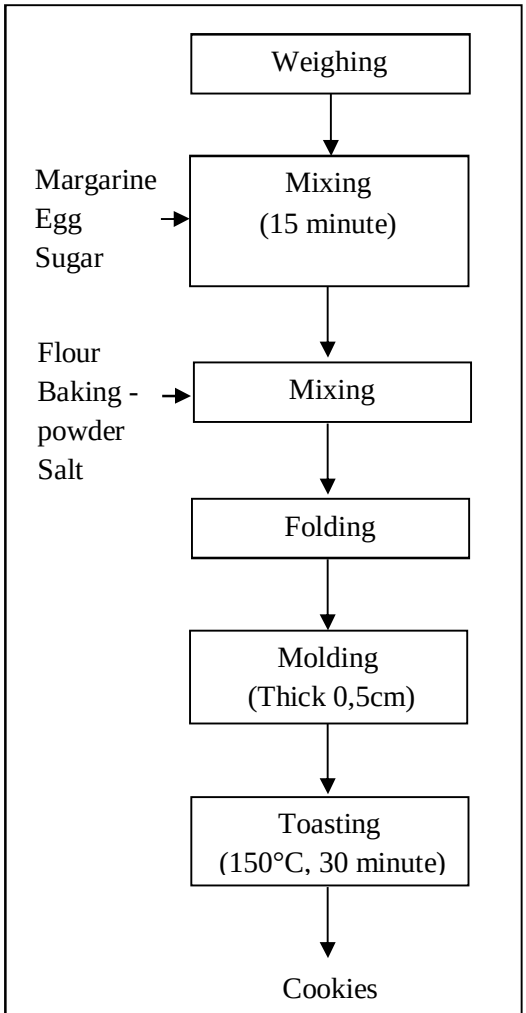


Figure 2. The Process Manufacture of Cookies
Source: Matz (1968)[8]

Effect of Sorghum Flour on The Nutrition Quality of Cookies

Cookies made of subtitution wheat flour with sorghum flour has the difference with wheat flour-cookies. These difference caused by different characteristic and nutrient content from sorghum and wheat flour.

Sorghum flour protein content is lower than wheat flour but in sorghum flour fiber content is higher than wheat. Its can give different characteristics of cookies. The framework forming and texture of cookies is strongly influenced by the flour. Starch and protein form a matrix that can trap the other ingredients in it and can hold CO_2 and this has led to the development of cookie dough. Dietary fiber in sorghum flour resulted in the framework forming disturbed. The bond between starch and protein will be disrupted so that the matrix formed less well and less cookies dough expands. The difference in the nutrient content of cookies from the substitution of wheat flour with sorghum flour can be seen in Table 3.

Table 3. Nutrient Content of Cookies on Variety Level Substitution Sorghum Flour

Substitution Wheat : Sorghum	Protein (%)	Fat (%)	Crude Fiber (%)	Ca (ppm)	Fe (ppm)	P (ppm)
100 : 0	16,12	3,12	2,18	599,1	29,7	1.227,5
20 : 80	11,88	6,18	3,22	622,8	54,5	1.296,4
30 : 70	12,35	5,99	3,01	621,9	52,8	1.289,8
40 : 60	12,98	5,01	3,09	618,7	50,9	1.281,2
50 : 50	13,43	4,76	3,14	615,8	48,7	1.276,7
60 : 40	13,78	4,39	3,21	912,5	46,8	1.271,1
70 : 30	14	4,18	3,39	611,6	45,9	1.268,3
80 : 20	15,26	4,06	3,66	608,9	38,9	1.261,7
0 : 100	11,09	7,88	2,55	627,3	57,8	1.308,8

Cookies from sorghum flour has some positive value at the rising value of the mineral content of Fe, Ca, and P, because the content of these elements in the wheat flour quite low. Sorghum flour-cookies is also beneficial for people with wheat allergies (cealiac disease) and for diabetics, because the characteristics of sorghum flour is more difficult to digest than wheat flour.

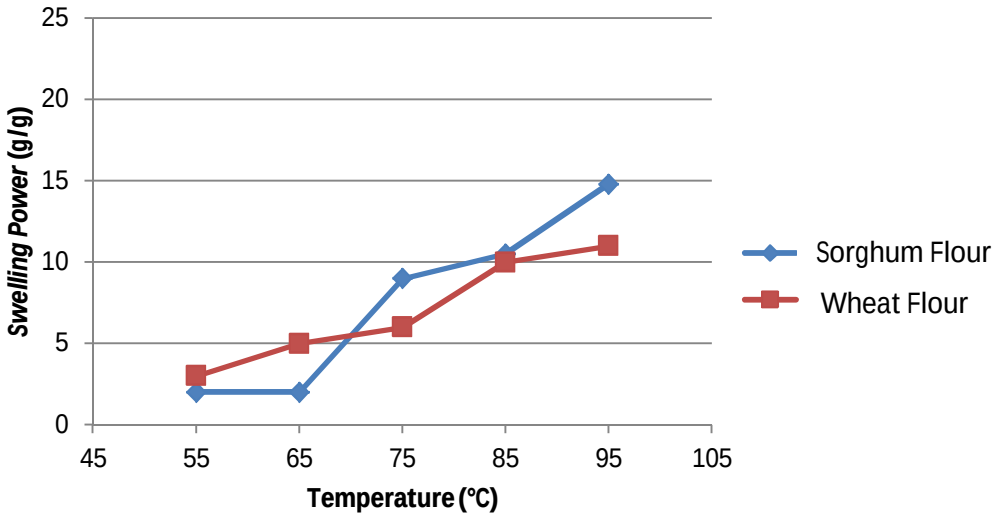
Effect of Sorghum Flour on Physical Characteristics and Organoleptic of Cookies

Sorghum flour composition has similarities to soft wheat flour but it has not gluten-forming protein in an equal number. The differences between the characteristics of sorghum flour and wheat flour can be viewed from two aspects, namely swelling power and solubility. Swelling power is the ability of flour to swelled. The ability of flour to expand not only influenced by the characteristics of the flour itself, but can also be influenced by the amount of water and the temperature of the process. Comparison of swelling power sorghum flour with wheat flour can be seen in Graph 1. Swelling power of sorghum flour is larger than wheat flour in the same conditions. sorghum flour cookies be more swelled, although development is not needed in making cookies.

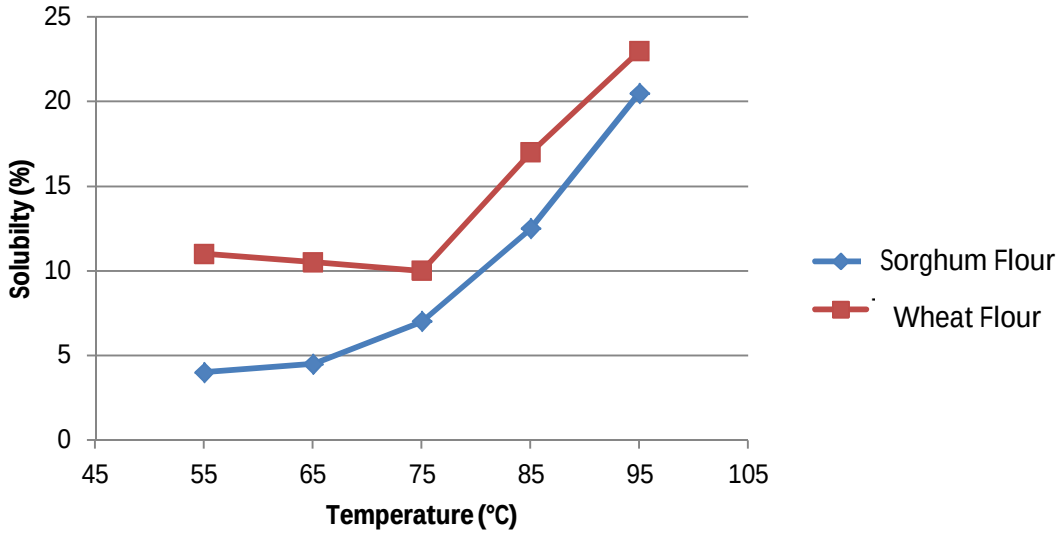
Solubility is the ability of a substance to dissolved in the solvent. Solubility of sorghum flour is lower than wheat flour, as shown in Graph 2. Most of the flour composition is carbohydrates that is polysaccharides, disaccharides, and monosaccharides. Carbohydrates are soluble in water is monosaccharide and disaccharide, usually a sugar, whereas polysaccharides such as starch and cellulose is insoluble in water. Solubility shows the number of solute in the flour. This indicates that even though the carbohydrate levels are almost the same between thats flours but the sugar content of sorghum flour fewer than wheat flour. Solubility will affect the flavor and color cookies.

Swelling power and solubility graphs shown in Graph 1 and Graph 2 shows that there is no significant difference between wheat flour and sorghum flour. This indicates that there will be no significant changes in physical properties of cookies.

The different characteristics of sorghum flour cookies with substitution can also be seen in organoleptic, such as the color, aroma, flavor, and texture. Cookies become paler color because the sugar content in sorghum flour is smaller than wheat flour. This resulted in the Maillard reaction and caramelization that occurs a little more so the color becomes paler. The smell of cookies is not too savory because of the volatile compounds contained by sorghum flour. Cookies taste a little more bitter. This is because the tannin in sorghum flour that brings the bitter taste. The texture of the sorghum flour-cookies becomes harder due to the lack of gluten is formed. This is due to sorghum contains high fiber, so when water is added, there will be competition between starch, protein, and fiber in water absorption. The results of the competition is fibers absorb the water faster than protein and starch. This resulted in gluten-forming proteins, gliadin and glutenin which can not form sufficient gluten and starch also will not get enough water to gelatinization. This is also corroborated by the use of water in the manufacture of cookies is very little because there is no addition from the outside, but only from the egg. The difference in the characteristics discussed above confirmed by test results panelists fondness for cookies with different levels of flour substitution that can be seen in Table 4.



Graph 1. Swelling Power of Sorghum Flour and Wheat Flour
Source: Chanapamokkhot and Thongngam (2007)[(2)]



Graph 2. Solubility of Sorghum Flour and Wheat Flour
Source: Chanapamokkhot and Thongngam (2007)[(2)]

Improving Quality of Sorghum Flour Cookies

Cookies sorghum has a weakness, low level of lysine. Lysine is an essential amino acid which is very useful for the body. Lysine is a precursor biosynthesis of carnitine. Carnitine stimulates β-oxidation of long chain fatty acids occurs in the mitochondria. The addition of lysine in food can increase the amount of carnitine, thereby β-oxidation in fat also increased.

The addition of lysine can be done with the addition of soybean protein concentrate on sorghum flour. Soybean protein concentrate has a high protein content (70%). It's essential amino acids is complete, because SPC has been made by good quality of soybean that has the most complete essential amino acids. Soybean protein concentrate had higher levels of lysine than other soybean processing, such as soy flour and soybean protein isolate as shown in Table 5. The more the addition of SPC resulted in the higher of protein level, but not in lysine levels as shown in Table 6.

Table 4. The Result of Organoleptic Test on Cookies at Variety Level Substitution Sorghum Flour.

Substitution Wheat : Sorghum	Value			
	Texture	Aroma	Flavor	Color
100 : 0	1,20	1,05	1,20	1,25
20 : 80	3,15	3,05	2,90	2,70
30 : 70	2,80	2,60	2,75	2,60
40 : 60	2,45	2,45	2,45	2,45
50 : 50	2,20	2,40	2,10	2,25
60 : 40	2,10	2,30	1,85	2,10
70 : 30	1,85	2,15	1,45	1,95
80 : 20	1,35	1,35	1,30	1,75
0 : 100	3,50	3,35	3,10	2,95

Value 1 = Very Like, 2 = Like, 3 = Just Like, 4 = Neutral, 5 = Dislike

Source: Suarni (2000)[11]

Table 6 shows that the addition of 8% SPC is the most effective in terms of increasing lysine levels as lysine may increase significantly, but with the addition of 8% will cause adverse effects on the cookies. Side effects are most visible in terms of the cookies texture. The addition of this SPC resulted in cookies texture can not be fused. SPC has caused high water absorption so it absorb too much water in the dough and cause the dough is formed not compact or not smooth. The proportions of the SPC should be highly considered in order to increase the levels of lysine but texture cookies do not damaged. The addition of SPC can improve the aroma of cookies because the SPC containing hydrophobic amino acids, such as alanine, valine, leucine, and isoleucine which will react with the sugar causing flavor like chocolate aroma. The intensity of the flavor of cookies also increased due to glutamate in the SPC that serves as a flavor enhancer and can mask the bitter taste of tannin. Colors become more chocolate, since the Maillard reaction occurs more than ever due to increasing amino group of the amino acids contained in the SPC.

Improving the quality of sorghum flour can also be done from the grinding. Grinding the sorghum grain can make sorghum bran separated so that the tannin content will decrease. The decrease in the tannin content of sorghum will reduce bitter taste of cookies so as to increase the acceptance of consumers. Grinding tool can affect the quality and yield of flour produced, as shown in Table 7. Combination tool when grinding stage that produces good flour is H-D-S, namely Hammer mill, Omega VI Grinder, and Sifting.

Table 5. Protein and Amino Acids Content of Soybean Protein Concentrate and Soybean Protein Isolate.

Product	Protein (%)	Ile (%)	Leu (%)	Lys (%)	Met + Cys (%)	Phe+ Tyr (%)	Thr (%)	Trp (%)	Val (%)
SPC	71,0	4,9	8,0	6,6	2,9	9,1	4,3	1,4	5,0
SPI	96,0	4,6	7,6	5,4	2,0	9,1	3,5	1,3	4,0

Source: Smith and Circle (1972)[10]

Table 6. The Result of Addition Soybean Protein Concentrate on Sorghum Flour.

Parameter	Sorghum Flour	SPC	Meal 1	Meal 2	Meal 3
Protein	14.00e	68.25a	18.00d	22.00c	26.00b
Lysine (mg/100g)	105,75	3306,50	252,40	510,73	506,58

Meal 1 = +4% SPC; Meal 2 = +8% SPC; Meal 3 = +12% SPC
Source: Awadalkareem, et al (2008)[1]

Table 7. The Result of Grinding Sorghum Grains with Variety Combination Tools

Tools	% Flour	% Bran	% Particle (<180 micron)	% Particle / Weight of Sorghum Grains
Dx6	100	0	74	74
Dx4-S-D-S	92	8	81	74
H-S-H-S	91	9	73	66
H-S-D-S	90	10	80	71
H-H-S	86	14	67	57
H-D-S	94	6	88	82

Note:
Dx6 : Omega VI Grinder
Dx4-S-D-S : Omega IV, Sifting, Hammer mill, Sifting
H-S-H-S : Hammer mill, Sifting, Hammer mill, Sifting
H-S-D-S : Hammer mill, Sifting, Omega VI Grinder, Sifting
H-H-S : Hammer mill, Hammer mill, Sifting
H-D-S : Hammer mill, Omega VI Grinder, Sifting
Source: Duville and de Zacatares (2010)[5]

CONCLUSION

The utilization of sorghum flour in the manufacture of cookies will produce a lower acceptance rate cookies at organoleptic aspect than wheat flour, but it has a positive side in terms of nutritional content. Sorghum potentially replace wheat flour in manufacture of cookies.

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USE OF HOMOGENIZATION TO IMPROVE MILK QUALITY AT FARMER LEVEL IN INDONESIA

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ABSTRACT

Milk is a highly nutritious food that has many uses in Indonesia. Milk can be used by directly consumed or to be used as raw material for dairy products. Milk quality is an important factor to be considered in the use of milk. One problem that arise is related to the quality of the milk during the distribution chain. Long distribution chain will take a long time and cause the milk to undergo separation naturally before reaching the destination. The solution of this problem by using the homogenization process has been widely known. The homogenization process reduce the milk particle size and fat globule thus increasing the stability of the milk. Homogenization process has been widely used on an industrial scale but very rarely used on the farmerlevel. The application of homogenization process at the farmer level will help to maintain the quality of milk, especially when undergo to the distribution process. Maintained milk quality will provide more value on the benefits of milk in terms of nutrition and economy.

Keywords: *milk, distribution, natural-separation, homogenization, farmer-level*

INTRODUCTION

Milk is a highly nutritious food that has many uses in Indonesia. These high nutrient content causes milk used by all people with various ages and needs. This fact led to high demand and needs for milk in Indonesia. Needs of milkis responsedholdingmilk farms ormilk cooperative with the purpose to fulfill the milkdemand for each area. However, until now, Indonesia is still not able to meet the needs of the milk itself and must import from the other country.

Percentage imports of milk which is approximately 85% (Directorate General of Livestock, 2011) left a problemrelated with milk production in the country. Comparingwith the number of milk farmers in Indonesia, according to the existing data,

the domestic milk production in 2011 reached 925.775 tons. With thosenumber, Indonesian should have the potential to meet its own needs of milk, or at least reduce the amount of imported milk. The fact that Indonesia is still not able to meet their own needs is due to the farmers whose deliberately reduce the milk production to minimalize lossbecause milk was damaged. Reduced amount of production is also because of the narrow range of distribution area so that production capacity at the existing amount already deemed sufficient needs of the region.

The main problem that is often associated with dairy products is a matter of contamination and damage caused by microorganisms. Milk contains various elements and consists mainly of food substances that are also required for the growth of bacteria, that caused the growth of bacteria in the milk very quickly at the appropriate temperature (Buckle et al, 2010). This problem can generally be resolved at the farmer level using pasteurization process that has been commonly used. Another issue that is less of concern is the separation of the emulsion. Separation is the nature of the emulsion of milk does go through separation after a certain time. This becomes a problem especially when the milk should be distributed and stored in a specified period.

Solution to maintain the stability of the milk is by homogenization. At the industry level, this process is a common process to maintain the quality of the milk used as raw material. This is a problem that is difficult to be resolved at the farmer level. The obstacles of using homogenization at the farmer level is the price of expensive equipment, although from an economic standpoint, the investment which should be used for this purpose can be relatively small compare to the prospects. This paper will discuss how the application of the homogenization process at farmer level is expected to improve the quality of milk production to provide positive values, especially from an economic standpoint.

METHOD

Writing method is to do literature study through various literature sources related to milk farm conditions in Indonesia and research on the quality of milk. The main sources of literature used are journals and research results in the form of thesis published in the past 10 years.

DISCUSSION

Conditions of Milk Farm in Indonesia

Milk farm in Indonesia in general is still traditionally managed by farmers with varying educational backgrounds. A study on farmers in three different villages by Bimo (2002), showed that the majority of farmers there have only up to elementary

school background. The same thing also revealed by Effendi (2002) through a research in a village in West Java. The lack of education of the farmers will affect the quality of the milk farm and milk products.

General process that occur in almost every farm ini Indonesia is milking process will be continued pasteurization pasteurization with an average temperature of 70°C or up to 100°C (Firman, 2007). Afterward, the milk will be sold directly to consumers or to the salesman who distributes milk to the surrounding area. Another alternative which is usually done is to bring the milk to a milkcooperative. At the milk cooperative (KPS), milk will be collected for distribution or brought to the industries that use milk as a raw material (Bimo, 2002). Distribution process takes time to reach the destination. The time required depends on the distance and the location of the destination factory.

Milk Production in Indonesia

According to recent data from the Directorate General of Livestock (2011), Indonesia has experienced quite significant increase in milk production in the last 5 years. In 2007, milk production only reached 567.9 ton while in 2011, milk production has reached 925.8 ton. Increase of 357.9 ton in 5 years shows that milk to be one of the important and promising farm productfor the people of Indonesia.

Milk Quality Problems

Milk quality is an important aspect and demands when milk is consumed or to be processed. This is the source of the problems associated with milk production in Indonesia. Research conducted by Puspitasari (2008) on a farm in East Java shows the low quality of the milk produced in terms of the application of Good Farming Practices (GFP) and Good Hygienic Practices (GHP). The data show that only about 13.79% of farmers have simply apply GFP and GHP, the other classified as less and even much less.

The data showedabove provides a common condition that also occurs in many other farms in Indonesia. This condition is a quite heavy problem considering the huge potential in milk production in Indonesia. If the quality of milk only determined by microbiological aspects, it can be said that with the current conditions of the farmers, the milk produced in Indonesia generally have meet the Indonesian National Standard (SNI). However, the problem when the milk is going to be used is not only about total colonies/ml. The physical appearance of milk is a point of concern for consumers to buy milk. One paradigm that has been embedded in Indonesian society about the appearance of milk is a goodmilk is unseparate milk. For the people, separation indicates the level of poor milk quality and not suitableto be consumed. This separation

is also often associated with microbiological activity, despite the separation that occurs is not always the result of microbiological contaminan

Table 1. Particle size (μm) of raw, pasteurized, homogenized-pasteurized milk

Treatment	$D_v0.9$	$D_v0.5$	D(4,3)	D(3,2)
Raw	5.07 ± 0.03[b]	3.11 ± 0.04[b]	2.90 ± 0.05[a]	0.63 ± 0.03[a]
Pasteurized	5.16 ± 0.04[b]	3.16 ± 0.01[a]	2.94 ± 0.01[a]	0.59 ± 0.01[b]
Homogenized-pasteurized	1.10 ± 0.03[c]	0.39 ± 0.00[c]	0.50 ± 0.01[c]	0.32 ± 0.01[c]

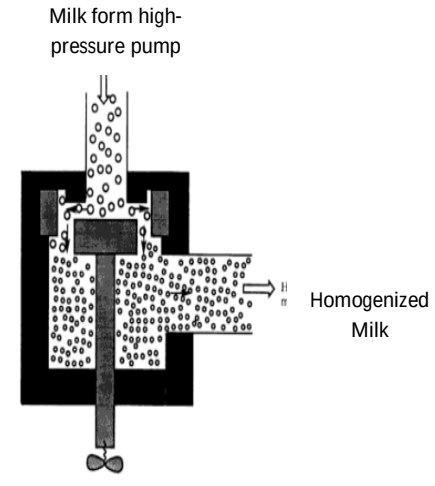
Source: Zamora et al, 2007 (edited)

The separation of the emulsion is one of the natural properties of the milk which is a natural emulsion system. Separation will occur after the milk stored in a place for some time at room temperature. Separation may occur due to the difference in density between the lipid components with the existing water in milk. The rate of separation can be inhibited by reducing the particle size of the milk fat globule sizes (Pereda et al, 2007).

Positive Value of Using Homogenization at Farmer Level

The process of homogenization is the process to reduce the particle size of milk by using an equipment called a homogenizer. The principle of homogenizationis utilizing the friction and collision force when milk was pumped with pressure to pass through the valve (Figure 1).

Homogenized milk will have a whiter color (Fox et al, 1998) and better taste (Trout, 1948). The important value given by the homogenization process is due to the increased stability of the emulsion by particle size reduction in milk. Table 1 shows that the size of the particles in milk that had been homogenized will be 5 times smaller than the particle size of fresh milk without homogenization and pasteurization. These posotive vale will caused the produced milk to have better quality in physicochemical and sensory aspect



Source: Fox et al, 1998

Figure 1. Diagram of Milk Homogenizer

Bussines Value of Using Homogenization at The Farmer Level

The processof homogenization requires a homogenizer. Purchasinga homogenizer may not be a small investment if applied at the farmer level. The price of a homogenizer for medium-scale machine with a capacity of 30-12000 L varies from 3 million to 28 million rupiah. However, if it is assumed that the production capacity of a farm is up to 100 liters of milk per day with milk prices varies from 4.500-5.000 rupiah per liter(Soegiyono, 2012), the time required to achieve the Break Even Point (BEP) will not be too long. Consideringthe investment costs and the positive values to be received, then the use of the homogenization process may be one way of improving the quality of milk with prospects and deserves to be used.

CONCLUSION

Use of homogenization process has the potential to improvemilk quality at the farmer level. Prospects of using the homogenization is assessed from the need of milk which is increasing in Indonesia. It is also supported by the capital rate of return which is relatively fast according the potential income that can be received by farmers everyday.

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THAI CONSUMER BEHAVIOR AND ATTITUDE: EFFECT OF GENDER AND DEGREE OF FOOD NEOPHOBIA ON PRODUCT LIKING AND FOOD RELATED LIFE STYLE

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ABSTRACT

Food Neophobia Scale (FNS) is important for product development since it might indicate consumer's purchasing decision of novel food products. This study was aimed to investigate whether FNS can identify product preference and consumer behaviors (Food Related Life Style (FRL)). Thai consumers were screened using FNS in order to have balanced number of consumer who has food neophilic, neutral, and neophobic. Each consumer responded to the questionnaire consisted of demographic, preference test, and FRL scale. According to the preference test, Flavored Brownie, Meangkam rice bar, Core pineapple and cream cheese pie, and Fang herbal juice, were significantly different by the highest liking means of all four product ideas obtained from neophobic consumer. Thus, it might be the evidence to show that food neophobia cannot predict whether consumer will like the new product. The finding from the FRL showed that there were 2 categories significantly different (Novelty and Looking for new ways). On the other hand, the preference score of male and female was not significantly different in all ten product ideas. However, there are 5 out of 23 lifestyle dimensions in FRL found significantly different by female had higher average Likert scores in Importance of product information[5.4, 4.8], Attitudes to advertising[5.1, 4.4], Specialty shops[4.8, 4.2], and Social relationships [5.5, 4.9]. Male was only more positive towards Snacks versus meals [4.3, 3.7]. And the finding from this study suggests that FNS may not be an effective way to predict product preference but it might help us understand consumer behavior and attitude.

Keywords: *food neophobia, consumer behavior, food related lifestyle, product development, and Thai consumers*

INTRODUCTION

Over the past few decades, food consumption habits have changed immensely. Today's lifestyle, it is common in the family that almost all of the adults would work outside. People do not have enough time to prepare food for their family but they are tended to be more conscious about health and foods. As a result, foods that provide good impact to health are very much involved in people's diets. As a result, new product developers are now

streaming in the healthy trend. However, people still want foods with good taste. The food industry has responded to this demand by developing fresh and nutritional products with conservation techniques that extend the shelf life of the product (Deliza et al. 2003).

In order to develop food products successfully, researchers need to understand attitude, behavior and preference of target consumers. Since consumers are very individual, market segmentation is a very important tool to group consumers with similar characteristics together, make it easier to understand how consumers who belong in the same group perceive a product, how they make choices and how they construct purchasing intentions. As consumer decisions about food choices are the result of a complex relationship between personal preferences, socio demographics, psychosocial, and environmental factors (Trudeau et al., 1998). Consequently, study of customer's behavior and attitude is the most important for all of food manufacturers. One characteristic that concerning with new food product is Food Neophobia which would be able to assess by using Food Neophobia Scale (FNS). FNS was developed in the early 1990s by Pliner and Hobden to use specifically for measuring willingness to try new or unfamiliar foods. The scales indicate the degree of agreement and disagreement consumers have using 10 statements about foods or eating situations, i.e., ethnic foods and innovative foods (Ritchey, Frank, Hursti, & Tuorila, 2003). It includes five positive and five negative statements that consumers respond to using a 7-point scale ranging from disagree strongly to agree strongly. The positive items are reversed, therefore higher FNS scores reflect greater objection to trying new foods. The scale was determined to be an accurate predictor for novel foods and positively correlated with other fear and anxiety measures. It is negatively correlated with familiarity to foreign foods, finickiness, and sensation seeking (Henriques, King, & Meiselman, 2009).

FNS has been used to characterize and compare consumers in different demographic groups, e.g., age groups and different countries. (Ritchey et al., 2003). In 2008, the FNS had been studied with "picky/fussy" eating consumer to create an understanding on the similarities and differences between the two in rejection and acceptance of fruits and vegetables in children. It was found that both FNS and "picky/fussy" eating affected rejection and acceptance of fruits and vegetables in children. There were other factors (e.g., age, tactile defensiveness, environment, and culture) that should be studied with FNS

and "picky/fussy" eating because these elements affected the children's attitudes towards fruits and vegetables. The study suggested that early life exposure helped promote acceptance and independent choice of fruits and vegetables in children (Dovey, Staples, Gibson, & Halford, 2008). When the difference among neophobic consumers and neophillic consumers, using novel flavored salad dressing, was studied findings indicated that neophobic consumers rated hedonic scores lower than neophilics for the novel salad dressings (Henriques, King, & Meiselman, 2009). However, ranking of hedonic scores for both groups were in the same order. The study suggested that the level of food neophobia may affect the magnitude of liking, but it may not affect product ranking based on hedonic scores. Thus, NFS helps product developers understand consumer psychographic profiles, but it may not give direction for the development of new products (2009).

Another factor that normally used to classify consumer is demographic. Demographic segmentation is perhaps the most commonly used and easy to collect. It has been widely described in the literature that demographic characteristics is an important factor to determine fruit intake. Furthermore; lifestyle segmentation has been used for several marketing and advertising purposes introduce the lifestyle concept into the debate in order to contextualize consumption processes in socio-economic and cultural regards, to differentiate in modern consumption societies between different social groups, and to differentiated accounting of the environmental impacts (Reusswig 1994). One of the measurements that used to capture food related behavior is Food Related Lifestyle (FRL). It collects consumer information on attitudes and behaviour to the purchase, preparation and consumption of food products to know the need of different consumers. (Kearney et al., 2000; Kvaakik et al., 2005).

This study was aimed to investigate effect of gender and degree of food neophobia on the preference pattern as well as to see if there are any differences in term of food related behavior using Food Related Life Style.

MATERIALS AND METHODS

Materials

1. Questionnaire
    1.1. Screening ballot
    1.2. Questionnaire for consumer survey
2. SAS® (Statistic Analysis System for Windows, Version 9.2, 2010, SAS Institute Inc., Cary, NC).

Methods

1. Recruiting consumers

Consumers were screened more than 120 consumers at Assumption University, Hua Mark campus. Each consumer have to respond the screening questionnaire in order to classify consumers.

Since the study was aimed to study the differences between Neophillic, Neutral, and Neophobic consumer, therefore, Food Neophobia Scale (FNS) was used to categorize consumers according to their responses to FNS. The consumers who obtained the score less than 35 were classified as Neophillic. The consumer who belong in Neutral group were those who obtained the score between 35-45, and the Neophobic group were consumer with the score higher than 45. At least 30 consumers should be recruited for each group.

2. Consumer survey

The consumer who passed the screening procedure will respond to the questionnaire. The questionnaire was divided into 3 parts, preference test of different product idea using 9-point hedonic scale, Food Related Lifestyle (FRL) scale using 7-point Likert scale, and demographic questions.

3. Data Analysis

The data analysis was aimed to compare the differences between Neophillic, Neutral, and Neophobic consumers on preference towards different product ideas as well as their responses to FRL. Effect of gender also was investigated. Responses from male and female consumers in term of product preferences and their food related life style.

The data were analyzed by using Microsoft Office Excel (2007) and SAS® (Statistic Analysis System for Windows, Version 9.2, 2010, SAS Institute Inc., Cary, NC).

An analysis of variance procedure (GLM Procedure) using SAS® (Statistic Analysis System for Window version 9.1, 2006, SAS Institute Inc., Cary, NC) was performed to determine the differences between the consumer types. Then, the least significant differences for mean separation of samples to indicate different mean of the attribute intensities among the products at p-value < 0.05. As for effect of gender, two sample t-test procedures (t-test Procedure) were used for the analysis.

RESULT AND DISCUSSION

Demographic characteristics

The demographic of the consumer participated in this study was demonstrated in table 1. There are equally number of male and female consumer as well as consumer whom belonged to food neophillic, neutral and neophobic group since they were fixed during the screening

process. Most of the consumers are 18-25 years old and attending undergraduate level.

Table 1. Demographic information of the consumers participated in the study.

Demographic		Percentage
Gender	Male	49.5%
	Female	50.5%
FNS group	Food Neophilic group	33.3%
	Food Neutral group	33.3%
	Food Neophobic group	33.3%
Age	< 18 year-old	3.0%
	18-25 year–old	82.8%
	26-40 year-old	8.1%
	41-55 year-old	6.1%
	>55 year-old	0 %
Education	Obtained primary school	1.0%
	Obtained secondary school	3.0%
	Obtained Vocational or High Vocational	4.0%
	Attending undergraduate degree	82.8%
	Obtained graduate degree	9.2%
Household Income	<10000 baht	8.1%
	10000-25000 baht	11.1%
	25001-40000 baht	16.2%
	40001-55000 baht	11.1%
	>55000 baht	53.5%

Comparing Food Related Lifestyle by Degree of Food Neophobia

When comparing food related lifestyle with consumer whom belong in different neophobia degree. According to the result shown in table 2, there were 2 categories significantly different which were Novelty and Looking for new ways. For novelty, food Neophobic group obtained the highest score followed by the Neutral, and Neophilic group with the mean of 5, 4.7, and 4.3 respectively. The same pattern was found in Looking for new ways. The highest mean score belonged to Food Neophobic (5), Neutral (4.7), and Neophilic (4.1), respectively.

Table 2. Likert scores obtain from Neophillic, Neutral, and Neophobic group

Lifestyle Dimensions	Means comparison + SD		
	Neophilic (n=33)	**Neutral (n=33)**	**Neophobic (n=33)**
Ways of shopping			
Importance of product information	4.7 ± 1.1	5.1 ± 1.1	5.3 ± 1.1
Attitudes to advertising	4.6 ± 1.2	4.7 ± 0.9	4.9 ± 1.2
Enjoyment from shopping	4.2 ± 1.2	3.8 ± 1.2	3.8 ± 1.3
Specialty shops	4.3 ± 1.2	4.4 ± 0.9	4.7 ± 1.0
Price criteria	4.6 ± 1.4	4.8 ± 1.2	4.9 ± 1.0
Shopping list	4.3 ± 1.2	4.4 ± 1.1	4.5 ± 1.4
Quality aspects			
Health	5.1 ± 1.1	5.0 ± 1.2	5.4 ± 1.2
Price/quality relation	5.2 ± 1.3	5.0 ± 1.3	5.4 ± 1.2
Novelty*	4.3^{a} ± 1.2	4.7^{ab} ± 0.9	5.0^{b} ± 1.0
Organic products	4.7 ± 1.4	4.8 ± 1.0	4.8 ± 1.0
Taste	5.1 ± 1.2	4.5 ± 1.2	5.5 ± 1.2
Freshness	4.8 ± 0.8	4.9 ± 1.0	5.0 ± 1.0
Cooking methods			
Interest in cooking	4.5 ± 1.1	4.5 ± 1.0	5.1 ± 2.7
Looking for new ways*	4.1^{a} ± 1.5	4.7^{ab} ± 1.5	5.0^{b} ± 1.4
Convenience	4.0 ± 1.3	4.2 ± 1.1	4.5 ± 1.1
Whole family	4.5 ± 1.1	4.4 ± 0.9	4.3 ± 1.2
Planning	4.4 ± 1.4	4.3 ± 1.1	4.2 ± 1.3
Woman's task	4.3 ± 1.4	4.2 ± 1.3	5.1 ± 4.3
Consumption situations			
Snacks versus meals	4.1 ± 1.4	4.1 ± 1.0	4.0± 1.1
Social event	4.7 ± 1.1	4.6 ± 0.9	4.9± 0.8
Purchasing motives			
Self-fulfillment in food	4.7 ± 1.1	4.2 ± 1.5	4.9± 1.1
Security	4.8 ± 1.3	4.6 ± 1.1	4.2± 1.5
Social relationships	5.1 ± 1.5	5.2 ± 1.0	5.2± 1.3

Note. * Indicates the factor found to be significantly different with P-Value at 0.05

Comparing Food Related Lifestyle by Gender

When comparing between male and female consumers, it was found that there are 5 out of 23 lifestyle dimensions in FRL found significantly different. Female consumer obtained higher average Likert scores than male consumer in Importance of product information [5.4, 4.8], Attitudes to advertising [5.1, 4.4], Specialty shops [4.8, 4.2], and Social relationships [5.5, 4.9]. Male consumers were only more positive towards Snacks versus meals [4.3, 3.7] as shown in table 3. The finding showed that female consumers were more interested in the product information and product advertising. They are more specific in term of what they want to buy that showed from the result that they paid attention in specialty shop. Moreover; female

consumers might think that eating food together is pushing up the social relationships, which implied that they liked to have social gathering that involving with foods. On the other hand, male consumer had the positive attitude toward having snack since female might be more concerned about their appearance.

Table 3. Likert scores obtain from male and female consumers

Lifestyle Dimensions	Gender (n ≈ 100)	
	Male (n = 49)	Female (n = 50)
Ways of shopping		
Importance of product information*	4.7 ± 1.2	5.3 ± 1.0
Attitudes to advertising*	4.5 ± 1.2	5.0 ± 0.9
Enjoyment from shopping*	3.9 ± 1.1	4.0 ± 1.4
Specialty shops	4.2 ± 1.1	4.8 ± 0.9
Price criteria	4.6 ± 1.0	5.0 ± 1.3
Shopping list	4.2 ± 1.2	4.6 ± 1.3
Quality aspects		
Health	5.0 ± 1.2	5.4 ± 1.1
Price/quality relation	5.0 ± 1.3	5.4 ± 1.3
Novelty*	4.5 ± 1.0	4.7 ± 1.1
Organic products	4.5 ± 1.0	5.0 ± 1.2
Taste	4.7 ± 1.2	5.0 ± 1.2
Freshness	4.9 ± 0.9	4.9 ± 1.0
Cooking methods		
Interest in cooking	4.6 ± 1.2	4.5 ± 1.3
Looking for new ways*	4.7 ± 1.4	4.5 ± 1.5
Convenience	4.2 ± 1.3	4.2 ± 1.1
Whole family	4.4 ± 1.1	4.4 ± 1.0
Planning	4.3 ± 1.3	4.3 ± 1.3
Woman's task	4.3 ± 1.0	4.3 ± 1.5
Consumption situations		
Snacks versus meals	4.3 ± 1.0	3.7 ± 1.2
Social event	4.8 ± 0.9	4.7 ± 1.0
Purchasing motives		
Self-fulfillment in food	4.7 ± 1.2	4.5 ± 1.3
Security	4.4 ± 1.3	4.7 ± 1.3
Social relationships	4.9 ± 1.4	5.5 ± 1.0

Note. * Indicates significant component from t-test at p-value 0.05

Comparing Preferences towards Product Idea Concepts

To study the preferences of Thai people by degree of food Neophobia and Gender were tested by this 9-point hedonic rating towards 10 product ideas as showed in table 4 and 5.

Comparing Preferences towards Product Idea Concepts by Degree of Food Neophobia

The finding showed that there are significantly different in hedonic scores of 4 product idea concept including Flavored Brownie, Meangkam rice bar, Core pineapple and cream cheese pie, and Fang herbal juice (table 4). It was demonstrated that consumer who belonged in Neophobic and neutral group rated the higher hedonic scores towards new product idea concepts than consumer who classified as Neophillic.

Table 4. Means of hedonic score obtained from Neophillic, Neutral, and Neophobic group

Product Idea Concepts	Means comparison + SD		
	Neophilic (n=33)	Neutral (n=33)	Neophobia (n=33)
Brownie with 3 flavors (Mint, Orange, Strawberry)	$4.8^{ab} \pm 2.1$	$3.8^{a} \pm 1.9$	$5.7^{b} \pm 2.4$
Rice bar with Maeng Kum** flavor	$4.2^{a} \pm 1.8$	$4.4^{a} \pm 2.2$	$5.6^{b} \pm 2.4$
Pineapple core and cream cheese pie	$5.1^{a} \pm 1.9$	$4.8^{a} \pm 1.9$	$6.2^{b} \pm 2.0$
Rice bar with seasoning squid flavor	4.5 ± 2.0	4.4 ± 1.7	5.5 ± 2.2
Salad dressing incorporated with orange pulp	5.4 ± 2.3	5.3 ± 2.2	6.4 ± 2.4
Fish sausage incorporate with spirulina algae	4.8 ± 1.8	5.4 ± 1.7	5.3 ± 2.7
Mixed soy milk and vegetable puree drink	5.1 ± 2.1	4.8 ± 2.3	5.6 ± 2.3
Chocolate beer	3.9 ± 2.3	5.3 ± 2.6	4.0 ± 2.8
Fang Herbal juice	$4.8^{a} \pm 1.8$	$4.5^{a} \pm 1.9$	$5.9^{b} \pm 2.4$
Banana beer	3.8 ± 2.2	4.6 ± 2.6	3.9 ± 2.2

Note. * Indicates the factor found to be significantly different with P-Value at 0.05
**Authentic Thai appetizer incorporated with roasted coconut flake, peanut and caramel sauce

Comparing Preferences towards Product Idea Concepts by Gender

There was no significantly different found in the hedonic scores obtained from male and female consumer. The range of means was between 3.7 to 5.7 (slightly dislike to slightly like).

Table 5. Means of hedonic score obtained from male and female consumers

Product Idea Concepts	Means comparison + SD	
	Male (n=49)	Female (n=50)
Brownie with 3 flavors (Mint, Orange, Strawberry)	4.7 ± 2.4	4.9 ± 2.1
Rice bar with Maeng Kum** flavor	4.3 ± 2.0	5.1 ± 2.3
Pineapple core and cream cheese pie	5.0 ± 2.2	5.6 ± 1.8
Rice bar with seasoning squid flavor	4.5 ± 2.0	5.0 ± 2.1
Salad dressing incorporated with orange pulp	5.6 ± 2.3	5.7 ± 2.4
Fish sausage incorporate with spirulina algae	5.0 ± 2.0	5.3 ± 2.2
Mixed soy milk and vegetable puree drink	5.0 ± 2.3	5.5 ± 2.2
Chocolate beer	4.7 ± 2.7	4.1 ± 2.6
Fang Herbal juice	4.6 ± 1.9	5.4 ± 2.3
Banana beer	4.4 ± 2.3	3.7 ± 2.4

Note. * Indicates significant component from t-test at p-value 0.05
**Authentic Thai appetizer incorporated with roasted coconut flake, peanut and caramel sauce

CONCLUSION

Comparing food related behaviors of the consumer belonged in different group according to degree of food neophobia showed that neophobic and neutral consumers were more interested in activities related with food than neophillic group. The similar pattern was found in the preference scores obtained from both groups towards new product idea concepts. Therefore, the findings from the study suggested that using food neophobia might not be an effective way to predict preferences. There were differences when comparing different gender using Food Related Lifestyle. Female consumers were specific in shopping. They paid attention in information, advertising and type of shop. Male were more involved in snack food and the way they spent time consuming foods.

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LOCAL CASSAVA CULTIVAR: BUSINESS NEED VS GOVERNMENT'S ATTENTION

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ABSTRACT

Cassava is used as food, feed, raw materials for food and chemical industries. Cassava is a source of carbohydrates and is a good choice of the people of Indonesia main food after rice, corn, and sago. Cassava was introduced to Indonesia at Dutch colonial era. The nutrients contained are rich in carbohydrate, also high rate of glucose but poor in protein. Basically there were two varieties of cassava, i.e. sweet and bitter cassava, which represents the local and hybrid varieties respectively. Sweet Cassava is widely used in the food industry, while many bitter varieties used for animal feed industry, adhesives, and other industrial needs. Over the last five years, cassava production in Indonesia was increasing, even though the domestic needs on consumption and industry could not been fulfilled. The purpose of this study was to compare the cassava production and the level of need, and to evaluate the role of the government in increasing cassava production in Indonesia. The method in this study was made by personal interviews with the farmers, industries and literature review. This study found that the increase in production of cassava was only occurs in the bitter varieties, which is a hybrid ones, whereas the sweet cassava production is decreasing, and therefore could not meet the needs of either consumers and food industries. Consequently, despite the increase in domestic production, imports of cassava was increasing as well. The further investigation found that the type of imported cassava were those can be consumed by humans, which was actually the same variety with local varieties of cassava. From these facts it can be concluded that the government was only focused on the development of hybrid cassava, but lack attention to local varieties.

Keywords: cassava, hybride varieties, consumption, import, government roles

INTRODUCTION

Basically cassava can be used as food and animal feed. For several years it appears the efforts to increase the production of cassava. Efforts to increase cassava production supported by rising productivity. Increased production of cassava is expected to meet the needs of cassava as food and as animal feed.

The problem that occurs is the strategy followed by the government does not support the national stock supply of cassava as food. Yet today, the people of Indonesia began developing a variety of products made from cassava. This leads to the need of cassava production is increasing consistently. Unfortunately, the needs of local cassava still not been met completely, so that Indonesia still imports from other countries. This is exacerbated by the government's role is less support in meeting the needs of the local cassava and are more likely to pay attention to the production of hybrid cassava varieties that can not be consumed, but as an animal feed ingredient.

Lack of government attention to the development of local cassava production are very much encouraged us to conduct this research. We will compare the total production of cassava as food and the amount of cassava production are in fact mostly used for cattle specialist materials, as well as knowing the actual role of the government in the current cassava productivity.

MATERIALS AND METHODS

The study was conducted to compare the levels of productivity and production, the need for cassava, and knowing the government's role in the productivity of cassava. Development of cassava productivity, can be obtained from the study of literature and desk study. Study literature can provide information about the level of development of the cassava productivity. Conduct desk study from data statistics central bureau, directorate general of food, and other relevant agencies. By doing desk study can be seen and observed the results of research carried out previously by other parties which have similarities in discussing cassava as local varieties. Knowing the level of need for local cassava food industry can be obtained by conducting a survey of the food industry that use cassava feedstock in Semarang. Conducting an analysis of the needs of cassava on an industrial scale using desk study phase has been studied by previous researchers.

RESULTS AND DISCUSSION

Table 1. Productivity and production of cassava in Indonesia in 2007 until 2012

Year	Area Harvested(Ha)	Productivity(Ku/Ha)	Production(Ton)
2007	1,201,481,00	166,36	19,988,058,00
2008	1,204,933,00	180,57	21,756,991,00
2009	1,175,666,00	187,46	22,039,145,00
2010	1,183,047,00	202,17	23,918,118,00
2011	1,184,696,00	202,96	24,044,025,00
2012	1,116,802,00	203,06	22,677,866,00

Description: Productivity and cassava production in 2012 is still in the forecast
Sources: Central Bureau of Statistics of the Republic of Indonesia

Table 1 may indicate an increase in cassava production in the last five years. The high level of production is supported by the increased productivity of cassava in Indonesia. Although the crop land is unstable or changes in small amounts.

It is prove that with the increase in cassava production in Indonesia, the development of which was in the field of technology. In other words, technology in developing cassava growing very rapidly. Productivity increases were offset by an increase in the value of exports.

Table 2. Exports of cassava as animal feed in the years 2009-2011

Year	Form of cassava				
	Gaplek		Tapioca		Others
	Export (million ton)	US$ Value	Export (ton)	US$ Value	Export (ton)
2009	159,87	23,64	13,19	4,5	-
2010	143,82	31,76	23,81	12,77	-
2011	40,9	-	83,15	-	1,2

Sources: Central Bureau of Statistics of the Republic of Indonesia

Table 2 shows that the production is exported mostly cassava varieties that are used as animal feed. If seen from the table above, a decline in the amount of exports of cassava in the form of cassava while total exports of cassava starch in the form of increasing. And if you converted a ton is equal to 120 kg of dried cassava tapioca. So it can be said that the required amount of dried cassava tapioca exports more so of course the amount of raw materials were exported cassava also increased. Then it takes more attention to the production of cassava as food and animal feed. In fact cassava as animal feed more attention.

Ironically needed of cassava as a domestic food shortage that Indonesia requires imported cassava as food from other countries. While many food industry requires raw materials to develop cassava food industry. So it can be said exports continue to increase, production has continued to increase but focused only

memorable for cassava as animal feed. Type cassava cassava imported in the form of raw materials used for food. While the types of cassava are exported to foreign countries are used as animal feed in the form of raw cassava, cassava, and tapioca.

From various food industries that use cassava as basic materials, can be obtained opinions. Basically, they have difficulty in obtaining raw materials of cassava as a food that will be used to process cassava into food products. They had felt critical of the condition of raw cassava for food. Indonesia, which is supposed to have great potential in producing cassava should experience difficulties or shortages of raw materials alone would cassava. While the level of exports by Indonesia even higher for other countries. Arising concern for the conditions experienced by Indonesia, when it should be a high production Indonesia is faced with the demands of cassava as food balanced with cassava as animal feed.

Level of imports is still limited to large scale. Everything shows the development of cassava production has not been integrated with the development of food. Still likely to lead to the need for animal feed. In other words, the need for food is still second place status and faced with the need for the production of animal feed.

CONCLUSIONS

Indonesia has a high level of productivity of cassava, but has not been able to meet the demand for cassava as food. This can occur because of the availability of toxic cassava varieties (not consumed) more than the varieties of cassava for food. The government is more focused in developing cassava varieties that are toxic as animal feed. So that still needed import cassava varieties are safe for consumption from other countries. State itself needs cassava as food, the fact the amount of toxic cassava exported in large amounts away to other countries. Imports should be restricted or reduced by increasing the varieties of cassava for food. And it should be a thing that can be done by Indonesia but until now could not be realized. The development of high cassava production has not been commensurate with the development of food in Indonesia.

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STUDIES ON THE EFFECTIVENESS OF THE REGULATION OF MINISTRY OF MARITIME AFFAIRS AND FISHERIES NO. 28/MEN/2004 ON SMALL BUSINESS OF SHRIMP FARM

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ABSTRACT

Shrimp is a fishery commodity that has a high economic value. To protect small businesses, the Government of Indonesia through the Ministry of Maritime Affairs and Fisheries established ministerial policy namely No. 28/MEN/2004, which stipulates that shrimp cultivation should be run by small businesses. On one hand, the decision was good because shrimp farmers were protected by this policy. However, from the other side the decision needs to be reviewed in term of the effectiveness and efficiency of the business of shrimp itself. This study aimed to evaluate the mentioned ministerial policy. The study was conducted through field studies, surveys to the farmers, survey on harvesting and post harvest facilities, as well as distribution facilities, both for export or domestic consumption, and also through literature review. From the field survey it was found that the average productivity of shrimp is 20 tons/ha. A commercially profitable shrimp aquaculture requires the setting of oxygen supplies, water circulation, pH control equipment, and the salinity control. All the equipments and tools were very expensive, and was not feasible when the cultivation was made on a small scale, i.e. less than 10 ha. Similarly, the implementation of harvest, post-harvest handling, facilities to maintain freshness of the shrimp, and the distribution facilities, all require high investment cost and highly working capital, which will not be feasible if run on a small scale aquatic farm. Furthermore, the rental fee of frozen facilities was only cheap when the capacity was 400 tons, below than this size the rent rate would be double. In fact, the regulation requires that shrimp cultivation at most only less than 10 ha, which means production is only 200 tons. Based on the various results of these studies, the mentioned the Ministry Regulation needed to be revised, while protecting small farmers.

Keywords: *shrimp, ministerial regulation, small business, shrimp business facilities*

INTRODUCTION

Shrimp fisheries as one of the good results of the marine fisheries and cultivation of farmed until recently still occupied the most important position in the marine and fisheries sector. This is because shrimp have a high economic value. In addition, shrimp is one of the non oil and gas export commodities that can have a substantial source of foreign exchange of the country.

In fact, according to the Department of marine and Fisheries (DKP) in 2006, nearly 50% (US $ 948.130.000) of the total fishery exports results (US $ 1.912.926.000) deriving from this commodity.

Indonesia shrimp exports still rely heavily on Japan's market with export value of US $ 635.174.000 and its contribution of 62,9% of the total shrimp exports of Indonesia in 1998. Although Japan is a major market of the world shrimp, but the markets of Europe, Asia and the United States that still continues to grow is an interesting market and could be developed in the long term. Therefore, the potential of the international market for shrimp exports of Indonesia is still very wide open.

Viewed from this potential, the Minister of marine and Fisheries in order to increase the productivity of shrimp exports, then set a decision of the Minister of marine and Fishery number: KEP. 28/MEN/2004 about general guidelines on Shrimp Farming Ponds. The main objective of this decision is to improve the production of shrimp shrimp aquaculture through the development of a integrated. In addition, in chapter V, which contains the pattern, business licensing, and there is a rule that States that shrimp cultivation should be run by small businesses and the existence of restrictions on maximum land area that must be adhered to by the small farm employers. However, after this decision has set, in fact there are many obstacles faced by entrepreneurs of small shrimp farm associated with the existence of a restriction of the farm land area. Even during the last five years, the value and volume of export shrimp tend to experience a significant downturn.

Based on the serious problems of the yngh occurred, indicating that there is a contradiction in the determination of the Minister's decision number KEP. 28/MEN/2004, in particular in chapter V is about patterns, extensive, and licensing efforts. The decision on the one hand because it aims to protect the small shrimp farmers, but this decision has also become less effective because it will hinder the Government's objectives in order to improve the quality and quantity of shrimp production. So in short, the Minister's decision need to be re-evaluated. The purpose of this paper is to evaluate the keefektivitasan decision of the Minister of marine and Fishery number: KEP. 28/MEN/2004, in particular in chapter V of about patterns, extensive, and licensing efforts against the production of shrimp and analyze the results of a study of the field.

MATERIALS AND METHODS

This research was conducted through several stages beginning from gathering all

the required data from sources that are related and relevant to the stage of analysis and synthesis. After that, made the final stage that is by taking the conclusion.

The type of data you're looking for in this study is the development of exports and the value of commodity exports of shrimp in Indonesia with the aim to:

1. to examine the effectiveness of the decision of the Minister of marine and Fishery number: KEP. 28/MEN/2004,
2. To examine the value and purpose of export, and
3. To analyze the level of difficulty and problems faced by the actors in this field is the small shrimp farm entrepreneurs from a variety of perspectives including economic value perspective and effectiveness.

Data sources searched by using internet search engines to find out the issue-current issue surrounding the development of the cultivation of shrimp and prawn export development, as well as looking for data destination countries export shrimp production in Indonesia. Then search for data through official agencies such as the associated Central Bureau of statistics. Do a desk study of the sex study, conducted a survey of farmers shrimp farm in order to know the difficulty% u2013 the difficulties faced by farmers in the cultivation pond.

After a stage of data collection from the internet search engines, results of the survey and the results of studies carried out, the next course stage of synthesis. Stages of the synthesis was carried out to compare the results of data obtained with the effectiveness of the Decision of the Minister of marine and Fishery number: KEP. 28/MEN/2004 so that it can be concluded about keefektivitasan the decision against the circumstances and conditions that occur at this time.

RESULTS AND DISCUSSION

Shrimp industry efforts in Indonesia particularly in the cultivation of shrimp farm still has a great potential to continue to be developed. Noted that there is still potential in areas in Indonesia that are not yet under cultivation amounted to 830.900 ha with its centre located on the island of Sulawesi, Java, Seiatan, Lampung and North Sumatra. As such, the development prospects of the industry and market opportunities of shrimp cultivation pond was very promising for the domestic market and the export market. In addition, commodity export fisheries Indonesia especially the shrimp has an important role in increasing export sub-sectors of fisheries, having contributed 60% of the total export

value of sub-fishery export value of over one billion u.s. dollars per year.

The Data that needs to be known is that the value of shrimp export trade increased from US $ 90 million in 1991 to US $ 1.03 billion in 2007. However, it is unfortunate in the last five years, the value and volume of export both shrimp shrimp shrimp catch and riparian experiencing instability and tend to decrease. Precisely in 2010 decreased to 989 million or 37% of the total value of exports of fisheries products in Indonesia. In addition, export destinations also experienced a shift, again dominated Indonesia shrimp exports to Japan with a share of 50-60% of the European Union, 16-18%, United States 20 16-17%, and the rest to other countries, then there are changes with the majority of exports to the United States became the goal.

The following are some data about the value of Indonesia's exports of shrimp during the last 7 years to the three major export destination countries.

Table 1. Indonesia Shrimp Export Value Growth Based On The Country Of Destination Of Exports

Year	Japan	US	EU
	Value (US$ 1000)	Value (US$ 1000)	Value (US$ 1000)
2006	419 895	418 175	190 125
2007	334 982	420 720	178 195
2008	337 681	550 773	177 855
2009	333 056	426 995	146 597
2010	351 402	443 220	10 549
2011	186 495	293 780	81 973

In table 1 above can be seen in the development of shrimp export value Indonesia in a period of 7 years to the three major export destination countries, namely Japan, the United States and the European Union. For the purpose of export to Japan, the 2006 shrimp export value reached 419 893 US $ 1000. In 2007, its value dropped to 337 982 US $ 1000, and again in 2008 increased to $ 550 718 US $ 1000. Back in 2009 dropped to 334 056 US $ 1000, and increased again in 2010 to be 351 402 US $ 1000. However in 2011 again dropped sharply to a mere $ 186 495 US $ 1000. For the purposes of exports to the United States in 2006, the value of exports of shrimps reached 418 175 US $ 1000. In 2007 it increased to 420 720 US $ 1000, and again in 2008 increased to $ 550 718 US $ 1000. In 2009 began to decline into 426 995US $ 1000, and again increased in 2010 be 443 220 US $ 1000. However in 2011 again dropped sharply to a mere $ 293 780 US $ 1000. Whereas for the purposes of exports to the European Union-2006 shrimp export value reached 190 125 US $ 1000. In 2007,

its value decreased to 180 195 US $ 1000, and again in 2008 decreased to $ 152 852 US $ 1000. Back in 2009 decreased to 147 597 US $ 1000, and the Summit of his descent to occur in 2010 to only 10 of 549 US $ 1000. But increased again in 2011 but only reached a value of 81 973 US $ 1000. Based on survey results from table 1 it can be noted that during the last 7 years the value of Indonesia's exports suffered instability and tends to decline in value of export shrimp that exist among decline quite significant to the main export destination of three countries, namely Japan, the United States and the European Union.

Here is the data on the volume of shrimp exports Indonesia during the last 7 years to the three major export destination countries.

Table 2. The Development Of The Volume Of Exports Of Indonesia Shrimp

Year	Japan	US	EU	Others
	Quantity(ton)	Quantity(ton)	Quantity(ton)	Quantity(ton)
2006	50 380	60 973	31 016	26 960
2007	40 334	60 399	28 845	27 967
2008	39 582	80 479	26 825	26 397
2009	38 528	63 592	23 689	25 180
2010	36 712	58 277	13 383	36 720
2011	17 712	33 779	9 265	14 536

In table 2 above can be seen in the development of the volume of exports of Indonesia shrimp in a period of 7 years to the three major export destination countries, namely Japan, the United States and the European Union. For the purpose of export to Japan, in 2006 the volume of shrimp exports reach 50 380 tons. In 2007, its value drops to 40 334 tons, and in 2008 again decreased to 44 582 tons. In the year 2009 shortfall again to 38 528, and back down to 36 712 tons in 2010. The top export volume decline occurred in the year 2011 to be only by 17 712 tons. For the purposes of exports to the United States in 2006, the value of exports of shrimps reached 60 973 tonnes. 2007 volume having a bit of a decline to 60 379 tonnes in 2008 experienced an increase of 80 479 tonnes. Back in 2009 dropped to 63 592 tons, and back down in 2010 to be 58 277 tons. However in 2011 is the top volume decrease by 33 to 16 tons. Whereas for the purposes of exports to the European Union-2006 shrimp export value reached 31 016 tons. 2007 volume decreased to 28 845 tonnes, and in 2008 again decreased to $ 26 825 tons. Back in 2009 decreased to 23 694 tons, and returns to decline in 2010 to 13 391 tons. The peak of his descent in 2011

the volume for only 9 265 tons. This decline also occurred in other export destination countries, and its peak occurred in the year 2011 the export large volumes to other countries only by 14 536 tons. Based on survey results from table 2 it can be aware that over the last 7 years the export volume of Indonesia also experienced instability and tend to experience a significant decline in particular the volume of exports to the three major export countries, namely Japan, the United States and the European Union as well as to other countries.

After seeing 2 based on the table above that contains a collection of data about the development of the value and volume of exports of Indonesia shrimp in a period of 7 years to the three major export destination countries, namely Japan, the United States and the European Union –, it turns out that the picture was obtained from any production problems of shrimp in Indonesia that led to a decrease in the value and volume of exports is quite significant. These problems can be caused by a variety of factors and can be seen from different sides. The cause can be derived from the actors in the field, namely the penambak, then from shrimp industry entrepreneurs and the last one was able to come from the Center like the Government regulation which regulates all activities related to the production of shrimp from the cultivation, harvesting, post harvest and shrimp products produced for export purposes.

Here's a chart that describes the condition of the development of the value and volume of shrimp exports to Indonesia's three major export destination countries, namely Japan, the United States and the European Union – in a period of 7 years.

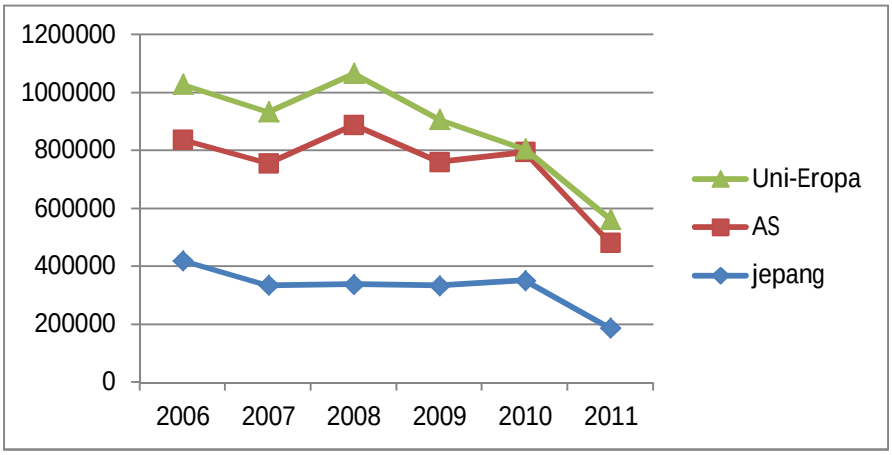

Figure 1. Indonesia Shrimp Export Value Growth

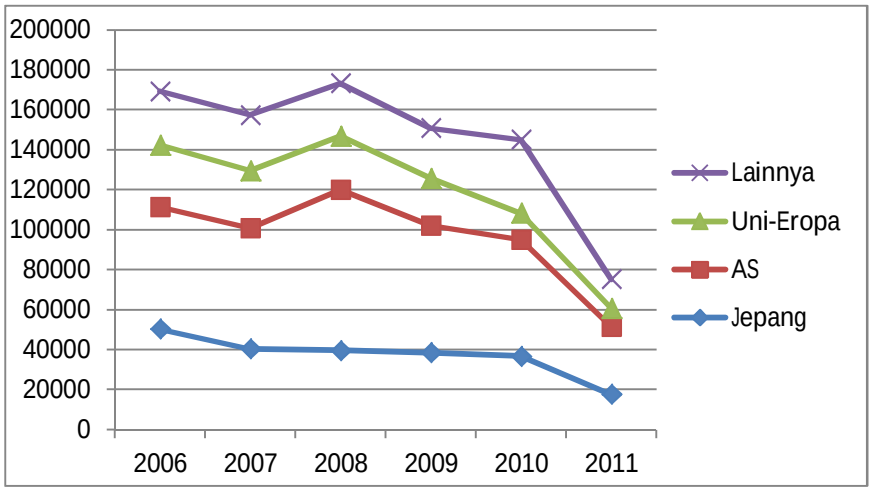

Figure 2. Indonesia Shrimp Export Volume Growth

According to figure 1 and Figure 2 above regarding the development of the value and volume of exports to Indonesia shrimp export destination country may note that there has been a significant drop in both volume and value of dai export shrimp to Indonesia three export destination country in particular, namely Japan, the United States and the European Union.

As already described above there is a primary cause of bhawa can lead to occurrence of a decrease in the value of Indonesia's exports of shrimp and vulume. It surely comes from the Central Government which regulates all activities of the shrimp production, in this case are government regulations that may need to be re-evaluated for its effectiveness. In this study, obtained that there is one of the Government's policy in particular the

decision of the Minister which is related: Minister of maritime and Fishery number: KEP. 28/MEN/2004 about general guidelines on Shrimp Farming Ponds that actually aims to increase the production of shrimp for shrimp aquaculture through the development of a integrated. However, there is one chapter i.e. Chapter V which deals with patterns, extensive, and licensing effort in cultivating shrimp farm. In this chapter it is said that the existence of rules for shrimp cultivation should be run by small businesses and there are restrictions on the maximum land area that must be adhered to by the small entrepreneurs embankment that is only limited to 10 ha.

Viewed from this policy are defined in 2004 and compare with the emergence of problems of shrimp is being faced by Indonesia is now especially in the production of shrimp for export. Then it can be dilihgat the existence of a relationship where a decrease in the production of shrimp exports experienced Indonesia caused by a decision of the Minister is not quite effective. Because, it has been known that shrimp products can be exported to a country of destination has to have some of the following criteria:

- Exported Shrimp must be free of heavy metals, especially mercury (Hg) and lead (Pb).
- Shrimp should be fresh and free from H2S, black spot and indol.
- Shrimp should be clean, free of impurities such as bacterium Salmonella, Vibrio and e. colii.
- Shrimp must be free of residues of hormones and antibiotics.

To meet all of it, of course it takes an intensive cultivation method of digunakanya with modern equipment and no doubt all the equipment and the equipment is very expensive and will become impossible when cultivation was made on a small scale, i.e. less than 10ha. Similarly, on the implementation of harvesting, post-harvest handling, facilities to maintain the freshness of the prawns, and distribution facilities. They require high investment costs and working capital are high i.e. when taken into account can reach the figure of Rp. 100 million/ha, while in General Indonesia's shrimp farmers still running traditional systems which cost 6 times cheaper than the cost of using modern systems, so it will not be possible to run in riparian with small scales.

Because, despite small farm farmers run the cultivation of shrimp farm with small scales, the risks posed to be higher, these are crop failures due to parasitic disease of shrimp, tiadak shrimp quality meets the standards of export so that even though the

cultivation of shrimp with a small scale can be run but the results cannot be accepted because it does not correspond to the criteria of shrimp exports. In short, the cultivation of shrimp with a small scale will not be able to assist the Government in increasing the production of shrimp exports of Indonesia.

Based on the foregoing, it can be noted that the Government's decision becomes ineffective. Therefore, the Government should need to review and re-evaluate the effectiveness of the decision of the Minister of marine and Fishery number: KEP. 28/MEN/2004 about general guidelines on Shrimp Farming Ponds. So in the end the purpose to overcome the problems of cultivation of prawns and shrimp production to increase exports of Indonesia return can be realized.

CONCLUSION

Shrimp is one of Indonesia's most important export commodities that have a great potential to continue to be developed in conjunction with the still open wide the potential of international markets. In order to improve the quality and quantity of export shrimp production of Indonesia and the Government through the Minister of marine and Fisheries issued a policy that is the decision the Minister of marine and Fishery number: KEP. 28/MEN/2004 about general guidelines on Shrimp Farming Ponds. But since ruled to this policy through the study of literature and the results of the study field, obtained the fact that over the last 7 years the value and volume of export shrimp Indonesia has experienced a significant decline. In addition there is a contradiction in which the policy thus inhibit the role of the small shrimp farm entrepreneurs to participate in improving the quality and quantity of export shrimp production in Indonesia. So in short, the effectiveness of such policies need to be reviewed and reassessed in order to realize the objectives of the Government of Indonesia in improving the production of shrimp exports.

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THE STEAMING EFFECTS ON PHYSICAL AND FUNCTIONAL PROPERTIES OF GREEN GRASS JELLY (*Premna oblongifolia* Merr.)

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ABSTRACT

Green grass jelly is one of the traditional functional foods from Indonesia. There have been a lot of researches about its functional efficacies for human health. Unfortunately, the production process of green grass jelly is not hygienic and the product is perishable. The main deterioration of green grass jelly is microbial contamination and syneresis. Steaming of green grass jelly at 100^{o}C for 5 minutes could effectively reduce the total number of microbes, *E. coli*, and *Staphylococcus* sp. This research objective was to find out the effects of steaming on its physical and functional properties. Steaming could decrease the syneresis rate of green grass jelly, where the equations of syneresis rate were y = 1.1055x + 3.346 for the unsteamed green grass jelly and y = 1.0019x + 7.091for the steamed one. However, this treatment also could decrease the rupture strength of 1.96% insignificantly, decrease the rupture point of 13.36% significantly, and increase the rigidity of 13.01% significantly. The color of steamed green grass jelly has insignificant higher L value and significant higher a value, which indicated lighter and less green color. Instead of the unsteamed one, steamed green grass jelly has significant decreased amount of total chlorophyll (70.81%), total phenol (54.86%), and antioxidant capacity (7.24%).

Keywords: *green grass jelly, steaming, physical, functional*

INTRODUCTION

Functional foods are natural or processed foods which contain one or more compounds based on scientific studies deemed to have specific physiological functions that are beneficial to health. One of the functional foods that have been studied is green grass jelly that contains hydrocolloid gelling components. Green grass jelly is a traditional gel product obtained from leaf extract or juice from several types of plants, one of them is *Premna oblongifolia* Merr. This gel is formed in the cold condition and doesn't need any starch component (Indonesian Food and Drug Control Agency 2006).

Traditionally, green grass plant has been used as a febrifuge (anti pyrectic), reducing the risk of gastroenteritis, nausea, and high blood pressure (Sunanto 1995). Several researches have explain some efficacy of

green grass leaves, such as anti cancer activity (Ananta 2000), increase the amount of lymphocytes (Pandoyo 2000), reduce the amount of free radical (Handayani 2000), increase antioxidant activity of lymphocytes (Koessitoresmi 2002), and non toxic forbody (Arisudana 2003).

Unfortunately, there is not enough sufficient study of green grass jelly, whereas green grass jelly stored too long will have syneresis and contain many microbes. Consequently, consumption of green grass jelly still has limitations. This is happened due to the absence of heating in the making process of green grass jelly as the gel won't be formed at temperature of 80°C or more (Ananta 2000). Furthermore, the production process is not hygienic. One of the solutions that could be conducted to solve this problem is heating treatment after the gel formed since the gel is irreversible which isn't melted to be colloid after heated. Heating treatment that could be used is steaming.

Pramitasari (2012) reported that treatment of steaming at temperature of 100^{o}C for 5 minutes could reduce the number of total microbes of green grass jelly on average from 1.07 to 1.10 log CFU/g, the number of *E. coli* on average from 1.00 to 1.18 log CFU/g, and the number of *Staphylococcus* sp. on average of 0.29 to 0.71 log CFU/g. However, this steaming treatment could also increase gel syneresis on average of 7.82 to 9.03%. Gel strength after steaming treatment decreased on average from 1.97 to 2.99 g/cm^2.

Heating will also lead to chlorophyll degradation reaction to form a brownish pheophytin (Gross 1991). Pramitasari (2012) reported that steaming at 100^{o}C for 5 minutes could change the color of green grass jelly to be brownish green. With the degradation of chlorophyll, the antioxidant capacity of green grass jelly is expected to decline due to the loss of metal at the center of the porphyrin ring on the chlorophyll structure (Ferruzzi *et al.* 2002). Functional properties degradation of green grass jelly gel is not expected to occur significantly. Thus, it is important to conduct this further research to find out the effects of steaming on the physical and health functional quality from green grass jelly product.

RESEARCH METHODOLOGY

Materials and Tools

The materials used were commercial green grass jelly, phosphate buffer solution of pH 4.00 and pH 7.00, methanol 85%, Folin-Ciocalteau reagent, sodium carbonate 7%, gallic acid, deionized water, ascorbic acid, methanol 99.9%, DPPH reagent, and acetone 99.9%. The important tools used were Stevens LFRA Texture Analyzer,

Minolta Chromameter CR 200, and Double Beam Spectrophotometer.

Methods

The commercial green grass jellies were divided into 2 treatments, i.e. the fresh green grass jelly and the steamed green grass jelly at 100^{o}C for 5 minutes. Data obtained was analysed by t test on the significance level of 5% to determine the effect of steaming on the parameters tested of physical and functional properties.

Observation of Physical Properties

Determination of Color

Determination of color was conducted by using Minolta Chromameter CR 200. Chromameter measurement results will be converted into the Hunter system with the symbol of L, a, and b. L value states brightness parameter that have a value of 0 (black) to 100 (white). L value indicates reflected light which produces achromatic colors of white, gray, and black. A value expressed mixed chromatic colors red and green, with a+ (positive) from 0 to +100 for the red color and the a- (negative) from 0 to -80 for the green color. B value expresses mixed chromatic colors blue and yellow, with b+ (positive) from 0 to +70 for the blue and b- (negative) from 0 to -70 for yellow.

Determination of Syneresis Rate

Gel syneresis observed according to AOAC method (1995) by storing gel at refrigerator temperature (10°C) for 24 hours, 48 hours, and 72 hours. Each gel was put into the cup to hold the water released from the gel during storage. Gel syneresis was calculated by measuring the weight loss during storage and compared with the initial weight of the gel.

$$\text{Gel Syneresis} = \frac{\text{A-B}}{\text{A}} \times 100\%$$

Where:

A = initial weight of the gel before storing (gram)

B = weight of the gel after storing (gram)

Determination of Gel Strength

Gel texture was measured by using Stevens LFRA Texture Analyzer. Measurement conditions were used according to the research that has been conducted by Camus (2000). The distance between the probes and the gel of 55 mm, probe speed of 2 mm/sec, chart paper speed of 30 cm/min, the probe diameter of 0.5 inches, sensitivity of 100 mV, and strain of 50%. The general curve obtained from the Stevens LFRA Texture Analyzer can be seen in Figure 1.

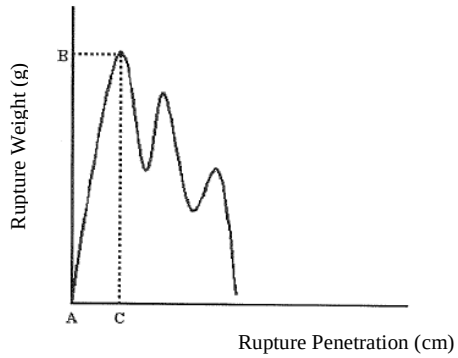


Figure 1. The general curve obtained from the Stevens LFRA Texture Analyzer

Parameters observed in this measurement were gel rupture strength, rupture point, and rigidity. Calculation for rupture strength, rupture point, and rigidity was done by using the formulas from Angalet (1986) and Fry and Hudson (1983) as follow:

Rupture strength (g/ cm^2)

$$= \frac{\text{Load of rupture}}{\text{Surface area of probe base}} = \frac{\text{AB}}{0{,}07\ cm^2}$$

Rupture Point = Rupture penetration = AC

Rigidity (g/ cm)

$$= \frac{\text{Load of rupture}}{\text{Rupture penetration}} \times \frac{\text{probe speed}}{\text{paper speed}} = \frac{\text{AB}}{\text{AC}}$$

Determination of Functional Properties

Total phenol (Sakanaka et al. 2005)

In brief, 1.8 grams of green grass jelly was extracted with 10 ml of 99.9% methanol solution, mixed well, and centrifuged at 3000 rpm for 15 minutes. The supernatants were filtered through a filter paper. Filtrates were adjusted to be 10 ml. Volume of 0.5 ml of deionized water and 0.125 ml of the extract were added to a test tube, followed by addition of 0.125 ml of Folin–Ciocalteu reagent. They were mixed well and then allowed to stand 6 minutes before 1.25 ml of 7% sodium carbonate solution was added. The mixture was diluted to 3 ml with deionized water. The color was developed for 90 minutes at room temperature and absorbance was measured at 760 nm using a spectrophotometer. The measurement was compared to a standard curve of prepared gallic acid solutions and expressed as mg of gallic acid equivalents per liter extract.

Antioxidant capacity (Sharma and Bhat 2009)

A total of ± 1 gram green grass jelly was extracted with 7 ml of methanol, homogenized, and centrifuged at 3000 rpm for 15 minutes, until the supernatants were obtained. Supernatants were filtered. Then, 2 ml solution of DPPH 0.25 mM added, homogenized, and incubated at the dark room temperature for 30 minutes. The absorbance then measured at 517 nm using a spectrophotometer. Ascorbic acid standard curve made with the preparation of such samples.

Total Chlorophyll (Nollet 2000)

A total of ± 2.5 green grass jelly was extracted with 10 ml of 99.8% acetone solution, then mixed well, and stored for 1 night in refrigerator. Sample centrifuged at

3000 rpm for 15 minutes, then filtered. The absorbance of the filtrate then measured at 645 nm and 663 nm using a spectrophotometer to measure the contents of total chlorophyll, chlorophyll a, and chlorophyll b. Calculation was done by the following formulas:

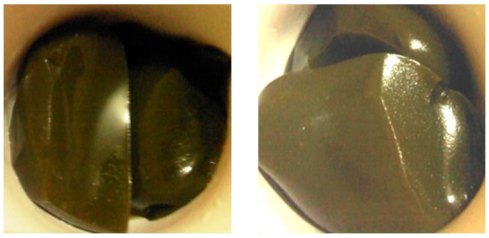
Total chlorophyll (mg/L) = 20.2 $A_{654\ nm}$ + 8.02 $A_{663\ nm}$

Chlorophyll a (mg/L) = 12.7 $A_{663\ nm}$ – 2.69 $A_{645\ nm}$

Chlorophyll b (mg/L) = 22.9 $A_{645\ nm}$ – 4.68 $A_{663\ nm}$

RESULTS AND DISCUSSION

The fresh and steamed commercial green grass jellies were compared on the physical and functional properties. The data obtained can be seen in Table 1 and Table 2. The L value of fresh green grass jelly is 27.00 which dark enough because it's still close to 0. Steaming at 100°C at 5 minutes could reduce the L value of green grass jelly at 0.40 units insignificantly. Moreover, the a value of fresh green grass jelly is -4.01 which shows the green color. Steaming could increase the a value at 4.27 units significantly. It means that steaming affects the color of green grass jelly to be redder. Steaming also could effects its color to be more yellow since the b value decreased at 1.67 units insignificantly. Gross (1991) stated that steaming could lead chlorophyll degradation reaction to form a brownish pheophytin. Thus, the L, a, and b value is changed. The color of fresh and steamed green grass jellies are shown in Figure 2.



(a) (b)

Figure 2. The color of (a) fresh green grass jelly and (b) steamed green grass jelly

Based on the texture properties, steaming of green grass jelly at 100oC for 5 minutes could reduce the rupture strength of 1.96% insignificantly and rupture point of 13.36% significantly. On the other hand, the rigidity of steamed green grass jelly is significantly higher than the fresh one at 13.01%. Heating will break the hydrogen cross bonds that maintain the junction zone, providing 3 dimensional structure of hydrocolloids (Lamkey 2009). Furthermore, Artha (2001) had succeeded to analyze the hydrocolloid gel components of green grass jelly, categorized as low methoxyl pectin which is thermo-irreversible and has the egg box gelling mechanism. By breaking of hydrogen cross bonds between its polymers, water trapped in the gel matrix would be run out (May 2009). Consequently, the gel would be more rigid.

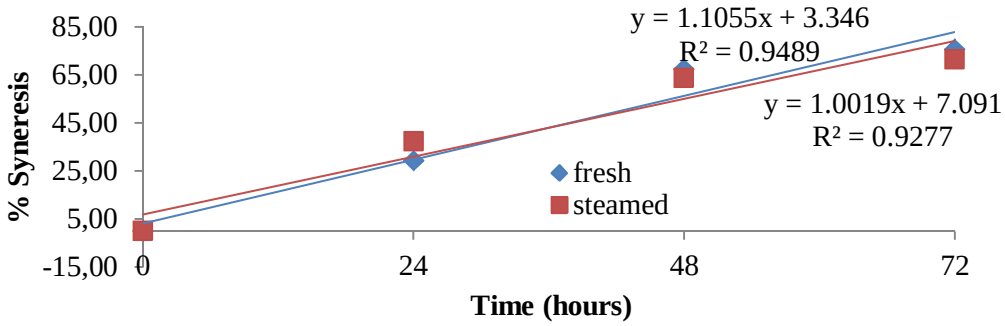
The syneresis curves of fresh and steamed green grass jelly are shown in Graph 1. The

initial syneresis point of steamed green grass jelly is higher. Nevertheless, syneresis rate of fresh green grass jelly is faster with the equation rate of y = 1.1055x + 3.346 and R^2 = 0.9849. On the other hand, the equation rate of steamed grren grass jelly is y = 1.0019x + 7.091 and R^2 = 0.9277. It is happened because steaming could break hydrogen cross bonds between its polymers, resulting run out of water trapped in the gel matrix (May 2009).

These results indicate that treatment of steaming can reduce the total chlorophyll contained in the green grass jelly significantly by 70.81%. Gross (1991) stated that steaming could lead chlorophyll degradation reaction to form a pheophytin, resulting decreased chlorophyll contents. Chlorophyll a and chlorophyll b contained in the green grass jelly also decreased by steaming treatment significantly, equal to 71.88% and 68.02%. Decrease in chlorophyll a levels larger than the decrease in the chlorophyll b levels. This corresponds to Teng and Chen (1999) that the degradation rate of chlorophyll a is larger than the degradation rate of chlorophyll b caused by wet heat treatment, such as steaming and blanching.

Table 1. Results of color and texture analysis

Parameters	Fresh Green Grass Jelly	Steamed Green Grass Jelly	Changes
Color Properties			
L value	27.00	26.60	-0.40
a value	-4.01	0.26	4.27*
b value	11.44	9.77	-1.67
Texture Properties			
Rupture strength	141.14	138.37	-1.96%
Rupture point	7.97	6.91	-13.36%*
Rigidity	17.70	20.02	13.01%*



Graph 1. The syneresis curve of fresh and steamed green grass jellies

Table 2. Results of functional analysis

Parameters	Fresh Green Grass Jelly	Steamed Green Grass Jelly	Changes
Chlorophyll			
Total Chlorophyll	13.59	3.97	-70.81%*
Chlorophyll a	9.82	2.76	-71.88%*
Chlorophyll b	3.77	1.21	-68.02%*
Total Phenol	60.02	27.10	-54.86%*
Antioxidant Capacity	38.85	36.03	-7.24%*

Antioxidant capacity of steamed green grass jelly is also decreased due to decrease of total phenol and chlorophyll. Ferruzzi *et al.* (2002) showed that chlorophyll has the ability to scavenge lipid radicals produced during oil autooxidation by breaking the chain of oxidation reaction. Javanmardi *et al.* (2003) stated that phenolic content can be potential antioxidant by the mechanism as reducing agent, scavenger of free radicals, chelating agent of metals, and preventing the formation of singlet oxygen. Addition of salt and hydrocolloid could be expected to be used in order to solve the problems arised on physical and functional properties because of steaming.

CONCLUSION

Steaming of green grass jelly at 100^{o}C for 5 minutes could impact its physical and functional properties. It could decrease the syneresis rate of green grass jelly. However, this treatment also could decrease the rupture strength insignificantly, decrease the rupture point significantly, and increase the rigidity significantly. The color of steamed green grass jelly has insignificant higher L value and significant higher a value, which indicated lighter and less green color. Instead of the unsteamed one, steamed green grass jelly has significant decreased amount of total chlorophyll, total phenol, and antioxidant capacity. Nevertheless, this product is more safe from the microbiological aspects.

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CULTIVATION OF *Spirulina sp* IN FED BATCH REACTOR AND ITS EXTRACTION FOR C- PHYCOCYANIN AS ANTIOXIDANT

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ABSTRACT

During normal metabolism, the body produces a small amount of high energy particles called as free radical. High concentration of free radical and material alike is harmful for living organism causing health problems such as : diabetes mellitus, heartstroke, etc. Antioxidant can obstruct free radical formation as it exists in Spirulina in the form of C-Phycocyanin. The purposes of this research are to study the growth of Spirulina sp in batch and fed batch reactor, also as well as to study influence of extraction time against concentration and purity of Phycocyanin produced. The method used was microalgae cultivation and extraction using methanol for 0.5 - 4 hour. The result showed that the growth of *Spirulina sp* is higher in fed batch reactor than in batch reactor and the optimal extraction is 4 hour, under methanol as a solvent.

Keywords : *Antioxidant, Extraction, Fed batch, Phycocyanin, Spirulina*

INTRODUCTION

Free radicals are strong oxidizing agents that can damage the body's defense system due to cell damage and premature aging. In this case, electron is always looking for a pair of electrons in biological macromolecules. Oxidizing conditions can cause destruction to proteins and DNA, cancer, diabetes mellitus, and other diseases. Antioxidants are compounds that can delay, slow down, or inhibit the oxidation reaction to food or drugs which compounds are easily oxidized, so other protected cells from free radicals. Chemical components that act as antioxidants are fenolic and polyfenolic compounds group. Compounds of this class are common in nature, especially in plants and microalgae, and has the ability to capture free radicals (Valco et al., 2006). One microalgae that can be used to capture free radicals is Spirulina sp.

Spirulina sp is a microalgae which is widely used as a source of protein and vitamin supplements in healthy drinks or in

tablet form with no side effects, for more than a decade (Sarada et al., 1999, Madhyastha, et al., 2006). Cultivation of Spirulina sp a mostly in batch and fed batch reactors. In the batch reactor, nutrient for Spirulina sp given at the beginning of cultivation, while the fed batch, nutrients are given periodically. C-Phycocyanin is an important pigment from microalgae Spirulina sp. Extracts containing C-Phycocyanin of Spirulina sp is a potential protective of free radicals and inhibiting the oxidation caused by free radicals. C-Phycocyanin has been shown to have therapeutic-pharmacological properties, such as high anti-oxidant, anti-inflammatory, hepatoprotective, and neuroprotective (Ou, et al., 2011; Penton-Roll, et al., 2011; Soni, et al., 2006; Suna, et al., 2011; Chaiklahan, et al., 2011; Huang, et al., 2007; Gupta, et al., 2011; Madhyastha, et al., 2006; Sarada, et al., 1999). C-Phycocyanin in 10 grams of dried spirulina also includes quite high The common method to obtain C-Phycocyanin extraction technique performed.

Currently, the extraction of C-Phyocyanin of microalgae is not well studied. There for, this research is required to optimize the extraction of C-Phycocyanin in high purity. The purpose of this study was to compare the optimization of the growth of microalgae Spirulina platensis types in batch and fed batch reactor, as well as the extraction time to assess the purity of the resulting C-Phycocyanin,

MATERIALS AND METHODS

Material

The microalgae of Spirulina sp was provided by C-Biore Bioproess Laboratory Chemical Engineering UNDIP. Cultivation was done in batch and fed batch reactor. Nutrient given in NaCl 0.5 g / L, $NaHCO_3$ 0.5 g / L, urea 0.05 g / L, TSP 0.01 g / L, and vitamin B12 by 5 pgr. Energy was provided by TL lamps 25 watt. The best result was applied to the open ponds.

Batch Reactor

In the batch process, Spirulina sp seeds mixed with fresh water and nutrients up to volume 2 L. Nutrient given that was done only at the beginning of cultivation until volume 2 L. pH is maintained in the system is maintained in the range of 8-11 and at temperatures of 28-34 ° C. The cultivation was done for 10 days.

Fed Batch Reactor

In fed batch reactor, nutrients was mixed in water that was periodically conducted once every 2 days on the basis of 200 ml for 10 days until volume 2 L. pH was maintained in the system is maintained in the range of 8-11 and at temperatures of 28-34 ° C.

Variable

Fixed variable: Methanol solvents 0.1 M;

Temperature 40oC; Ratio biomass: solvent (w/v) is 1: 75.

Changed variables: Media cultivation (batch and fed batch), and extraction time (0.5, 1; 1.5, 3, 4) hours

Methods

Experimental procedure include microalgae cultivation, harvesting, extraction, and analysis of C-Phycocyanin.

Analysis of C-Phycocyanin

Optical density

Analysis using spectrophotometry at 615 nm wavelength (Sarada et al., 1999). Standard solution used is a medium to grow Spirulina sp.

Purity of the C- Phycocyanin

Analysis using spectrophotometry, the value of C-Phycocyanin purity was defined as the ratio of absorbance at a wavelength of 620 nm and 340 nm (A620/A340) nm.

Calculate of Spirulina rate

Growth rate of Spirulina sp was calculated with: $\mu = \frac{\ln OD2 - \ln OD1}{t2 - t1} / D$

RESULTS AND DISCUSSION

Cultivation Spirulina sp in Batch and Fed Batch Reactor

Cell growth is characterized by green color appeared in media and increase in its absorbant value. Cultivation of microalgae in a limited media consists of several phases of growth. Growth phase covers lag phase, exponential phase, the phase of decline in the growth rate, stationary phase, and death phase (Fogg 1998). Growth of microalgae Spirulina sp in batch and fed batch reactor can be seen in Figure 1.

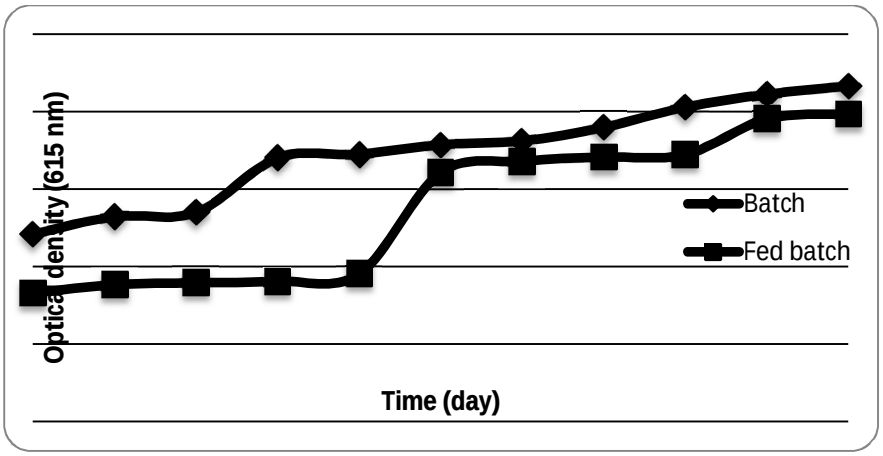

Figure 1. Optical Density Relation in Time vs Batch and Fed Batch Reactor

Optical density measurements using spectrophotometry at 615 nm wavelength. In Figure 1 it can be seen that the growth of Spirulina sp in batch and fed batch reactor are increased equally.

Lag phase is called the phase of adaptation because microalgae cells are adapting to the growing place. In the batch reactor lag phase occurs for 2 days with an optical density of 0.484 to 0.54, faster than the fed batch reactor that occurred for 4 days with an optical density of 0.332 to 0.381. This is due to larger amount of nutrient content in a batch which caused quicker adaptation. Larger amount of nutrient cause quicker adaptation.

Exponential phase characterized by a high rate of growth. This is due to the active breeding microalgae (Fogg 1975). Growth in batch reactor reach optimum condition at day 2 to 3 with an optical density of 0.54 to 0.681 so growth rate can be calculated, μ = 0,231/ D, whereas in fed batch optimum growth reached at days 4 to 5 with its optical density 0.381 to 0.643 with grow rate, μ = 0,523/ D.

Grow rate on fed batch is higher because of the amount of nutrients that can be controlled, while for batch, nutrient only given once at the time of cultivation.

On the fifth day, second reactor on stationary phase when there is no a significant increase in population increase. Comparison of the optical density cultivation batch and fed batch reactor for 10 days can be calculated:

Batch = 0.867 to 0.484 = 0.383, while the fed batch = 0.794 to 0.332 = 0.462. It can be seen that the growth of microalgae in batch fed was better than the batch.

If the batch cultivation was continued until day 10+n then microalgae will experience death phase. At death phase, microalgae would be significantly reduced and die because there are no nutrients so that they cannibal. While in fed batch micro-algae still grow because nutrients are given periodically to meet the needs of microalgae that microalgae do not experience death phase.

Effect of extraction time on purity of the resulting C-Phycocyanin

Factors that affect the rate of extraction are: the type of sample preparation, extraction time, the quantity of solvent, solvent temperature, and type of solvent. Extraction time influence amount of C-Phycocyanin produced. Absorbance indicates the amount of pure C-Phycocyanin is the absorbance (A620/A340) nm. The higher the absorbance, the higher the purity of C-Phycocyanin contained in Spirulina sp.

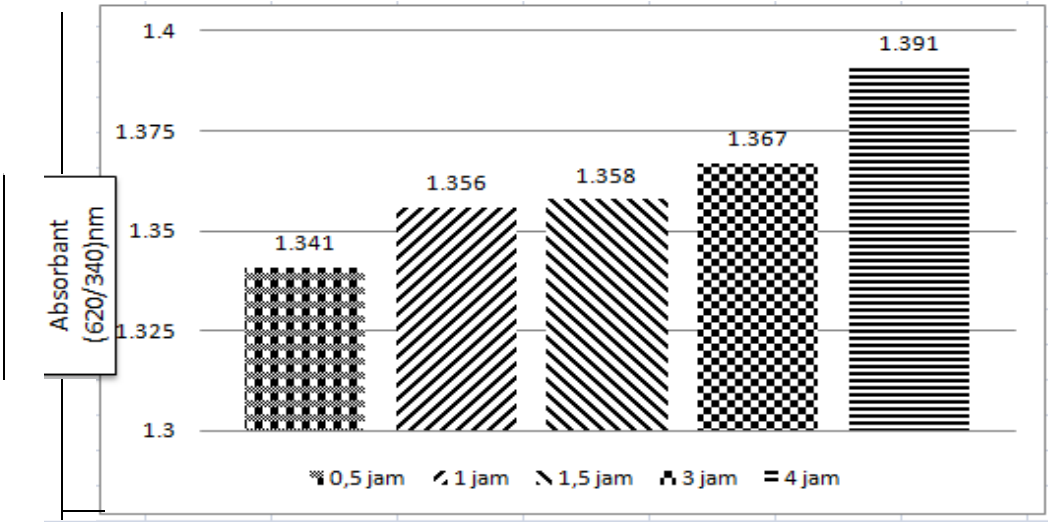

Figure 2. Relationship between Time Extraction by absorbance (A620/A340) nm.

Figure 2 shows that the maximum occurs when the extraction time 4 hours. This is because the longer the extraction time of contact between the sample and the solvent will be even longer. If the longer the contact time of the dissolution of C-Phycocyanin from Spirulina sp will occur until the solvent saturated with C-Phycocyanin. In the optimum time of extraction to the point indicates that at the C-Phycocyanin has been widely separated from the cell structure of Spirulina sp.

CONCLUSION

This study shows the rate of growth of microalgae Spirulina sp cultivated in fed batch reactor is higher than the batch reactor that are applied to the cultivation in open ponds is a batch reactor. In the solvent extraction process using methanol at 40 ° C with a ratio of biomass: solvent is 1: 75, to produce the maximum yield of C-Phycocyanin occur when the extraction4 hours time.

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Optimization Immobilization LPO from Bovine Whey Using Sepharose ®

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ABSTRACT

Lactoperoxidase (LPO) is an enzyme that is naturally presented in milk and has an effect on antibacterial activity. Lactoperoxidase works in the presence of both SCN^- and H_2O_2 in a system for hyphothiocyanite ($OSCN^-$) production as antibacterial agent. Since the demand for utilization of LPO to produce Immobilized is recently high needed, the more LPO is required. This research was performed by immobilizing LPO using ion exchange method to SP Sepharose Fast Flow (SP-FF) column. The various volume of LPO was used to determine the maximum immobilization efficiency of LPO. The experiment has been conducted entirely in 4ºC to maintain the enzyme activity. SP-FF circulated with 10, 100, 200 and 300 ml of LPO and the remaining LPO activity in the SP-FF was used to determine the activity. The results showed that 1,0 gram of Sepharose SP-FF can optimally be used to immobilized 100 ml LPO or 540 unit of Lactoperoxidase.

Keywords : *Lactoperoxidase, Immobilized, Sepharose, Whey*

INTRODUCTION

Lactoperoxidase is an enzyme that has an effect on antibacterial activity. The LP system is completed when LP, thiocyanate ion (SCN^-) and hydrogen peroxide (H_2O_2) are present together. LP-catalysed reactions yield short-life, intermediary oxidation products of SCN^-, which are responsible for its antibacterial activity. The major intermediary oxidation product, at physiological pH, is hypothiocyanate ($OSCN^-$) (Madureira *et al.*, 2007). Assah *et al* (2007) was used LPO to know the effects of the lactoperoxidase system on raw bovine milk produced under ambient temperature treatment. Result was showed that reduced the lactic acid content in milk by 29% and 15% in water bath after 16 hours. The LPS reduced the microbial load in milk stored under ambient temperature by more than one log cycle, after 8 hours of storage. LPO are the basic proteins and instead captured from whey or skim milk by *cation exchange chromatography* and sold as specialty ingredients. LPO is not capture during WPI production by *anion exchange chromatography* because of its highisoelectric points (Fee and Chand,2006).

Immobilization is a part of the development of the biotechnology industry that spurred the development of enzyme engineering in their utilization on an industrial scale. Immobilization one of method to overcome the conventional use of enzymes is less profitable and efficient because for each use or analysis should be using a new enzyme. Immobilization will use a matrix that can catch the enzyme so it can be used repeatedly. Determination Immobilized enzyme activity with the use of recurring aims to determine the stability of the enzyme immobile (Sebayang, 2006). Immobilized enzymes are easily separated from the reaction products and consequently, reusable. These features contribute to reduce the cost of the production of chemical substances using enzyme-catalyzed reactions. Such an effective biocatalytic reaction (process) using immobilization technology let us challenge the preparation of immobilized LPO (Al-Baarri *et al.*, 2012c).

Previuos research show that 1.0 g of SP-FF has capacity to effectively adsorb 300 ml of whey. The observation of LPO activity in whey resulted in the value of *ca.* 2.5 U/ml. Based on this calculation, 300 ml of whey equal to 750 U/ml of LPO activity; thus, it can be concluded that an optimum adsorptive capacity of resin is *ca.* 750 U/ml LPO per gram resin (Al-Baarri *et al.*, 2010a). This result is comparable to another previous study finding using pure LPO, which resulted the optimum IE of approximately 600 U/ml per gram resin (Al- Baarri *et al.*, 2010b).

The facts imply that the storage of immobilized LPO at 4˚C results in a storage efficiency of LPO since the immobilized LPO is able to stored with no changes in its capability for $OSCN^-$ production (Al-Baarri *et al.*, 2012c). The aim of this research to find out the most efficiency of sepharose to immobilize LPO from bovine whey.

MATERIAL AND METHODS

Materials

The samples (cow milk) for this research is planned to be taken in the Farming Faculty of Agriculture Diponegoro University. SP Sepharose Fast Flow (SP-FF) from Amersham Pharmacia Biotech, Sweden, rennet, NaCl 0,4 mM and 1 mM, aquades, phosphat buffer (PB), 2,20-azino-bis(3-ethylbenz-thiazoline-6-sulphonic acid) (ABTS). Tools used in this study be a device for chemical analysis, centrifuge, filter cloth, *chromatografi open coloumn*, spectofotometri.

Preparation of Whey

Whey is made from two liters cow's milk that was heated in water-bath until it reached a temperature of 35ºC. When the milk has been reached a temperature of 35 º C, lactic acid was added up to pH 6.0 and then put as much rennet 0.02% (w/v). The solution was stirred until entirely distributed and waited up to 40 minutes. Milk that has been cut from a clot then diced into cubes and allowed up to 40 minutes. Then, the milk was separated by filtration through filter cloth. This kind of whey filtrate was used in this study.

Immobilized Lactoperoxidase **(LPO)**

Immobilized lactoperoxidase (LPO) was performed by using *ion exchange chromatography*. Whey was flowed into the column containing Sepharose FF. After that, Sepharose FF was flowed with 0.4 M NaCl in 0.1 M phosphate buffer of 500 ml to get LPO. Sepharose FF then refluxed with 0.1M NaCl to clean Sepharose. Sepharose FF, then, was soaked in a solution of distilled water with 20% alcohol for storage.

Determination Of Capture Separose

Lactoperoxidase solution, which has been recognized its activities, was passed on the columns containing SP-Sepharose as much as 1 gram. Lactoperoxidase as many as 10, 100, 200 and 300 ml were circulated through the column at flow rate of 1.0 ml / min. using a peristaltic pump. The liquid effluent that has passed through the column, then, was determined the activity of its LPO solution.

Lactoperoxidase determination was carried out by using ABTS as substrate. 450πl (1.0 mM) ABTS in 10 mM acetate buffer (pH 4.4) and 450πl H_2O_2 (0.55 mM) in pure water were put into the cuvet. The output as much as 50 πl column was poured into the cuvet, shaken gently by using a micropipette to be homogeneous and was read at the absorbance of 412 nm. A unit of LPO enzymatic activity was expressed by the amount of enzyme required to oxidize 1 πmol ABTS/min. Molat removal coefficient was at 412 nm for ABTS 32.400 $m^{-1}cm^{-1}$ The immobilization efficiency (IE) was calculated as follows: IE(%)= E1/E0x 100 , where E0 is the total LPO activity added to the resin (U) and E1 is the total LPO activity embedded in the resin (U). (Al-Baarri, *et al.*, 2010a).

RESULTS AND DISSCUSION

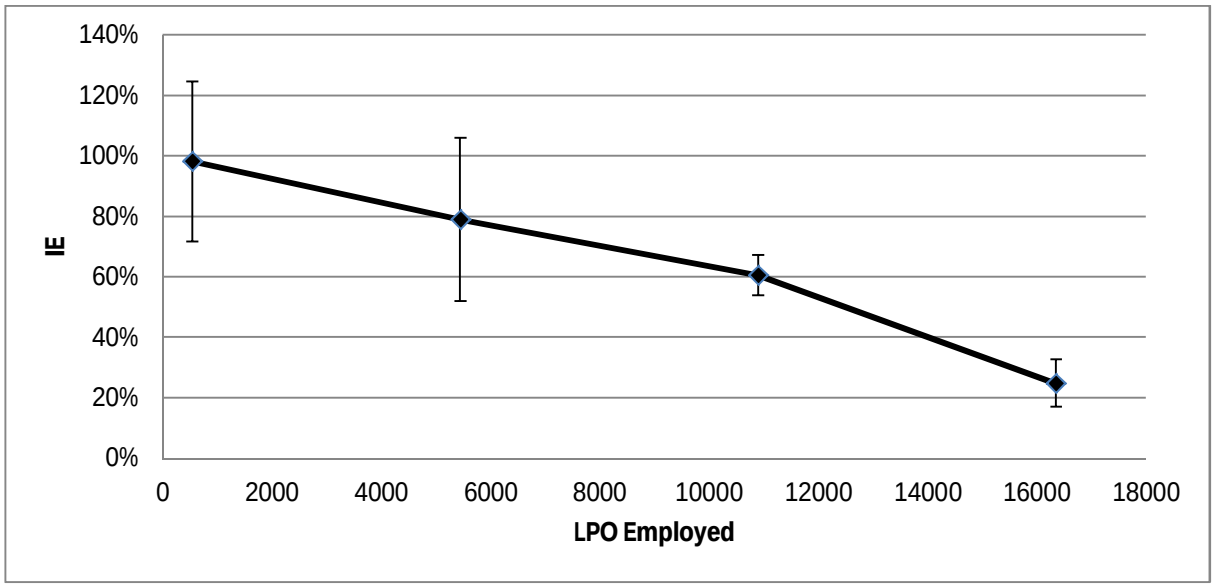

Figure 1. Effect of the increase in whey volume added into SP-FF column on immobilization efficiency into 1.0 g of SP-FF.

Figure 1. shows the use of Sepharose fast flow (SP-FF) in capturing LPO. LPO was used in different volume of 10, 100, 200 and 300 ml. They consisted of 54,52 unit/ml. The enzyme LPO used in this study was taken from bovine whey milk, while separation of lactoperoxidase used *ion exchange chromatography* with Sepharose fast flow (SP-FF).

Graphic of the experiment showed that Sepharose fast flow had the limited ability to capture the LPO. The more enzyme LPO was added would affect the ability to capture Lactoperoxidase. It can be seen from the graph that the larger LPO unit streamed on *ion exchange chromatography*, the ability to capture LPO would decrease.

One gram of Sepharose FF could be optimally captured 500 unit of LPO with flow rate 1 ml/ min. Sepharose had a ability to capture lactoperoxidase that can be seen when SP-FF was flowed 100 up to 500 unit LPO, SP FF could still be able to catch it. However SP-FF also had a limitation in capturing LPO enzyme, when SP-FF streamed more than 500 unit, SP-FF could not optimally catch enzyme LPO. This evidence was proved by the increasing number of LPO that could not be captured by the SP-FF. Research about the use of less than 500 units LPO had an efficiency value of immobilization of 97% (unpublished data). It could also be seen at previous research that showed 1 gram SP-FF was effective to absorb 300 ml of whey by conversion of 300 ml whey that was

similar as 750 units / ml LPO. Thus it could be stated that the optimum adsorption activity of 1 gram Sepharose was 750 units (Al-Baarri *et al.*, 2010a). Another study showed that the SP-FF could be able to immobilize pure enzymes of LPO 600 units / ml per gram of resin (Al-Baarri *et a.l*, 2010b).

CONCLUSION

Based on the data obtained in this study, it can be concluded that the immobilization efficiency of the most effective LPO using Sepharose Fast Flow is 500 units per ml LPO.

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ANTIOXIDANT ACTIVITY OF GLICATED GOAT MILK WITH VARIOUS MONOSACCHARIDES

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ABSTRACT

This research was carried out to comparethe antioxidant activity of 90 °C,10 min-glycatedgoat milk protein as fortified with 1% and 4% (w/v) of D-Psicose and D-Fructose.The antioxidant activities were examined with ABTS + PP + methanol mixtures at 734 nm.The observed activities were 70.87%, 75.51%, 87.90% and 91.49% for 1% and 4 % D-psicose as well as 1 and 4% D-fructose respectively. The result showed that glycated goat milk protein using 4% of D-Fructose performed the highest antioxidant activity.

Keywords: *glycation, goat milk, antioxidant, D-Psicose, D-Fructose*

INTRODUCTION

Nowadays, goat milkshave become more popular as it has many health benefits. However, their (goaty) flavor is still problematic for some people thus limit their preference. Flavor modification istherefore necessary to cover the problem.

Non-enzymatic glycation could be promising as such a modification. Some reactions occurring between amines of milk proteins and carbonyl compounds of reducing sugars (Sun *et al.*, 2006)could lead to improve the flavor as well as color and enhance the taste.

Rare sugars have attracted a great deal of attention, mainly concentrated on their role for a various of uses, such as potential inhibitors of various glycosydases (Maniruzzaman*et al.*, 1996), low caloriecarbohydrate sweeteners and bulking agents (Levin, Zehner, Sanders, & Beadle, 1995; Livesey& Brown, 1996; Matsuo, Suzuki, Hashiguchi, &Izumori, 2002).

Utilizing this saccharide as carbonyl source in non-enzymatic glycationof milk goat protein was intended to examine the antioxidant activities of glycated milk protein. The antioxidant activities of glycated goat milk proteins were compared to that induced by D-Fructose, a common sugar.

MATERIAL AND METHODS

Protein glycation

A set of goat milk samples fortified with 1% and 4% of D-psicose and D-fructose were prepared in microtubes.Samples then were heated in waterbath at 90 °C for10 min.

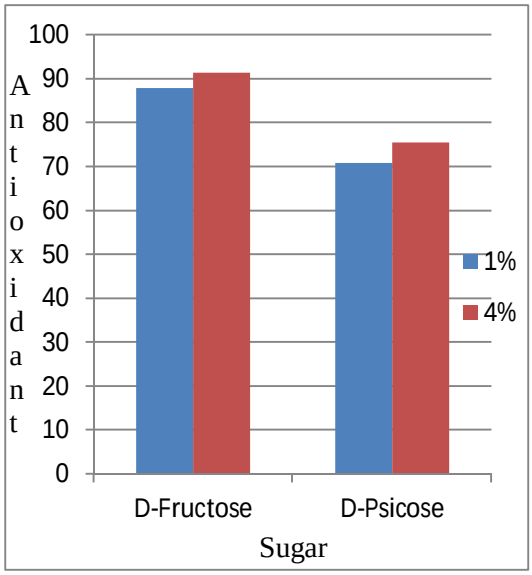
OBSERVATION ON ANTIOXIDANT ACTIVITY

50mL of those were mixed with 950 µL of ABTS PP(30µL)+methanol (970 µL) mixtures. After 2 hours of dark incubation at 21°C,their absorbance were measured at 734 nm to observe the antioxidant activities.

RESULTS AND DISCUSSION

Antioxidant Activity

Antioxidant is a substance which can inhibit or delaying oxidation process. Antioxidant is absorbance without incubation minus absorbance after incubation and devided by absorbance without incubation multiplied with 100%.Oxidation is a chemical reaction which involving oxygen bounding, hydrogene releasing, or electron releasing.Absorbance can be measured with spectrophotometer in 734 wavelength. 734 is selected, because in 734 wavelengthcould minimize intervention from the other absorbance component. ABTS is use to catch up the free radicals.From figure 1 showed that D-Fructose 4% have a highest antioxidant activity (91,49%) than the other sugar. The results indicated that glycation could induced an antioxidant activity to the protein, the intensityof which depended on the duration of incubation and reducing sugar usedfor modification (Sun*et al.*, 2005). From this research was seen that effect ofsugar adding by various monosaccharidessuch as D-Fructose and D-Psicose will affected on increasing antioxidant activity. D-Fructose have a rare compound which can induce a high antioxidant activity, a component from a natural sugar D-Fructose can make protein bounding in milk more higher so that causing a higer antioxidant activity (Ardiyant, 2012).This is caused by D-Fructose ability when its added with ABTS can catch free radicals in milk, that affected antioxidant activity in milk could improved. A rare sugar can improve an antioxidant activity, because a rare sugar can bounding protein molecule at food or milk that can improve antioxidant activity (kagawa, 2004). A rare sugar is a low calories sugar, so that can be substitute with a convensionalsugar.



Graph 1. Antioxidant activities of goat milk protein fortified with 1% and 4% D-psicose and D-fructose after glycated at 90 °C for 10 min

CONCLUSION

From this research, we can concluded that D-Fructose have given the highest antioxidant activity among the other sugars. D-Fructose is more sensitive to captured free radicals on goat milk. D-Fructose was very good in combining with goat milk, because D-fructose could improved an antioxidant activity. D-Psicose is also can improved an antioxidant activity in goat milk too even though as not big as D-Fructose. D-Psicose have a special fature, that is D-Psicose have a low calories.

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THE DRYING KINETIC OF FOAM MAT DRYING COMBINED WITH AIR DEHUMIDIFIED FOR CARRAGEENAN DRYING

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ABSTRACT

This research concerns to study the kinetic of foam mat drying combined with air dehumidified for carrageenan drying in different operational temperature, thickness, and composition of foam agent and foam stabilizer. The result of the experiment showed that drying of foamed materials gave better textural properties of the final product than non-foamed ones. Dehumidified air combined with extensive porous structure and lower densities of foams which operated at 80 °C, 4 mm foam thickness, with using egg white (20%) as foaming agent and methyl cellulose (10%) as stabilizing agent has reduced drying time 70 min than non-foamed ones. Based on the experiment, the drying of carrageenan recomended to operate at 80 °C, 2 mm foam thickness, with using egg white (20%) as foaming agent and methyl cellulose (10%) as stabilizing agent. It has indicated shorter drying time and higher drying rates.

Keywords : *drying kinetic, foam mat drying, dehumidified air, carrageenan , drying time.*

INTRODUCTION

In food industry, carrageenan is widely used for stabilizing and texturing some food product: a chocolate, frozen desserts, ready-to-eat deserts, soy milk, and cottage cheese dressings (Bixler et al., 2001). Carrageenan is extracted from the seaweeds, species of Euchema *cottonii*. (Mc Candless et al., 1973).

The foam-mat drying is a process in which the transformation of products from liquid to stable foam follows air drying at relatively low temperatures to form a thin porous honey-comb sheet. The foam-mat drying produces better quality, porous and can be easily reconstituted product (Kadam., et al 2010). Recently foam-mat drying widely used in drying process of vegetable puree and fruit juice commodities. (Falade et al., 2003; Sankat and Castaigne., 2004; Ratti and Kudra., 2005). The stable foam is produced by foaming agents. Generally, foaming agent are soluble proteins. Proteins moves through the aqueous phase and are spontaneously adsorbed at the air–aqueous interface where the viscoelastic films are subsequently formed. The outcome of proteins adsorption is a reduction in surface

tension, which improves the foam formation (Prins., 1988).

Foam structure increased interfacial area of foamed materials; as a consequence it can be accelerate transport of liquid water to the evaporation front. It gives the shorter drying time. Besides that foamed materials have lower density, so that the mass load of the foam-mat dryer is also lower (Rajkumar et al., 2005). Some research informed that foam structure plays a major role in moisture movement during drying process and influence of it to product quality (Cooke et al.,1976; Karim and Wai., 1999b; Sankat and Castaigne., 2004). Foam mat drying method was suitable used for heat sensitive, sticky, viscous and high sugar content food products (Chandak & Chivate., 1972; Labelle., 1984). Suitable with physical characteristic of extract carrageenan that heat sensitive, sticky, viscous and high sugar content food products, the foam mat drying method was recommended to produce carragenan powder.

The drying times reduce with increase of the driving force. It's is increased by: 1) reducing the humidity of air, 2) decreasing air pressure, or by combinations of these two (Djaeni et al., 2007). In other research, the influence of air dehumidification is improves the driving force for drying and allows drying at low and medium temperatures at atmospheric pressure (Ratti C., 2001). The capability of zeolite to absorb the humidity of the air is another option for air dehumidification in drying process. Djaeni et al was developed the drying process with dehumidified air by zeolite. To produce the dehumidified air the processes is operated by passing the ambient air through a bed of activated zeolite. The effect of dehumidified air is increasing the driving force and the air temperature due to the release of adsorption heat. The experience showed that dryers operating at 40-60°C reach an energy efficiency up to 90%, which is 30-40% above that of conventional dryers (Djaeni et al., 2009).

This research concerns to study the kinetics of foam mat drying combined with using air dehumidified in different operational temperature, thickness, and composition of foam agent and foam stabilizer using tray dryer to produce carrageenan powder.

MATERIALS AND METHODES

Extract Carrageenan Process

The first step to made extract carrageenan was identified and choosed the seaweeds. Make sure that it was *Euchema cottonii species.* Then, washed them by aquadest to remove salt, sand and stones before treating with various alkalis to swell the seaweed and extract the carrageenan. Clean seaweeds submerged in alkali solution (HCl

+ Aquadest) in pH 5-6 for 15 minutes. After that, seaweeds submerged in alkali solution (KOH + Aquadest) in PH 9-10 for 24 hours. The seaweeds were ready to be dried by the sun ray about 2 - 3 days. The extraction processes run in the stirrer column extraction. Mixed the dried seaweeds (15 gr) with aquadest (900ml), and then added alkali solution (NaOH + Aquadest) until the pH of the solution to be 9 with temperature of the extraction was (70-80) ^{o}C for 2 hours. After extraction process, the dilute carrageenan solutions were filtered. Then, precipitated the solutions with potassium chloride (KCl 2, 5%) to give a fibrous mass which is pressed to removed impurities and then dried.

Foam Preparation

Foaming is a process to make liquid or semi solid to be form foams. Many foods which contain soluble proteins, e.g., egg white, beef extract and milk can be converted into stable foams when being whipped. In general, when the content of soluble solids in the sample is low, more amounts of foaming agent and stabilizers are required to be added (H art et al., 1963). This experiment used egg white as foam agent and methyl cellulose as foam stabilizer with various composition. The combination of those materials were : 20% egg white with 10 % methyl cellulose, 10% egg white with 20 % methyl cellulose, and 15% egg white with 15 % methyl cellulose. Both of those agents mixed by blender with rotational speed 720 rpm for 15 min to made stable foam. Based on the research, higher stirring time increases foam stability and higher stirring speed increases foam expansion significantly.

Experimental procedure for carrageenan drying

The drying experiments were performed in a tray dryer which equipped with seri unit for air dehumidification by zeolite and 3000 W electritical heated element capacity. The drying air carried out from the blower to the drying chamber with 28 x 43 cm cross-section area. A removable tray was placed to support the petri dishes which located above. Ambient air with relative humidity (RH) between 70-80% and temperature between 29-33°C was carrying out from the blower. Kept the superficial air velocity which passed the absorber column (suppose A) which contains the activated natural zeolite constantly. After the drying air trough out from the zeolite column, about 70-80% of water in air removed, the humidity of the air was increased and the air temperature increased about 5-10°C.

At the first experiment the dehumidified air was heated by heater component which was set 80 ^{o}C by thermocouple. The hot air with low humidity and high driving force was entering the dryer chamber from the center of bottom side. Moisture content of the

material evaporated from the wet extract carrageenan sheets which placed 4 mm thickness in the petri dishes. About 150 minutes after the drying process, the capability of zeolite was decrease. It must be regenerated at 200°C for 2 hours. The process still continued by removed air flow rate to the other zeolite column (side B).

To generate the data which needed for drying kinetics, the decreasing of weigh of carrageenan was measured by electronic balance (accuracy ± 0.01 g) every 10 minutes. Information of drying process condition were collected. Humidity of drying air measured by humidity meter and velocity of the drying air measured by anemometer. The drying process stopped after about 120 minutes. In other operational variables, the procedure of drying process was repeated.

This research work in various operational variables: temperature 60 °C 80 °C and 100°C, carrageenan thickness 2 ,3 and 4 mm, and various foam agent and foam stability, 20% egg white with 10 % methyl cellulose, 10% egg white with 20 % methyl cellulose, and 15% egg white with 15 % methyl cellulose.

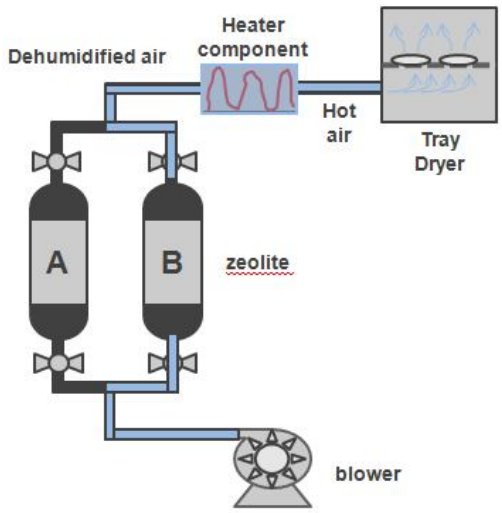


Figure 1. Schematic overview of the experimental equipment

Data processing

The data measurement showed the decreasing of carrageenan weigh. It used for calculated the theoritical of moisture content by :

$$X\,(dry\ basis) = \frac{M\,(wet\ solid) - M\,(dry\ solid)}{M\,(dry\ solid)} \quad (1)$$

The drying curve of carrageenan as a funtion of drying time vs moisture content. Drying rate curve known as N versus X. From the experiment, the drying rate determined by this equation:

$$N = -\frac{Ms}{A}\frac{dX}{dt} \quad (2)$$

More over, The total drying time to reduce the solid moisture content from initial moisture content *(X1)* to moisture content that expected *(X2)* can be estimated. Its can be simply calculated by:

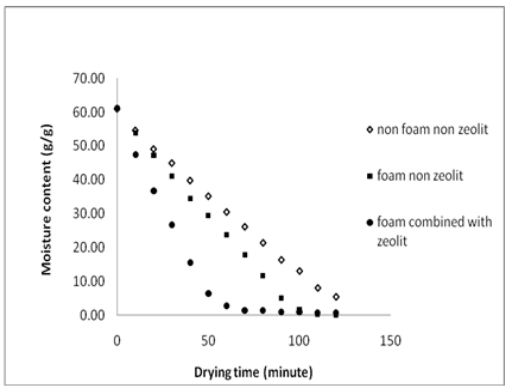
$$tc = \frac{Ms}{A}\frac{(X2 - X1)}{Nc} \quad (3)$$

$$tf = \frac{Ms}{A}\frac{(X2 - X1)}{(N1 - N2)}\ln\frac{N1}{N2} \quad (4)$$

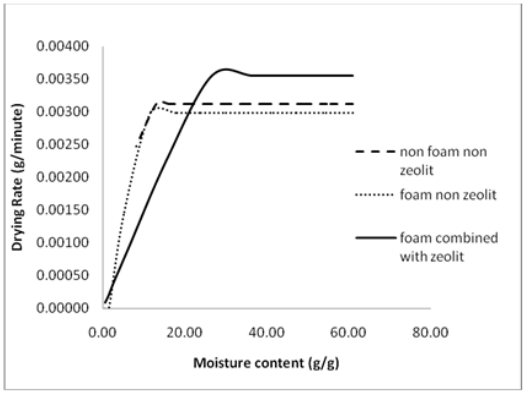
RESULTS AND DISCUSSION

Drying Kinetics

The effect of Foam Mat Drying Combined with Air Dehumidified



Graph 1. Drying curves of at the normal drying process (non foam and non zeolite), application of foam mat drying, and combination foam mat drying with air dehumidified to dry extract carrageenan



Graph 2. Drying rate curves of the normal drying process (non foam and non zeolite), application of foam mat drying, and combination foam mat drying with air dehumidified to dry extract carrageenan

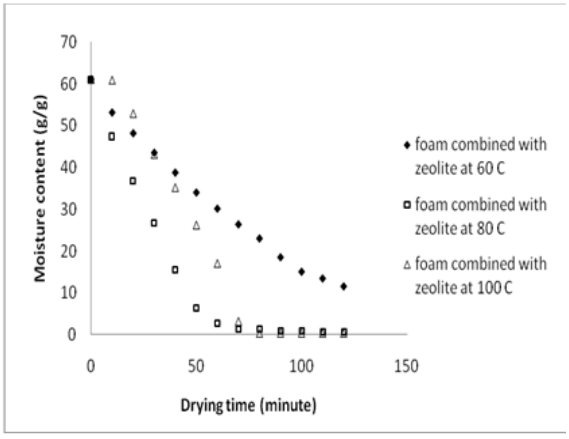
The first step of this research was compare the drying kinetic at the normal drying process (non foam and non zeolite), application of foam mat drying, and combination foam mat drying with dehumidified air by zeolite to dry extract carrageenan at the same condition of operation. The drying process operated in 80°C, drying air velociry 3,5 m/s, 4 mm thickenes, and foam produced by 20% egg white ang 10 % methyl cellulose. The result of this experiment was shown by drying curves (see Graph 1). Foam mat drying process gave shorter drying time to decrease of moisture content carrageenan from 61 g/g to 0,1 g/g dry basis than normal drying process. The mixed of carragenan, egg albumin as foam agent and methyl cellulose as foam stabilizer produced stable bubble structure of the foam. It's mean that the surface area for evaporation of the material which foamed was increased. The higher evaporation area gave impact to reduce the drying time. The shortest drying time performed by combination foam mat drying with dehumidified air by zeolite. When the humidity of the air was lower, the gradien humidity betwen solid material and drying air was higher to. As a concequency, mass transfer of moisture content from the material to the drying air can be accelerated.

Table 1. Drying time to reducing moisture content from 61 g/g until 0,1 g/g.

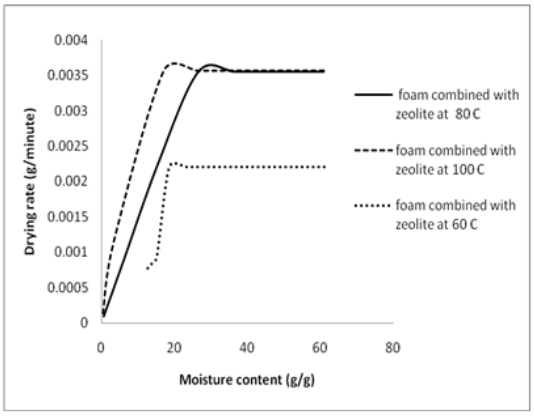
	Normal drying process	application of foam mat drying	combination foam mat drying with air dehumidified
Drying time (minute)	223	166	153

As seen in Graph 2, drying rate curve for foam combined with zeolit need shortest time for constant period rate phase and continued by falling period. Drying rate was the function of mass transfer coefficient and driving force between humidity of solid and humidity of air. Lower air humidity affected higher driving force; automatically it was increased the drying rate.

The effect of operational temperature



Graph 3. Drying curves of combination foam mat drying with air dehumidified to dry extract carrageenan at different temperature



Graph 4. Drying rate curves of combination foam mat drying with air dehumidified to dry extract carrageenan at different temperature.

In the second type of the experiments studied the effect of operational temperature in combination foam mat drying with dehumidified air by zeolite. The drying process operated in drying air velociry 3,5 m/s, 4 mm thickenes, and foam produced by 20% egg white ang 10 % methyl cellulose with different drying temperature; 60 °C 80 °C and 100°C. From the drying curve showed that the shortest drying time obtained by operational temperature at 100°C. The higher temperature affect the higher moisture diffusifity of the solid material. It's mean that the drying time to evaporate the moisture content from the solid material can be speed up. At 80 °C drying operational temperature, the drying time of the carragenan almost similar with 100°C, operational temperature at 100°C gave about 10 minute faster than 80 °C. But in the other way, when the operational temperature operated at 60 °C, the drying

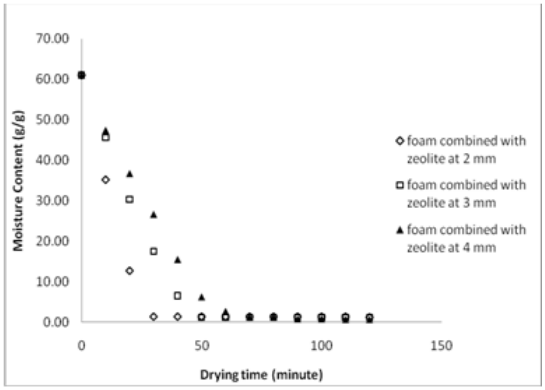
process need so long drying time, about two time longger than it operated at 80 °C. The higher temperatur affected higher diffusivity. In spite of higher temperature give higher diffusivity, all of the drying process cannot operate in the high temperature. There are some consideration, including the critical temperature of the material, heat sensitive characteristic of the material and drying cost efficiency. The relationship between temperature and diffusivity used to optimise the drying proses variable, especially in temperature variable.

Table 2. Drying time to reducing moisture content from 61 g/g until 0,1 g/g in some different temperature.

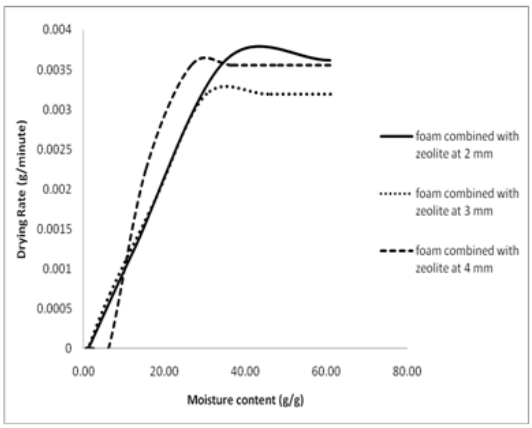
	Drying temperature		
	60°C	**80°C**	**100 °C**
Drying time (minute)	329	158	149

Besed on the calculation of the drying time at some different temperature, the drying process of carrageenan recommended operating at 80°C. It gave more efficient cost of energy and retains the quality of the carrageenan product.

The effect of carrageenan thickness



Graph 5. Drying curves of combination foam mat drying with air dehumidified to dry extract carrageenan at different thickness.



Graph 6. Drying rate curves of combination foam mat drying with air dehumidified to dry extract carrageenan at different thickness.

The recommended temperature of drying process from the past experiment was used to set drying temperature when studied the effect of carrageenan thickness. From the Graph 6, it wass seen that the moisture content reduced linearly with the drying time. The drying process with 2 mm thickness showed fastest drying time. The less of thickness affect the less distance of

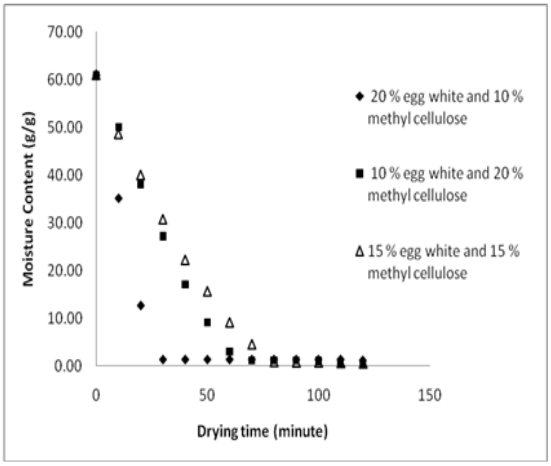
diffusivity, as a consequence the time of the moisture evaporation can be accelerated.

Table 3. Drying time to reducing moisture content from 61 g/g until 0,1 g/g in some different thickness.

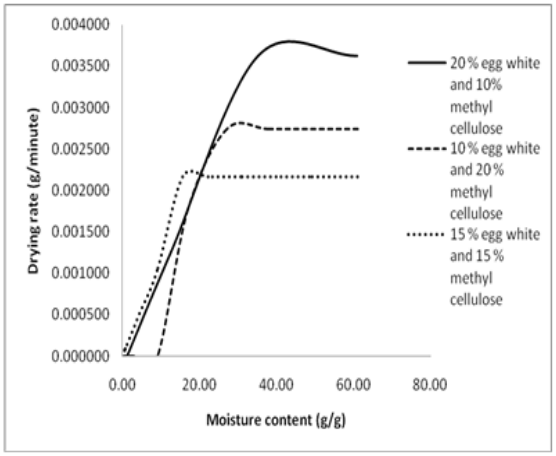
	Drying thickenes		
	2 mm	**3 mm**	**4 mm**
Drying time (minute)	136	150	158

From the calculation of the drying time at some different thickness it is seen that the different thickness had no significant effect to accelerate the drying rate, nevertheless the drying process recommend operating in 2 mm thickness for shorter drying time.

The effect of composition foam agent and foam stabilizer



Graph 7. Drying curves of combination foam mat drying with air dehumidified to dry extract carrageenan at different composition



Graph 8. Drying curves of combination foam mat drying with air dehumidified to dry extract carrageenan at different composition

In this section, the studying of effect of composition foam agent and foam stabilizer was evaluated. The drying curve shown that the shortest drying time performed by 20% egg white and 10 % methyl cellulose. The higher foam agent (egg white) and lower foam stabilizer (methyl cellulose) give better foam stability. The stability of the foam, affect the stability of expose area interface of the foamed material during drying process.

Table 4. Drying time to reducing moisture content from 61 g/g until 0,1 g/g in some different composition.

	Drying thickenes		
	20% egg white and 10 % methyl cellulose	**10% egg white and 20 % methyl cellulose**	**15 % egg white and 15 % methyl cellulose**
Drying time (minute)	136	168	147

From the calculation of the drying time at some different composition, it was seen that

20% egg white and 10 % methyl cellulose were recommended for drying process for shorter drying process.

Product Quality

Textural properties

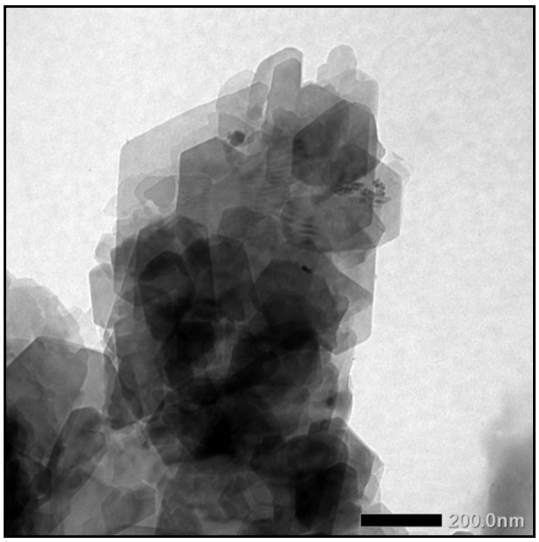


Figure 2. TEM image of carragenan powder after dried by non foam and non zeolite drying

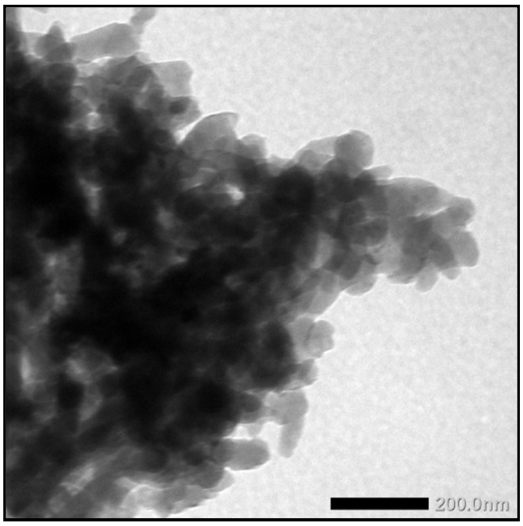


Figure 3. TEM image of carragenan powder after dried by combination foam mat drying with air dehumidified

High resolution transmission electron microscopy (TEM) image was used to determine the phase composition of the nanoparticles. The microstructures of the resulting nanoparticles were characterized by Transmission electron microscope JEM-1400 (JEOL, Japan) is optimized for high-contrast hogh-relosution. Accelerating voltage: 40-120 kV, cathodes – tungsten ar LaB6, magnification: x50-x800000, resolving power (points) – 0.38 nm. The microscope is equipped with high-tilt goniometer, high-resolution water-cooled bottom-mounted CCD-camera and a film camera. Microscope functionality is fully computer-controlled, with high degree of automation.

As seen at Fig. 10 and Fig. 11 the microstructures nanotape of carragenaan at dimension 200 nm in length can be identified. Both of those image showed similar shape, but different in size. At the same dimension, textural properties of the carragenan which dried by combination foam mat drying with air dehumidified was smaller than non foam.

CONCLUSIONS

The combination of foam mat drying with air dehumidified to dry carrageenan gave better performance than non foam and non zeolite ones. The drying time can be speeded up 70 minutes, with better quality of textural properties of carrageenan powder.

Based on the calculation of the drying time, the temperature drying process at 80°C performed more efficient cost of energy and able to retain the quality of carrageenan product.

From the experiment, the different thickness had no significant effect accelerated the drying rate, nevertheless the drying process recommended to operate in 2 mm t thickness for shorter drying time.

The combination of 20% egg white and 10 % methyl cellulose gave better foam stability and gave the sortest drying time.

ACKNOWLEDGEMENT

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NOMENCLATURE

A = evaporation area (m^2)

M = mass (kg)

N = drying rate ($kgm^{-2}h^{-1}$)

Nc = drying rate at constant rate period ($kgm^{-2}h^{-1}$)

t = drying time (h)

tc = drying time at constant rate period (h)

tf = drying time at falling rate period (h)

X = moisture content (kg/kg)

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MIXED ADSORPTION DRYER IN FLUIDIZED BED FOR CORN DRYING : THE EFFECT OF TEMPERATURE AND SUPERFICIAL AIR VELOCITY TO MOISTURE CONTENT OF CORN

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ABSTRACT

Corn is one of the major ingredient in foods. Corn with high moisture content is not suitable for storage. The high moisture content of corn in storage leads to deformation. Post harvest treatment such as drying is an important step to produce high quality of corn since it determines the water content. A batch fluidized bed dryer was carried out for corn drying. The objective of this work is to study how to decrease corn moisture content using fluidized bed dryer by the following conditions: inlet air temperatures of 40-50^{o}C and superficial air velocities 9-13 ms^{-1}. Zeolite was mixed with corn in fluidized column to investigate the effect of zeolite during drying process. Drying was started with an initial moisture content of 30% and ended with a final moisture content 14% in maximum (SNI 01-3920-1995). From the experiments, it can be shown that in order to reach 14% moisture content in corn, drying on 50^{o}C with superficial air velocities of 13 ms^{-1} need shorter time. In that condition, mixed drying with 50% zeolite gave significant effect in moisture content removal and drying time.

Keywords : *corn, drying, fluidized bed, moisture content, temperature*

INTRODUCTION

Corn (*Zea mays* L.) is one of main food resources in the world. Corn kernels, on the average, contain up to 16% moisture, 72% starch and 9–10% protein. (Dickerson, 2003). Normally, moisture content of freshly harvested corn varies in a range of 33 - 40 %. At this moisture level under hot and humid climates, *Aspergillus flavus* easily infected in corn kernels and produces aflatoxin substance (Wongurai et al., 1992). Post harvest treatment such as drying is an important step to produce high quality of corn since it determines the water content and ingredients and long life storage.

Corn should be stored as dried product with a maximum water content of 14% (SNI 01-3920-1995). With this condition, it is expected that microbial activity is decreased thus corn can be either stored or marketed in longer time period.Some drying methods have been used in drying process, such as direct sun drying, convective drying, microwave and infra-red drying, freeze and vacuum drying. Current drying technology is often not efficient in

energy consumption and has a high environmental impact because of combustion of fossil fuel or wood as energy source (Kudra and Mujumdar, 2002).

From all the existed methods, Soponronnarit, et al (1997) stated that the fluidized bed dryer is widely used in many industries because of its several advantages than the other types such as rates of heat and mass transfer are high, consequently drying time is short, the dryer is small but high capacity, isothermal bed yields a desired product quality and makes continuous dryer to be controlled easily.

Soponronnarit, Pongtornkulpanich, and Prachayawarakorn (1997) studied the drying characteristics of corn in a batch fluidized bed dryer at 150, 170 and 200^{o}C air temperatures. Jittanit, et al (2010) also attempted to increase the performance of fluidized corn and rice by implementing two stage dryer. The process can reduce the operational temperature as well as improving the quality of corn during storage. However, the operating temperature is still higher than 60^{o}C then the ingredients degradation has to be more considered. Lynch and Morey (1989) in their research suggested that ambient air corn drying gives advantages in corn quality compared to high temperature drying.

Considered about the quality of product, drying process and energy efficiency, mixed-adsorption drying is studied to dry corn with water adsorbents. Based on Revila et al., (2006), the effect of zeolite to water removal from a grain product (corn and seed) is the most superior compared to silica, alumina, sand and pillared clay.

In mixed adsorption dryer, zeolite and the seed product such as corn are mixed in a column and fluidized by air as drying medium. The air will evaporate water from the product, and at the same time, zeolite will adsorb vapor from air. As results, air humidity can be kept low. Moreover, operational temperature can be maintained at the certain condition due to the latent heat of adsorption. Thus, the driving force of drying can be kept high.

This paper discussed about the effect of temperature and drying air velocity to moisture content of corn in fluidized bed dryer in order to get dried corn which is satisfied SNI standard. The effect of zeolite in drying process is also investigated.

MATERIAL AND METHODS

The drying of corn was carried out in batch fluidized bed dryer installed in the Chemical Engineering Department of Diponegoro University. The dryer basically consisted of a blower to supply the air flow, a fluidized column, an electric heater and

an electronic temperature controller. The air velocity was measured with an Extech Instruments Thermo-Anemometer 407113.

The sweet corn harvested from local farmer in Semarang with average initial moisture content 30%. The initial moisture contents of sweet corn kernels was determined by oven at 135^{o}C for 2 h. (AOAC 930.15).

Zeolite that is used in this research was Zeolite 3A provided by Zeochem, Switzerland. It was activated by physical methode through heating at 300^{o}C for 3 h. The aim of physical activation methode is to improve water loaded capacity of zeolite by remove water molecules and organic compounds that exist in zeolite without using chemical substances so that zeolite can be mixed with corn in fluidized column. (Djaeni et al., 2010).

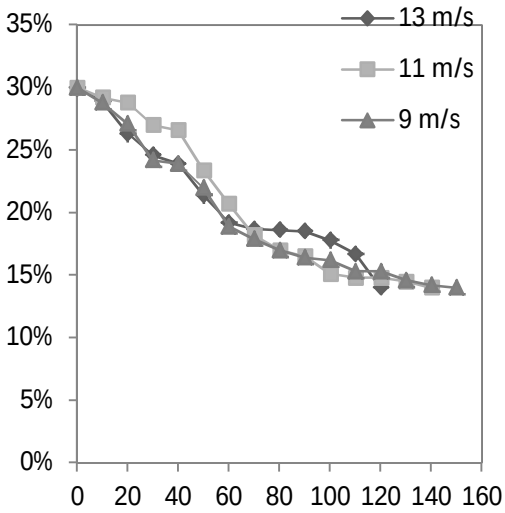
Corn kernels with total weight 150 gr fuidized with warm air in dryer column. The inlet air temperature was varied 40-50^{o}C and the air velocity ranged from 9 to 13 m/s. The response, water content in corn was measured every 10 minutes during the process using Krisbow KW06-404 Grain Moisture Meter. Drying of corn was finalized when the moisture content decreased to 14% from initial value of 30% and the moisture content at each value was used for drawing the drying curve. In this research, the bed contain 50% Zeolite and 50% corn was also fluidized using similar condition procedure.

RESULTS AND DISCUSSION

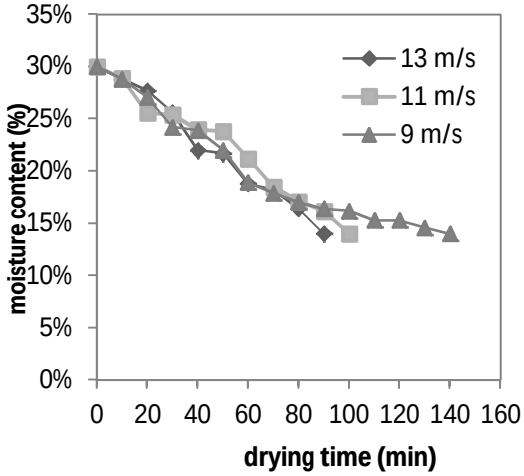
The experiment was set up to investigate moisture content of corn during drying process in fluidized bed. Graph 1 shows the result of moisture content value during the drying process at 40^{o}C. At air velocity of 13 m/s, it needs 120 minutes to decrease moisture content of corn from 30% to 14%. While at air velocities of 11 m/s and 9 m/s the drying process ended after 140 and 150 minutes. Moisture content of corn was more rapidly reduced at higher air velocity than that at lower air velocity. High air velocity will rise water evaporation capacity from material, so drying at 13 m/s needs the shortest drying time to reach 14% moisture content on dried product. Beside that, Soponronnarit, et al (1997) stated that humidity of drying air at shallower bed depth was relatively lower than that at deeper bed depth. Due to high air velocity, the corn can be fluidized better and humidity on the bed becomes more uniform so that the water can be removed from corn easier. This phenomena is occured in drying process at temperature 50^{o}C, as well. As shown in Graph 2, at air velocity 13,11, and 9 m/s the processes need 90, 100, and 140 minutes to reduce moisture content to 14%.

Inlet air drying temperature greatly affected on moisture content of corn in fluidized bed

dryer as shown in Graph 3, for two temperature levels at the same bed depth and superficial air velocity of 13 m/s.

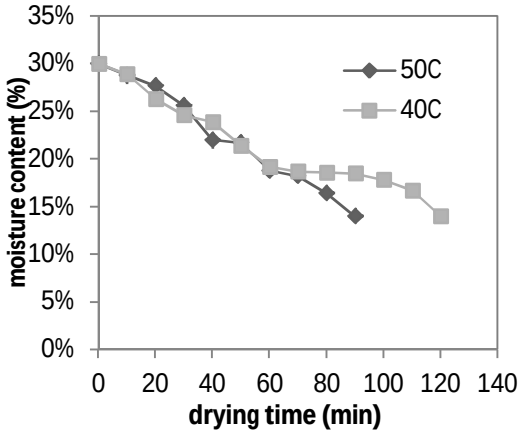


Graph 1. Effect of air velocity on moisture content at 40°C and different air velocities



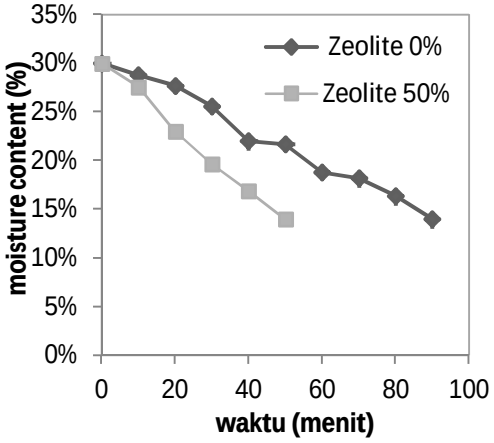
Graph 2. Effect of air velocity on moisture content at 50°C and different air velocities

By the fact of the results, it can be explained that moisture diffusion in a corn kernel becomes greater with higher grain temperature which results from higher heat transfer rate between corn kernel and drying air. The higher temperature that used in process, the more heat that is received by corn's surface so evaporation rate in surface area per hour will increase. That define why drying at 50°C needs 90 minutes while at 40°C spends 120 minutes.



Graph 3. Comparison of corn moisture content profile at 50°C and 40°C with air velocity of 13 m/s

The presence of zeolite in mixed fluidized bed gave significant effect on drying corn as indicated in moisture content removal. Based on Graph 4, to decrease moisture content of corn from 30% to 14%, mixed bed which was consisted of 50% corn and 50% zeolite in the same temperature and air velocity resulted 40 minutes faster than the bed that there was no zeolite mixture. It means that the zeolite can improve driving force for drying by adsorbing water from air as drying medium.



Graph 4. Comparison of water removal in corn drying with 0% and 50 % zeolite at 50°C and air velocity of 13 m/s

CONCLUSIONS

Moisture content reduction from 30% to 14% of corn in fluidized bed dryer was affected by air velocity, inlet air temperature and the presence of zeolite in the fluidized bed. Through drying at 13 m/s and 50°C the corn is faster to reach moisture content of 14% in order to satisfy SNI 01-3920-1995. The presence of corn-zeolite mixture applied in drying process results the shorter drying time. This research is used for consideration in the further research regarding product quality and thermal efficiency.

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THE USE OF SWEET POTATO FLOUR (*Ipomoea batatas* L. cv. Kentang) AS THE SOURCE OF VITAMINS AND SWEETENER SUBSTITUTE OF CHIFFON CAKE

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ABSTRACT

Sweet potato (*Ipomoea batatas* L. cv. Kentang) locally called as "ubi madu" is a indigeneous sweet potato variety, grown on the slopes of Sumbing mountain, Central Java. The tuber is rich in starch and β-carotene, which during the curing process the starch is converted into sugar. The tuber is potential to be applied as a substitute of sweetener as well as β-carotene sources in making chiffon cake. In this study, the tuber was processed into flour before it was applied to the chiffon cake. The study aimed to obtain formulations of chiffon cake with sugar substitute appropriate percentage in order to obtain the most appropriate quality and accepted by consumer in terms of physical, chemical, and microbiology, as well as add value to the product. The levels of sugar substitution were 0% (control), 15%, 30%, 45% and 60%. The sensory evaluation was analysed by median and chi-square tools while the physical and chemical characteristics results were analysed using one-way ANOVA, and the difference between the treatment means were analyzed at p = 0,05. The highest physical characteristics and sensory evaluations of the produced chiffon were obtained at 15% of sugar substitution. Chiffon cake control was contained 35.64% of the total sugar, 6.62 mg of β-carotene per 100 grams, and 15.75% antioxidant activity. Meanwhile, the chiffon cake substituted with 15% of tuber flour contained 34.67% of the total sugar, 10.52 mg of β-carotene per 100 grams, and 25.65% antioxidant activity. The maximum storage period of the chiffon cake control and chiffon cake with 15% of the substitute of sugar was two days. Therefore, tuber starch can be applied as a substitute for sugar at a maximum rate of 15% without decreased of quality and consumers acceptance of the produced chiffon cake.

Keywords: *local sweet potato variety, sugar substitute, chiffon cake, consumers' acceptance, physical and chemical characteristics*

INTRODUCTION

Sugar is one of staple need for people either dirrect consumption or food processing. The Indonesian needs of sugar in 2006 is estimated reach 3,8 million tons, while sugar production is estimated 2,6 million tons only. Thus Indonesia imports sugar for 1,2 million tons (31,58%). The sugar role as sweetener still dominate by sucrose (Haji, 2009).

Sugar is an important constitution in bakery products, such as cake, pastry, and cookies. As the development of trend and consumer

needs, producers of bakery products try to develop the other natural sweetener (sugar) alternative in their products, such as cake (Haji, 2009). Therefore, the other natural sweetener (sucrose) alternative needs to be developed (Triyono, 2007).

Besides, Indonesia has natural resources that potential to be used as sugar (sucrose) substitution. One of them is sweet potato (Onggo, 2006). Sweet potato is one of tuber that has strong sweet taste and sticky texture after baked during two or three hours in oven (Solihat, 2005 in Onggo, 2006). Starch content in sweet potato will be converted into sugar during storage (Onggo, 2006).

Sweet potato also contains β-carotene (provitamine A) that can give added value in products. More than 250 million children in the world suffer vitamine A deviciency. Most of them is in developing country, include Indonesia. This vitamine A deviciency is the main cause of blind (Bagriansky and Ranum, 1999).

The challenge is to combine needs, trend, and potention to be applicated into a product. Cake is one of bakery product that use a lot of sugar and includes as leavened product (Matz, 1992). Sugar is used to give sweet taste and tender texture in cake. Chiffon cake is a kind of cake that has high raise and soft texture (National Food Service Management Institute, 2009). Thus, sugar (sucrose) substitution with other ingredient (sweet potato flour) in chiffon cake will change it raise, texture, and product acceptance. The study aimed to obtain formulations of chiffon cake with sugar substitute appropriate percentage in order to obtain the most appropriate quality and and accepted by consumer in terms of physical, chemical, and microbiology, as well as add value to the product.

MATERIALS AND METHODS

The Making of Sweet Potato Flour

Sweet potato that used is *Ipomoea batatas* L. cv. Kentang grows on the slope of Sumbing Mountain, Kaliangkrik subdistrict, Magelang regency, Central Java province, that stored during 3 weeks in room temperature. After storage, sweet potato is washed, peeled, sliced, and dried by Solar Tunell Drying (STD) during one or two days. Dried slices are ground became flour (625 mesh) then storage in closed container to be used in next process (Adeleke and Odedeij, 2010).

Total Sugar (Anthrone Method)

Standard Curve

100 mg pure glucose diluted in pure water (aquabidest) until 100 ml. This solution was taken 10 ml then dilute in pure water until 100 ml (100 ppm). Other solutions in other concentrations was made: 0 ppm (blanko), 8 ppm, 16 ppm, 24 ppm, 32 ppm, and 40 ppm. Each solution was taken 1 ml then 5 ml

anthrone solution was added. The tubes closed and heat at 100°C during 12 minutes. After its cooled down, meassure the absorbantion at 630 nm wave length (Apriyantono *et al.*, 1989).

Total Sugar of Sweet Potato flour

20 g sweet potato flour (*Ipomoea batatas* L. cv. Kentang) dissolved in 80% alcohol (1:1) then filtered with cotton (wash with 80% alcohol until all sugar dissolved). The pH of filtrate meassured (added $CaCO_3$ until alkali). Filtrate heated at 100°C during 30 minutes the filtered with Whatman No.2 filter paper. Alcohol evaporated by the heat at ± 85°C. Added water if its almost dry. If there still sediment, need to be refiltered. 3-5 ml aluminium hidroxide added until its clear. The filtrate filtered with Whatman No.2 filter paper then diluted with pure water (aquabidest) until 100 ml (Apriyantono *et al.*, 1989). That filtrate was taken 1ml and diluted with 9ml pure water (aquabidest) in tube (10 dilution). Then made other dilution (100 and 1000). The solution (1000 dilution) was taken 1 ml then react with 5 ml anthrone. The tube was heated at 100°C during 12 minutes then cooled down. The absorbantion was meassured at 630 nm wave length (Apriyantono *et al.*, 1989).

β-Carotene

Standard Curve

25 mg pure β-carotene dissolved with 2 ml eter then diluted with 9% acetone in hexane until 25 ml (1000 ppm). The solution was taken 10 ml then diluted with 9% acetone in hexane until 100 ml (100 ppm). From this solution, it was taken each 5 ml, 2,5 ml, 1,25 ml, 0,625 ml, 0,313 ml, 0,156 ml, dan 0,078 ml to dilute with 9% acetone in hexane until each 10 ml. The absorbantion was meassured at 436 nm wave length (Apriyantono, 1989).

β-Carotene of Sweet Potato Flour

2 g sweet potato flour (*Ipomoea batatas* L. cv. Kentang) was extracted a night in 30 ml acetone hexane (3:7) then filtered with Whatman No.2 filter paper. It washed and diluted with hexane until 100 ml then filtered with Whatman No.2 filtered paper that given 1 g *cellite* dan 1 g Na_2SO_4 on the filtered paper. The absorbantion was meassured at 436 nm wave length. β-carotene in sweet potato flour counted use equation.

$$\text{mg } \beta - \text{carotene/100g sample} = \frac{\text{standard curve concentration x dilution factor (100)x 100}}{\text{sample weight (g)x 1000}}$$

(Apriyantono, 1989).

If it needed, vitamine A content could be count by multiply with conversion factor (1,6667 SI) (Helrich, 1990).

Antioxidant Activity of Sweet Potato Flour

0,5 g sweet potato flour (*Ipomoea batatas* L. cv. Kentang) was extracted 2 hours in 5 ml

methanol. The extraction solution was taken 0,1 ml then react with 3,9 ml DPPH (2,2-*diphenyl*-1-*picrylhydrazyl*) solution during 30 minutes. The absorbantion was meassured at 515 nm wave length. As blanko, it used 0,1 ml methanol that react with 3,9 ml DPPH (2,2-*diphenyl*-1-*picrylhydrazyl*) solution during 30 minutes. Antioxidant activity was meassured as % *discoloration* by an equation.

% *discoloration* = [1-(At=30/At=0)] x 100%

Explanation:
At = 30 : sample absorbantion
At = 0 : blanko absorbantion
It tested 5 times
(Miliauskas *et al.*, 2003).

Water Content of Sweet Potato Flour

0,5 g sweet potato flour (*Ipomoea batatas* L. cv. Kentang) spread on moisture balance plate then close the cover. Press the start button and wait for 20 minutes. The number that displayed was noted as loss on drying percent. It tested 5 times (Ohaus, 2001).

The Making of Chiffon cake

The formulation of chiffon cake could decide after amount of total sugar in sweet potato flour counted (75%). The formulation of chiffon cake decided based on the test of total sugar in sweet potato flour (*Ipomoea batatas* L. cv. Kentang). The sweet potato flour (*Ipomoea batatas* L. cv. Kentang) was applicated in chiffon cake with sugar substitution 0%, 15%, 30%, 45%, and 60% (Table 1.). Yolk and sugar (sucrose) was beaten until the colour change lighter. Flour (either wheat flour or sweet potato flour), that has been mixed with baking powder, was added by turns with water. After mixed well, vegetable oil was added (the 1st battered). While the white part of egg, salt, and cream of tartar were beaten until stiff (the 2nd battered). The 2nd battered mixed slowly into the 1st battered then poured in pan. The baking process did at 170°C during 45 minutes (modified of Akesowan, 2009). After its cooled down, chiffon cake was dispatch from pan then stored in PE (*Polyethylene*) bag at room temperature (25°C) before it analyzed (Yung & Wen, 2010).

Table 1. The Chiffon Cake Formulation in Sugar Substitutions Determination.

	75% total sugar of sweet potato (*Ipomoea batatas* L. cv. Kentang)				
Ingredients	**0%**	**15%**	**30%**	**45%**	**60%**
Wheat flour	87,5 g	82,5 g	77,5 g	72,5 g	67,5 g
Sweet potato flour	0 g	20 g	40 g	60 g	80 g
Sugar (sucrose)	100 g	85 g	70 g	55 g	40 g
Salt	1 g	1 g	1 g	1 g	1 g
Vegetable oil	50 g	50 g	50 g	50 g	50 g
Egg (white)	105 g	105 g	105 g	105 g	105 g
Cream of tartar	1 g	1 g	1 g	1 g	1 g
Water	50 g	50 g	50 g	50 g	50 g

Yolk	45 g	45 g	45 g	45 g	45 g
Baking powder	2,5 g	2,5 g	2,5 g	2,5 g	2,5 g

(Matz, 1972 yang dimodifikasi).

Raise Volume and Baking Loss of Chiffon Cake

Raise volume was meassured using rapeseed method (AACC, 1983). The weight of pan, the weight of battered, and the weight of chiffon cake was weighing. Baking loss was counted from dercrease battered weight and chiffon cake weight then compared it with battered weight. The result was multiplied with 100% (Akesowan, 2009).

Texture of Chiffon Cake

The crumb texture of chiffon cake was meassured by Lloyd Texture Analyzer with sized 3x3x2 cm, trigger 20 gf, and cross head speed 1 mm/s. The aspects that meassured include hardness, springiness, cohesiveness, dan adhesiveness (Modification of Akesowan, 2009).

Color Meassurements of Chiffon Cake

The color of the crumb of chiffon cake was meassured by colorimeter. The aspects that meassured include L* (lightness), a* (redness/greenness), and b* (yellowness/blueness). It used 25 mm apperture (Akesowan, 2009). The color difference between chiffon cake 0% (control) and the others chiffon cake was symbolized as ΔE. ΔE was determined use equation.

$$\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$$

(MacDougall, 2002).

The Sensory Evaluation of Chiffon Cake

The sensory evaluation did by 40 panelists include 5 aspects (color, aroma, taste, texture, and overall). (Resurreccion, 1998). The sensory evaluation was analysed by median (rating) and chi-square (ranking hedonic) tools while the physical characteristics results were analysed using one-way ANOVA, and the difference between the treatment means were analyzed at $p = 0,05$. The highest physical charracteristics and sensory evaluations of the produced chiffon was obtained at 15% of sugar substitution. Therefore, the next tests was focused on this two samples. The next tests includes total sugar, β-carotene, antioxidant activity, water content, and selflife.

Water Content of Chiffon Cake

The crumb and crust of chiffon cake (either 0% or 15% sugar substitution) was ground then spread 5 g on moisture balance plate and closed. Press the start button and wait for 20 minutes. The number that displayed was noted as loss on drying percent. It tested 10 times in 2 batch (Ohaus, 2001).

Total Sugar, β-Carotene, and Antioxidant Activity of Chiffon Cake

All of the steps did the same as the test for sweet potato flour sample. It tested 10 times in 2 batch.

Total Plate Count of Molds and Yeast in Chiffon Cake

The sterilization process did in autoclave at 121°C during 15 minutes. Chiffon cake (either 0% or 15% sugar substitution) was ground and weighing 25 g. It was diluted in 225 ml PW (*Peptone Water*) (dilution 1:10). Dilution was made until 1:1000. 1 ml from each dilution was spread in petridish (duplo). 15-20 ml PDA (*Potato Dextrose Agar*), that have been mixed with chloramphenicol, was poured in each petridish at (45 ± 1)°C. Incubation did at (25 ± 1)°C during 5 days. The colonies of molds and yeasts was determined use equation.

$$\text{cfu/g} = \text{counted colonies} \times \frac{1}{\text{dilution factor}}$$

(SNI 3751:2009).

RESULTS AND DISCUSSION

The Sweet Potato Flour (*Ipomoea batatas* L. cv. Kentang) in Chiffon Cake

Sweet Potato Flour (*Ipomoea batatas* L. cv. Kentang) used as sugar (sucrose) substitute in chiffon cake (Table 2.). The more sugar substitute precentage, baking loss and raise volume of chiffon cake became smaller (Table 3. And Figure 1.). Besides contain starch, β-carotene, and minerals (Ca, P, Fe, and K), sweet potato flour is also contain dietary fiber (Woolfe,1992; Ulm, 1988 in Singh *et al.*, 2008). There are two kind of dietary fiber. Insoluble dietary fiber has ability to form bulky mass, while soluble dietary fiber has ability to absorb water. Thus it can increase food viscosity and often used in baking, milk, and meat industry to reduce fat (Stephen 1995). Besides, it also contribute in chiffon cake (crumb) texture (Table.4). The more sugar substitute, hardness, springiness, and cohessiveness increase, while adhesiveness decrease. In all sample, during the storage, hardness, springiness, and cohessiveness also increase, while adhesiveness decrease. This change is because staling process during the storage. In staling process, there are two things happened. Moisture transfer from crumb to crust and intrinsic firming from materials cell wall that related with starch retrogradation during storage. Thus the crumb texture will be harder and dryer (Guy, 1983 in Seyhun *et al.*, 2005).

Table 2. The Contains of Sweet Potato Flour (*Ipomoea batatas* L. cv. Kentang).

Parameter	Result
Water content (%)	8,14 ± 0,11
Total sugar (%)	74,8 ± 4,17
β-carotene (mg / 100 g)	4,74 ± 0,40
Antioxidant activity (%)	13,58 ± 0,93

Explanation :
The number displayed is the means of 5 tests ± standard deviation.

Table 3. Raise Volume and Baking Loss of Chiffon Cackes.

Percentage	Raise Volume (%)	Baking Loss (%)
0%	$112,35 \pm 1,18^{a}$	$24,53 \pm 1,36^{a}$
15%	$81,78 \pm 0,87^{b}$	$23,69 \pm 1,95^{ab}$
30%	$71,87 \pm 2,93^{c}$	$22,93 \pm 1,74^{b}$
45%	$42,93 \pm 2,09^{d}$	$22,76 \pm 1,42^{b}$
60%	$25,96 \pm 1,95^{e}$	$17,69 \pm 1,53^{c}$

Explanation :
The number displayed is the means of 10 tests (in 2 batch) ± standard deviation.
The same alphabet superscript mean there's no difference between samples (in different precentages) using Oneway ANOVA (Duncan).

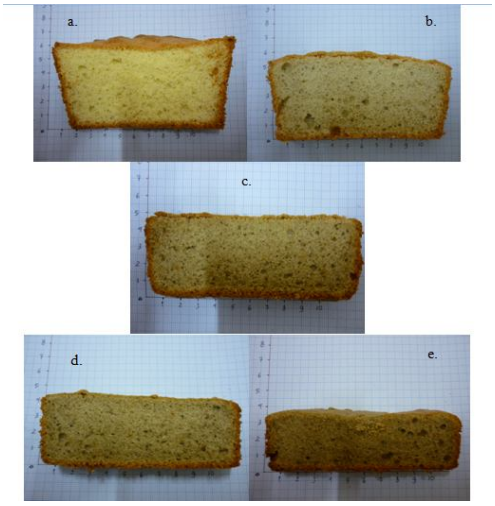


Figure 1. Chiffon Cakes with Various Sugar Substitutes (a.) 0%, (b.) 15%, (c.) 30%, (d.) 45%, and (e.) 60%.

Table 4. Texture Meassurements of Chiffon Cake with Various Sugar Substitutes From Day 0 until Day 2.

Percentage	Day	Parameter			
		Hardness	Springiness	Cohesiveness	Adhesiveness
0%	0	$55,1188 \pm 2,01^{a,1}$	$2,5234 \pm 0,19^{a,1}$	$0,2846 \pm 0,08^{a,1}$	$-0,0337 \pm 0,006^{a,1}$
	1	$56,6352 \pm 4,54^{a,1}$	$2,5957 \pm 0,41^{a,1}$	$0,3162 \pm 0,08^{a,1}$	$-0,0339 \pm 0,009^{a,1}$
	2	$67,1495 \pm 4,26^{a,2}$	$2,6946 \pm 0,46^{a,1}$	$0,3461 \pm 0,11^{a,1}$	$-0,0277 \pm 0,004^{a,1}$
15%	0	$59,6688 \pm 4,75^{b,1}$	$2,5428 \pm 0,39^{a,1}$	$0,3160 \pm 0,05^{ab,1}$	$-0,0306 \pm 0,007^{ab,1}$
	1	$62,1364 \pm 4,58^{b,1}$	$2,6230 \pm 0,37^{a,1}$	$0,3234 \pm 0,09^{a,1}$	$-0,0291 \pm 0,008^{a,1}$
	2	$74,6484 \pm 6,52^{b,2}$	$2,8237 \pm 0,61^{ab,1}$	$0,3537 \pm 0,08^{a,1}$	$-0,0158 \pm 0,006^{b,2}$
30%	0	$68,3367 \pm 4,55^{c,1}$	$2,9535 \pm 0,25^{b,1}$	$0,3475 \pm 0,07^{bc,1}$	$-0,0255 \pm 0,006^{b,1}$
	1	$70,6747 \pm 4,95^{c,1}$	$2,8732 \pm 0,41^{a,1}$	$0,3442 \pm 0,17^{a,1}$	$-0,0207 \pm 0,007^{b,12}$
	2	$85,7838 \pm 3,49^{c,2}$	$3,0323 \pm 0,55^{abc,1}$	$0,3767 \pm 0,11^{a,1}$	$-0,0158 \pm 0,009^{bc,2}$

45%	0	107,9749 ± 4,65^{d,1}	3,1363 ± 0,40^{bc,1}	0,3675 ± 0,02^{bc,1}	-0,0186 ± 0,007^{c,1}
	1	120,4565 ± 3,59^{d,2}	3,2418 ± 0,29^{b,1}	0,3741 ± 0,04^{a,1}	-0,0162 ± 0,005^{bc,12}
	2	128,1490 ± 4,25^{d,3}	3,1562 ± 0,37^{bc,1}	0,3655 ± 0,05^{a,1}	-0,0102 ± 0,009^{c,2}
60%	0	144,8076 ± 2,74^{e,1}	3,2571 ± 0,29^{c,1}	0,3779 ± 0,05^{c,1}	-0,0139 ± 0,003^{c,1}
	1	154,9488 ± 6,26^{e,2}	3,4358 ± 0,27^{b,1}	0,3892 ± 0,07^{a,1}	-0,0120 ± 0,007^{c,1}
	2	207,4127 ± 4,03^{e,3}	3,3913 ± 0,22^{c,1}	0,3855 ± 0,04^{a,1}	-0,0099 ± 0,004^{c,1}

Explanation :
The number displayed is the means of 10 tests (in 2 batch) ± standard deviation.
The same alphabet superscript mean there's no difference between samples (in different precentages) using Oneway ANOVA (Duncan).
The same number superscript mean there's no difference between days of storage (in a precentage) using Oneway ANOVA (Duncan).

The more sugar substitution in chiffon cake, L* (lightness) and b* (yellowness/blueness) decreased, while a* (redness/greenness) increased (Table 5. and Figure 1.). Thus, the more sugar substitution in chiffon cake, the color difference between the sample and chiffon cake control (ΔE) increased. The color change is caused by the sweet potato flour. Sweet potato flour contains β-carotene that can contribute in product color (Singh *et al.*, 2008). During the storage, L* (lightness) decreased, while a* (redness/greenness) and b* (yellowness/blueness) stable. This chage is because β-carotene is sensitive with oxygen (O_2) and light during the storage (Erawati, 2006).

Table 5. The Color Meassurements of Chiffon Cake with Various Sugar Substitutes From Day 0 until Day 2.

Precentage	**Day**	**Parameter**			
		L*	**a***	**b***	**ΔE**
0%	0	76,27 ± 1,28^{a,1}	-3,53 ± 0,60^{a,1}	19,91 ± 1,85^{a,1}	
	1	75,34 ± 1,27^{a,12}	-3,63 ± 0,21^{a,1}	20,25 ± 2,02^{a,1}	
	2	75,10 ± 0,65^{a,2}	-3,21 ± 0,58^{a,1}	20,03 ± 1,87^{a,1}	
15%	0	64,45 ± 0,67^{b,1}	-0,46 ± 0,29^{b,1}	14,94 ± 0,40^{b,1}	13,34 ± 1,10^{a,1}
	1	61,87 ± 1,51^{b,2}	-0,36 ± 0,16^{b,1}	14,82 ± 1,20^{b,1}	15,11 ± 1,43^{a,2}
	2	58,64 ± 0,51^{b,3}	-0,49 ± 0,30^{b,1}	14,17 ± 1,05^{b,1}	17,79 ± 0,73^{a,3}
30%	0	57,01 ± 0,43^{c,1}	1,26 ± 0,19^{c,1}	14,29 ± 0,30^{b,1}	20,71 ± 1,35^{b,1}
	1	56,24 ± 1,14^{c,1}	1,28 ± 0,12^{c,1}	13,67 ± 0,36^{b,2}	20,87 ± 1,82^{b,1}
	2	53,18 ± 1,64^{c,2}	1,28 ± 0,08^{c,1}	13,39 ± 0,40^{b,2}	23,44 ± 1,69^{b,2}
45%	0	50,11 ± 0,79^{d,1}	1,93 ± 0,19^{d,1}	12,31 ± 0,44$^{c,1\,2}$	27,86 ± 1,30^{c,1}
	1	49,19 ± 0,34^{d,2}	2,32 ± 0,15^{d,2}	12,45 ± 0,72^{c,1}	28,00 ± 1,50^{c,1}
	2	46,53 ± 0,92^{d,3}	2,52 ± 0,20^{d,3}	11,84 ± 0,39^{c,2}	30,35 ± 1,16^{c,2}
60%	0	47,17 ± 1,02^{e,1}	2,34 ± 0,13^{e,1}	11,20 ± 0,73^{d,1}	31,04 ± 1,50^{d,1}
	1	45,36 ± 0,66^{e,2}	2,14 ± 0,13^{e,2}	11,10 ± 1,46^{d,1}	31,99 ± 2,26^{d,1}
	2	42,31 ± 1,68^{e,3}	2,29 ± 0,19^{d,1}	10,91 ± 0,76^{c,1}	34,57 ± 1,95^{d,2}

Keterangan :
Parameter : L* = lightness
a* = redness/greenness
b* = yellowness/blueness
ΔE = the color differences with chiffon cake control.
The number displayed is the means of 10 tests (in 2 batch) ± standard deviation.
The same alphabet superscript mean there's no difference between samples (in different precentages) using Oneway ANOVA (Duncan).

The same number superscript mean there's no difference between days of storage (in a precentage) using Oneway ANOVA (Duncan).

Sensory Evaluations did by 40 panelists include rating and ranking hedonics (Table 6.). From rating sensory evaluation, chiffon cake with 15% sugar susbtitute has similiar texture and aroma acceptance, compare with chiffon cake control (0%). From ranking sensory evaluation, chiffon cake with 15% sugar susbtitute also has similiar aroma, compare with chiffon cake control (0%).

From sensory evaluation and physical characteristics analyses, chiffon cake with 15% sugar substitute has the most similiarity aspecs caompare with chiffon cake control (0%). Therefore, they need further analyzed.

Table 6. The Sensory Evaluation of Chiffon Cakes.

Precentage	Rating					Ranking				
	Color	Aroma	Texture	Taste	Overall	Color	Aroma	Texture	Taste	Overall
0%	36^{a}	26^{a}	29^{a}	34^{a}	34^{a}	30^{a}	19^{a}	26^{a}	27^{a}	24^{a}
15%	25^{b}	28^{ab}	28^{ab}	29^{b}	30^{b}	5^{b}	13^{a}	11^{b}	10^{b}	12^{b}
30%	16^{bd}	20^{b}	15^{bc}	14^{bc}	15^{bc}	4^{b}	2^{b}	3^{c}	3^{b}	3^{c}
45%	4^{c}	8^{c}	8^{c}	9^{cd}	8^{c}	1^{c}	2^{b}	-	-	-
60%	8^{cd}	4^{c}	3^{d}	5^{d}	4^{d}	-	4^{b}	-	-	1^{c}

Explanation :
All scoring did in range 1 (for the most worst sample) until 5 (for the best sample).
The rating sensory evaluation was analyzed use median non-parametric test (overall median was 3).
The number displayed (for rating sensory evaluation) was appearance frequencies of the scoring above the median (3).
The same alphabet superscript in rating sensory evaluation mean there's no difference between samples (in different precentages). The ranking sensory evaluation was analyzed use Chi-Square non-parametric test.
The number displayed (for ranking sensory evaluation) was 5 score appearance frequencies (from 40 times appearance possibilities).
The same alphabet superscript in ranking sensory evaluation mean there's no difference between samples (in different precentages).

The application of sweet potato flour as sugar substitute in chiffon cake (up to 15%) could produce the chiffon cake that has no difference in total sugar contain (compare with chiffon cake control) besides could give significantly difference of added value (β-carotene and antioxidant activity) in chiffon cake (Table 7.). The use of sweet potato flour could significantly increased water content in chiffon cake and it could increased during the storage (Table 8.). Molds could grow in food that contains starch, pectin, protein, and lipid. Besides, water contain also contribute in microbial growth (Fardiaz, 1992). Therefore, TPC (Total Plate Count) of molds and yeast were important to be analyzed (Table 8. and Graph 1.). The application of sweet potato flour for 15% in chiffon cake cause the more microbial growth in products (compare with chiffon cake control). It because the nutrition value was more complex than chiffon cake control. Maximum limit of molds and yeasts in special bakery products

(sweet, salty, and umami) is 2.10^2 Cfu/g (2,301 log CFU / g) (SNI 7388:2009 about microbial limit in food products). Thus, in day 2 and day 3, both chiffon cakes was no longer edible.

Table 7. The Analyze of Chiffon Cake Control (0%) and Chiffon Cake with 15% sugar Substitute.

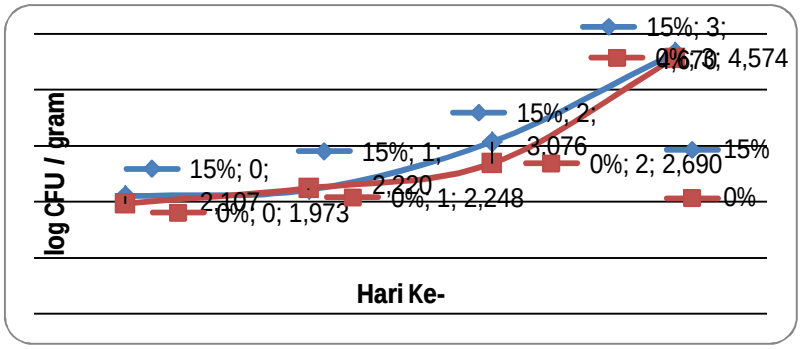
Precentage	Total Sugar (%)	β-Carotene (mg / 100 g)	Antioxidant Activity (%)
0%	35,64 ± 3,16[a]	6,61 ± 0,63[a]	15,76 ± 0,53[a]
15%	34,67 ± 2,43[a]	10,51 ± 0,78[b]	25,65 ± 0,18[b]

Explanation :
The number displayed is the means of 10 tests (in 2 batch) ± standard deviation.
The same alphabet superscript mean there's no difference between two samples using Oneway ANOVA (Duncan).

Table 8. Water Content and Total Plate Count of Molds and Yeast in Chiffon Cake control (0%) and Chiffon cake with 15% Sugar Substitute during The Storage.

Precentage	Parameter	Day			
		0	1	2	3
0%	Water content (%)	33,27 ± 0,23[a,1]	34,46 ± 0,37[a,2]	35,80 ± 0,23[a,3]	37,84 ± 0,57[a,4]
	Molds and Yeasts (Cfu / g)	94	177	490	37500
15%	Water content (%)	37,40 ± 0,45[b,1]	38,18 ± 0,56[b,2]	39,08 ± 0,18[b,3]	40,00 ± 0,16[b,4]
	Molds and Yeasts (Cfu / g)	128	166	1190	46750

Explanation :
Molds and yeasts limits based on SNI 7388:2009: 2 x 10^2 Cfu / g.
The number displayed (water content) is the means of 10 tests (in 2 batch) ± standard deviation.
The same alphabet superscript mean there's no difference between two samples using Oneway ANOVA (Duncan).
The same number superscript mean there's no difference between days of storage (in a precentage) using Oneway ANOVA (Duncan).



Graph 1. The Microbial Growth of Chiffon Cake Control (0%) and Chiffon Cake with 15% sugar Substitute.

CONCLUSIONS

- The Sweet Potato Flour (*Ipomoea batatas* L. cv. Kentang) could be applicated in chiffon cake up to 15% sugar (sucrose) substitute.
- The Sweet Potato Flour (*Ipomoea batatas* L. cv. Kentang) sugar (sucrose) substitute (up to 15%) could produce chiffon cake with good quality (physical, chemical, and microbiological) and good sensory evaluation (acceptance and likeness) that no difference with chiffon cake control (0%).
- The Sweet Potato Flour (*Ipomoea batatas* L. cv. Kentang) could give added value by increase β-carotene and antioxidant activity in chiffon cake.

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EFFECTIVENESS OF FIELD-TREATMENT WITH CLING WRAP AND PARAFFIN IN PROLONGING THE RIPENING PERIOD OF "KEPOK PIPIT" BANANA (MUSA PARADISIACA VAR. KEPOK PIPIT)

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ABSTRACT

Banana (Musa paradisiaca Lin.) var Kepok Pipit is one commodity which is commonly consumed by people in Indonesia, and is generally cultivated on a small scale farming. The marketing is normally run in a long market chains that takes a long time to get to the market. Some time, the banana is ripe when it reached retailer, which mean the time to display in the fruit shop is limited. This study aimed to extend the delay fruit ripening with simple and inexpensive techniques, to facilitate small farmers to do on their own farms. The study was conducted using two treatments; cling wrap and paraffin, applied to the newly harvested bananas. Parameters of the study included changes in weight, changes in color and texture of the fruit during the process of ripening. As the control some other banana were left untreated. The results showed that treatment of cling wrap gave the lowest decline fruit weight (10.129%) followed with paraffin treatment (19.843%), and the control (24.066%). On the parameter of fruit color, that was tested using cromameter by measuring L *, a *, and b *, there was also found that treatment of cling wrap showed the slowest colour change, followed by paraffin, while the colour of control fruit showed the most rapid color changes. On the parameters of hardness, which was tested by Texture Analyzer and was conducted at the end of the study, also showed that banana wrapped in cling wrap, was the hardest fruit (265.9638), followed by paraffin (260.04) and the control was 243.6. The results of this study indicated that the cling wrap could be used by farmers and distributors to delay post-harvest fruit ripening, at a low cost.

Keywords: *banana, post harvet, ripening, cling wrap, parafin, fruit weigh, fruit colour, sfruit texture*

1. INTRODUCTION

Banana var Kepok Pipit is one commodity which is commonly consumed by people in Indonesia and is generally cultivated on small scale farming with limited land areas. Bananas usually used in several food sectors, processed products, and can also as bird's food. Although bananas have many usefulness in daily consumption, but this kind of bananas still produced in small

scales with small targets in traditional market.

There are many technologies in post harvesting of banana such as waxing, cooling, and many others, but they are expensive and need significant investment. So, the operational cost is too expensive to do by farmers in small scales as bananas farmers. On the other hand, the use of banana var Kepok Pipit in food sectors, both for human consumption and birds food, have relatively low in selling price. Thus, the processes of handling after harvesting as cooling, waxing, etc are too expensive and don't worth with their business. Therefore, it's needed a research to find simple methods but effective for increasing shelf life bananas and affordable (feeding birds, food process usually called setup, etc.). The distribution chain from farmers to the consumer is long enough. Usually, the bananas are already ripen when they are sent to the seller, that can caused the shelf life become shorter, so the value become low and decrease the consumer interest. As a result, the seller will get a lot of losses. In addition, if the bananas which sent to the seller already ripe enough, it can cause spoilage during storage.

This study aimed to delay the fruit ripening with simple techniques to facilitate the small farmers. The study was conducted by using two treatments, cling wrap and paraffin applied to the freshly harvested bananas. In this study we used several parameter, they are weight, color changing, and texture the fruit during ripening. Weight of bananas was tested using analytical balance, and the texture (hardness) was tested by Texture Analyzer. While the fruit color was tested using chromameter by measuring *L**, *a**, and *b**, when *L** indicates lightening, *a** indicates about red colors (+*a**) and green colors (-*a**), and *b** indicates yellow (+*b**) and blue colors (-*b**).

2. MATERIAL AND METHOD

2.1. Material

The materials that are needed in this experiments are raw banana var kepok pipit, paraffin blocks, cling wrap, label, pan, *chromameter*, *Texture Analyzer* and knife.

2.2. Methods

This experiment took samples as much as two groups of bananas. Then each group of bananas divided into two top bananas and two down bananas. Then the bananas were cut, so it got injured. Then they're given three treatments. The parameters that used in this experiment are texture, color, and weight shrinkage. Every treatment took for 8 days with five times observations every two days. But for texture, it was tested only on 8th day. The first treatment, the bananas just saved at room temperature with 26° C

without any treatment. Then, the second treatment, bananas were coated of paraffin. Before cut the bananas, the paraffin must be melted perfectly by heating. After that, the injured bananas dipped into it. Next, the third treatment is wrapped with cling wrap. The injured bananas were wrapped with cling wrap so there is no compound that can enter and caused spoilage to the bananas.

The parameters that used in this experiment are texture, color, and weight shrinkage. First, the color, is carried out by means of chromameter to measure *L**, *a** *b**; which *L** indicates lightness, *a** shows red color (+*a**) and green (-*a**), also *b** that shows yellow (+*b**) and blue colors (-*b**) as for the texture observed after the last day by using a Texture Analyzer.

3. RESULTS AND DISCUSSION

3.1 Texture

The texture condition of banana var Kepok Pipit on the 8th day can be seen in table 1.

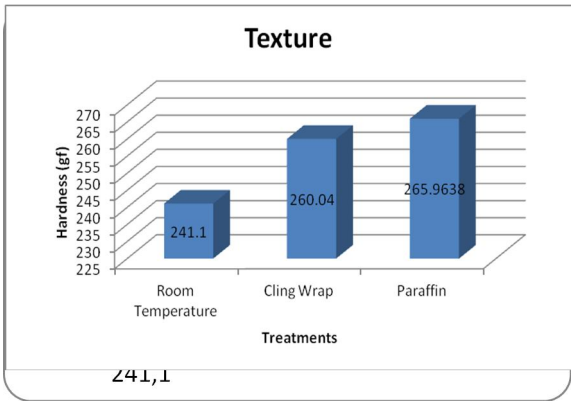
Table 1. The texture of bananas on the 8th day

The hardness of bananas on the 8th day (gf)	
Room temperature	241,1 [a]
Cling Wrap	260,04 [b]
Paraffin	265,9638 [b]

Information : Figures followed by the same letters indicate as not significantly different at 95%

In table 1, the texture of bananas on the 8th day was measured by hardness. At the table, the bananas at room temperature results 241,1 gf, while cling wrap results 260,04 gf, and paraffin results 265,9638 gf. The texture on room temperature has the lowest hardness, and the superscript letter indicates it is significantly different at 95%. Besides, the cling wrapped bananas results 260,04, while bananas that coated with paraffin results 265,9638 gf. The bananas that are treated by cling wrap and paraffin have the same superscript letters. Therefore, it is not significantly different at 95%.

The results of texture also can be served as a graph.



Graph 1. The hardness texture of bananas at 8th day

The hardness of bananas that was saved in room temperature is 241,1 gf ; cling wrapped banana results 260,04 gf, and paraffin results 265,9638 gf. As the result, giving paraffin is the best treatment to keep the texture of bananas.

Thompson, (1996) reported that the softening of banana fruit during ripening treatment is associated with the conversion of starch to sugar, the breakdown of pectin substances and the movement of water from the rind of the banana to pulp during ripening. According to the data, the treatment to coat bananas with paraffin is the best effective treatment to keep the hardness texture of bananas. The paraffin is included the coating compound. The coating barrier probably induced anaerobic respiration and the synthesis of ethanol and acetaldehyde, and entrapped volatiles, including ethanol and acetaldehyde. (Baldwin et al.,1992). Moreover, the paraffin can retard the rate of moisture loss, and maintains plumpness and turgor, and may modify the internal atmosphere of the commodity. The paraffin also impact to the appearance of bananas. It can gloss the skin and gives the produce a more shiny appearance than the un-treatment bananas. (Sumardi, 2005).

3.2. Weight Shrinkage

Beside the texture, the second parameter is weight shrinkage which can be seen in table 2.

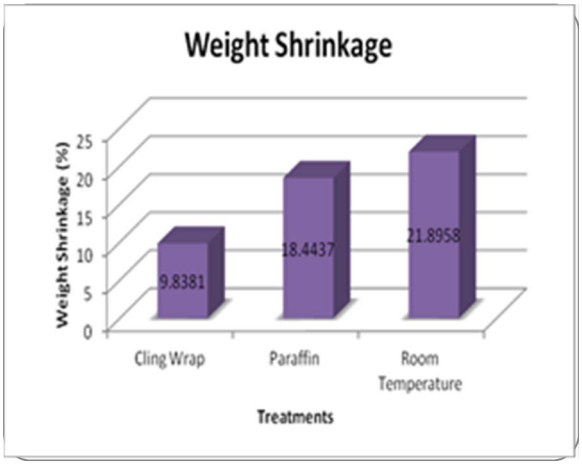
Table 2. The weight shrinkage of bananas can be seen on table 2.

	Weight Shrinkage (%)
Cling Wrap	9,8381 [a]
Paraffin	18,4437 [b]
Room Temperature	21,8958 [c]

Notes: Figures followed by the same letters indicate as not significantly different at 95%

In this experiment, the weight of bananas was tested with Texture Analyzer that was measured by hardness. Based on the table, the bananas that saved at room temperature results 9,8381% in weight shrinkage. And it is the highest percentage of weight shrinkage. Then, the bananas that coated by paraffin result 18,4437% in weight shrinkage, and the cling wrapped bananas results 9,8381% of weight shrinkage. Then, the different superscript letters shows that the weight shrinkage of every treatment significantly different at 95%. And the lowest percentage of weight shrinkage is banana that wrapped with cling wrap, while the highest percentage of weight shrinkage is bananas that saved on a room temperature.

The data of weight shrinkage also can be presented in the graph 2.



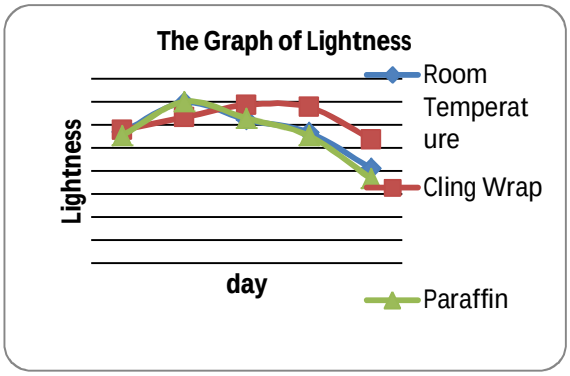
Graph 2. The weigh shrinkage of bananas

On the graph 2, the bananas that treated on room temperature has the highest percentage of weight shrinkage as much as 21,8958%. Then followed by the paraffin treatment that result 18,4437% of weight shrinkage during 8 days. And the bananas that saved at room temperature have the lowest percentage of weight shrinkage as much as 9,8381%.

Banana is one of many fruits that undergo ripening. Ripening is a physiological maturation catalyzed by the plant hormone ethylene (C_2H_4). Ethylene starts a cascade of reactions leading to a respiratory climacteric (basically a brief but significant spike in respiration). Carbohydrates are used as substrate, hence the decrease in weight. Thus there is a direct correlation between weight loss and ripening. The ripening process also releases other chemicals into the air. It is indicated by the smell of the volatile compounds. All of the evaporations result in weight loss, which is a consequence of the ripening process. Weight loss of a ripening banana is correlated with its ripening, not the cause. The gas is released by the chemical reactions involved in the ripening process. This results in a slight weight loss. However, weight loss is also a cause of the ripening process. During the climacteric, ethylene is produced in situ as one product of respiration. This induces the production of more ethylene, which further ratchets up the process. More importantly, the banana skin and the inside of the banana become softer and more permeable to water loss, so it can cause the weight loss of bananas during ripening process.

3.3. The Color of Banana

The color changing during ripening process was tested with chromameter to measure *L**, *a**, and *b** that can be presented in graph 3.

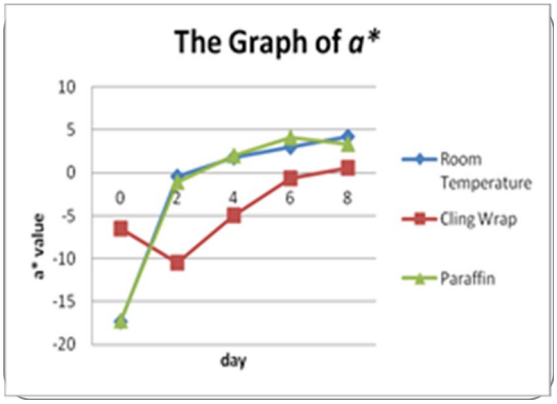


Graph 3. The Graph of lightness in ripening process

The chart shows the different rate of lightness during ripening process in bananas. The blue line shows the rate of bananas in room temperature, the red one shows the wrapped bananas, and the green line shows the coated bananas. It can be seen the green and the blue line indicate the same curves, that increase on the first than decrease at the last. But there is a little difference with red one. The red line is more stable than the others, or it can be said that wrapped bananas have a most stable result in color changing. So, using cling

wrap is the best treatment to keep the lightness of bananas.

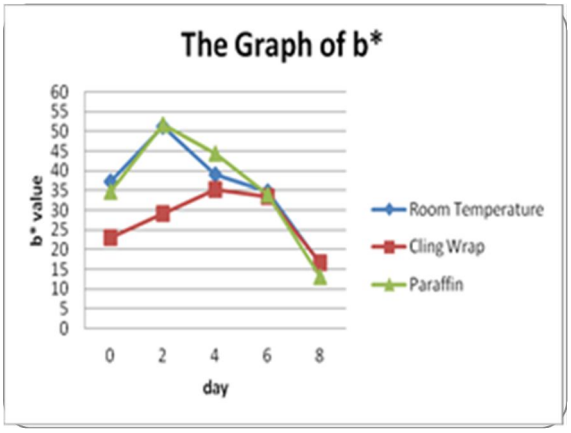
Then, the graph 4 shows the value of *a** in chromameter test.



Graph. 4. The comparison of *a** between room temperature, cling wrap, and paraffin for eight days.

On the chart, there are negative value of *a**. At the chromameter test, *a** indicates red color when *a** is positive, and indicates green color when -*a** is negative. On the chart, the blue and green lines have the same pattern, where the value of *a** started with negative, than increasing significantly on the second day. But it's different with red line. It is decrease on the second day, than increase slowly until the last day. The cling wrap is the most stable to keep the color of bananas green. It is showed by the value of *a** that relative low that indicates still contain more green colors.

And the last color's parameter is *b** that can be seen in graph 5.



Graph 5. The comparison of *b** between room temperature, cling wrap, and paraffin for eight days.

From the chats, it can be seen that the change of one *b**. The green and yellow lines also have a same pattern. They are increase at the first, than decrease till 8th. But the red one is more stable than the others. The value of the *b** that shows yellow when *b** is positive, and blue colors -*b**. Based on the chart, there is no negative value of *b** that indicates there is no blue color, but the three of lines are decrease at the last that shows the yellow color is decrease.

From the 3rd result graph above, the measurement of the color change is done by using the tool chromameter results obtained, so *L**, *a**, *B**. Where an increase on *a** banana fruit occurs before the experience level of maturity. According to the research that there is a loss of green color is due to damage of the pigment chlorophyll that occurs in the skin tissue of bananas. The slope of that part of the graph

showed the rate of the color changing provides useful information about the number of days during which the color turns from green to yellow (Muskovics et al., 2006). These changes during ripening period (loss of greenness and increase in yellowness) may occur as a result of the breakdown of the chlorophyll in the peel tissue. Where the pulp color already changes from whitish to yellowish creamy with fruit ripening.

4. CONCLUSION

From various studies that have done, wrapped bananas with cling wrap is the most effective methods in delaying the ripeness. It is showed by the weight loss of bananas and color changing of bananas is relative low. The cling wrap is the best effectiveness to keep the color of bananas during ripening process by preventing direct contact with the air so it can be delay maturity and may be lengthening the shelf life of banana. While, giving paraffin to bananas is the most effective method to keep the texture of bananas. In the other hand, the un-treated bananas that were only saved at room temperature have a fastest respiration rate that can cause the spoilage. May this experiment can be used by the farmers to extend the shelf life of bananas after harvesting.

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STUNNING APPLICATION IN SLAUGHTERING MANAGEMENT OF PIG IN SEMARANG

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ABSTRACT

Semarang is one of the Chinese migration centers in Indonesia. Here we can find whole Chinese migration waves. They brought their culture and food, while some have been acculturated with local community, particularly in respect to Moslem dominants community, some other are still consistent with the original cuisine and the most famous one is the use of pork. Semarang itself with a population of 1.5 million people, each day on average takes 25 pigs. In order to produce healthy pork, slaughtering house is the key factor prior to pork supply. The healthy pig meat could be obtained when the slaughtering process of the pig is conducted in the right way. The pigs those were going to be slaughtered must be relaxed and were not in the stress condition otherwise the meat color will become pale or dark. In order to avoid and reduce the stress before slaughtering, the common operated technique was stunning. In Indonesia, howevr, most stunning technique is not accepted by stronghold Indonesian Moslem Ulemas (MUI). The only technique tolerable technique is the use carbon dioxide, whereas the other techniquea such as drum and electricity are prohibited. Without MUI's permition the produced meat will be labeled as "haram". The pork itself is considered as a "haram" meat therefore the stunning might be applied in the pig slaughtering house. This study reported and discussed the opreration of pig slaughtering house in Semarang and observed the quality of the produced meat.

Keywords: *stunning, pig, meat quality, haram, Semarang*

1. INTRODUCTION

Slaughtering management is the most important factor in producing high quality meat. In order to produce the good quality meat, the slaughtering process should be done in a right way too. The main objective in slaughtering process and the most important thing is we have to avoid the stress condition and as much as possible we have to make the pigs are relaxed. Because, if the pigs are stressed, the meat color will be very pale or even very dark so it will reduce the selling cost of the pork itself.

In Indonesia, especially in Semarang, most stunning technique is rejected by stronghold Indonesian Moslem people. The only technique that tolerable in slaughtering pig is by using carbon dioxide applications. The

CO_2 application is a great alternative when the rest technique such as drunk and electricity are prohibited. However, pork in Indonesia itself is considered as a "haram" meat therefore the stunning technique that actually considered as a prohibited technique. Without MUI's permition the produced meat will be labeled as "haram". The pork itself is considered as a "haram" meat therefore the stunning might be applied in the pig slaughtering house. This study reported and discussed the operation of pig slaughtering house in Semarang and observed the quality of the produced meat.

2. METHODOLOGY

This research's methods have 4 steps. First, we were going to have some short interview with one of caretaker of animal slaughterhouse in penggaron, Semarang and we come to slaughtering house at 2.00 a.m. Second, we were going to observe the slaughtering process in animal slaughterhouse when the pig getting slaughter. The team observe the slaughtering process from the start, and those process are :

a. Resting Time
b. Stunning Process
c. Scraping Process
d. Head Removing
e. Organ Removal and Hanging Process
f. Cleaning Process
g. Ready to cut piece by piece

The third one is with testing the quality of pork using the pork which purchased in the market where gets pork from the slaughterhouses penggaron. Parameters that Observed is pork's color and the water content on pork. Last, by doing comparison with references obtained from the journal and the internet as the study of halal meat from MUI, literature hunting, etc.

RESULTS AND DISCUSSION

A meat's quality depends on the physical and chemical changes that occurred on the flesh before, while, and after slaughtering process. Conversion of glycogen to lactic acid that occurs after slaughtering process become the most important thing in meat's quality due to decreasing meat's pH caused by lactic acid. Decreased pH will affects the color of the meat so that it will become one of the factor that affecting meat's value (Prieto, 2007).

There are basically two ways of slaughtering techniques, (1) direct cutting and (2) indirect cutting. Direct cutting is done after the cattle is healthy stated, and could be slaughtered at the neck by cutting the cattle's carotid arteries, veins jugular and esophagus. Different from direct method, the indirect one is using stunning technique to make the cattle fully fainted, then the slaughtering process can be started. The objective by doing stunning is to simplify the slaughtering process, to reduce

and avoid the risk of abused and to increase the quality of produced skin and carcass. By doing stunning, we can reduce the possibility of stress so the defects of the skin or the bruises of the carcass could be minimized.

In slaughtering process, there are some steps that have to be done and each step needs a good technique to produce a good meat. Usually, some step which is done wrongly, can make the pig become stress and un-relaxed so the meat will be unaccepted by a consumer. Usually, the steps which is done in one slaughtering house is same with the other one, no exception in Semarang Slaughtering House. Those steps are:

1. Resting Time of The Cattle

The pigs derived from Kopeng and Bandungan, Semarang was given a resting time to make them relaxed and to decrease a chance of being stress. In this step, the pigs was gathered in one big shed and given feeds.

Figure 1. Pig's Condition Before Slaughtering

2. Stunning Process

The "non-ruminansia" cattle such as pig is slaughtered by using indirect technique. The pigs are stunned before the slaughtered. In Semarang, pig from the cattle was herded to enter the stunning place. Usually, the herding process is done "softly" so the pig will not be stressed. But, in Semarang Slaughtering House, it is done roughly by hitting the pig using a broom stick so the pig was feeling a pain and becoming stress before slaughtered. The pig hit by the broomstick usually moaning with a big voice so its friends will be scared and stress too. After entering the stunning place, the pig is stunned by electric flow that streamed behind the pig's ear with a tool like pliers clamp. The pliers clamp is drained with low voltage (±70 volts) electric flow or more. The electric flow will flow through the brain so the pig will be fainted. Before the stunning, the pig can be doused with clean water to facilitate the spread of electricity flow. After stunned, the pig is immediately slaughtered by piercing the neck towards large blood vessels and the heart near the end of *anterior sternum* so the blood can be broke out as much as possible.

Figure 2. Stunning Place

Hunt and Zenger (1998) don't agree with that technique by saying the color of a fresh fork will vary in some countries. There are so many intrinsic and extrinsic factors that affect the color of the pork, such as genetics factor, dietary intake, slaughtering process, pH, storage and etc. The muscle type which is taken also can differentiate their color. Glyolytic muscle will have white color whether the oxidative one is red. Both of the muscles are different from the dominance of energy metabolism (Lindahl, 2005). Myoglobin is one of the component that give a color to the meat. Different forms of myoglobin itself will give different color too, such as purple (deoxymyoglobin), red (oxymyoglobin) and brown (metmyoglobin)

Figure 3. After Stunning

3. Scraping Process

No skinning process is done because the pig's fat is relatively many and expensive. Because it is not skinned, then there will be scraping process. Scraping process is done after a dead pig is put into warm water between 60-70ºC for 5-6 minutes. Dipping a dead pig into the warm water is to make the removal of the skin is easier.

Figure 4. Dipping Place

4. Head Removing

After scraped, the pig is clean and ready to be slaughtered. The first step of slaughtered is head removing. The head is cut by using a very sharpchopper knife. The knife has to be very sharp so the cutting process could be done smoothly.

Figure 5. Head Removing Process

5. Cleaning Process

The carcass then washed and sprayed with water to clean out the pollutant and the bacteria. It is also to sterilize the meat. Complete the cleaning process by praying or dashing clean water on the carcass. Beginning at the hind legs, scrape and shave all remaining hair and scurf from the entire carcass with the skinning knife. Be sure the carcass is clean before removing the internal organs.

6. Organ Removal and Hanging Process

After head removing, the pig's organs such as heart, kidney, liver, and intestine are removed so it leaving the meat and the bones only. Then, the carcass is hanged on a hook to emit the blood perfectly.

Figure 6. Hanging Process

7. Ready to cut piece by piece

The carcass then is ready to be cut piece by piece and to be distributed to the market. The characteristics of fresh pork vary from grayish pink to red (Singhal *et al*., 1997). According to Buege (1998), there are 4 types of pork based on color, texture and the wetness of the pork, such as PSE (Pale, Soft, Exudative), DFD (Dark, Firm, Somewhat Dry), RFN (Red, Loud, Issued Exudate) and RSE (Red, Soft, Exudative). Then, RFN is the best pork's quality, while the PSE one is the worst. DFD and RSE itself are not too good (Singhal *et al*., 1997).

Table 2.4. Comparison of the type of meat freshness in terms of color, bright color quantitatively, ability to hold water in the meat (calculated by amount of fluid lost) and the final pH.

Quality	Color	L value	Droplets	pH
DFD	Dark	≤ 52	< 5,0	High at the end (> 6.0)
RFN	Red	52-58	< 5,0	Normal
PFN	Pale	≥ 58	< 5,0	
RSE	Red	52-58	≥ 5,0	
PSE	Pale	≥ 58	≥ 5,0	Fastly decrease

Source: Lindhal, 2005

Usually, the meat quality that derived from stunned pig has PSE quality. PSE is caused by severe, short-term stress just prior to slaughtering process, for example during off-loading, handling, holding in pens and stunning. The stress result in biochemical processes such as rapid breakdown of muscle glycogen and the meat becoming very pale with pronounced acidity (pH values of 5.4- 5.6 immediately after slaughter) and poor flavor. This type of meat is difficult to use or cannot be used at all by butchers or meat processors and is wasted in extreme cases.

Figure 7. Meat's condition (fresh)

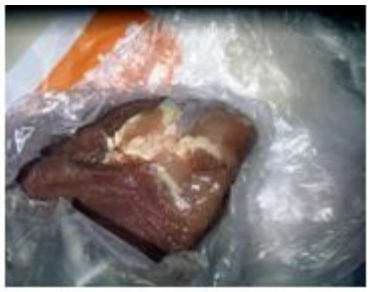

Figure 8. Meat's condition (after 12 hours)

The problem in Indonesia, including Semarang is stunning before slaughtering is restricted by stronghold Indonesian Moslem Ulemas (MUI). There was some standardization about slaughtering process which is determined by MUI:

1. Who may slaughter the cattle: those who are Muslims and *aqil baligh.*
2. Slaughtering method is legal if done by:
   a. Reading "*basmalah"* while slaughtering.
   b. Using a sharp cutting tool.
   c. Cut simultaneously to drop respiratory throat, esophagus and both veins.
   d. At the slaughtering time, the cattle are still alive.
3. Basically, stunning is legal as long as it is not hurting the cattle and after the process, the cattle is still alive.
4. Stunning mechanically, electrically, chemically or other ways which is deemed hurting the cattle is restricted.

3. CONCLUSIONS

The study attempt to reported and discussed the operation of pig slaughtering house in Semarang and observed the quality of the produced meat especially for its stunning application. In this regard, the results showed that the pigs meat produce from the slaughtering house got the PSE quality according to its stunning application and the process before causes the pig getting stress out and those stressed resulted from biochemical processes such as rapid breakdown of muscle glycogen and the meat becoming very pale with pronounced acidity and poor flavor. Since the pig itself is considered "haram", and stunning application is also forbiden in Indonesia, that means these application is still can be done for pigs slaughtering method in Indonesia especially in Semarang.

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THE EFFECTIVENESS OF SWEET POTATO AS SUGAR AND FLOUR REPLACER IN THE MAKING OF SWEET BREAD

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ABSTRACT

The presence of sweet potato (Ipomoea batatas) in Central Java is increasing, so development is needed. Sweet potato has several advantages, namely sugars with a low glycemic index. The weakness from yams is this food has a short shelf life, so one solution is to be made into flour before it is applied to the formulation of sweet bread. Sweet bread bakery become a trend in addition to very practical, it has a lot of variety of flavors, and favored by the people. Application of sweet potato flour in a sweet bread was conducted with sugar substitution on sweet bread with sweet potato flour as 0% as a control, 15%, 30%, 45%, and 60%. The purpose of this study was to determine the formulation that produces sweet bread with the most optimal substitution and favored by consumers. Tests were conducted in the form of physical tests and chemical tests on sweet potato flour and sweet bread, sensory tests on sweet bread. Based on the research that has been done, the greater the concentration of sweet potato flour cause a reduction in pore diameter but caused increase in the number of pores, and followed by decreased levels of development and increased hardness. Increasing yellowness occurs along with the increasing concentration of beta-carotene, is followed by increasing antioxidant activity. Based on the level of preference panel, the higher the sweet potato flour substitution the more out of favor. Substitution of sweet potato flour into sweet bread, the optimum is 30% substitution.

Keyword : *sweet potato, sweet bread, glycemic index, beta-carotene*

INTRODUCTION

Referring to the BPS, The production of sweet potato (Ipomoea batatas) in Central Java have increased since 2005. In 2010, the production of sweet potato in Central Java amounted to 137,723 tonnes of sweet potato with a harvest area 7,965 ha. The number of the growing yams in the market also increases the variation in its processing, as was made into a variety of traditional snacks, like pao, snack chips, buns, cakes, and many more (Suprapti, 2003). Based on the nutritional content, sweet potato (Ipomoea batatas) has a pretty good nutrient. It is contain vitamin B, vitamin C, carbohydrate, fat and a little protein (Suparman, 2007). The carbohydrate has a low glycemic index. This means it can be said that the sweet potato consumption suitable for people with diabetes and obesity (Kunia, 2009). Moehyi (1992) said that consuming food with low calorie is important because it can prevent the

rist of diabetes. Other chemical compound contained in the sweet potato is beta-carotene, which is good for maintaining eye health as well as the compound has antioxidant properties.

Bakery products is now also being increasingly recognized by the public, especially the sweet bread. According Moehyi (1992), sweet bread include in the menus staple food in Indonesia, so people can get calories as a source of energy sufficient, nutritious, and practical enough to be consumed as a booster hunger. Sweet potatoes have a weaknesses, that is does not last long in storage (Suparman, 2007). This mean that sweet potatoes need to be further processed soon after harvested to extend shelf life. One way is by cultivating sweet potatoes into starch content of water level is lower, so the shelf life of sweet potato takes longer. Application of sweet potato flour into sweet bread formulation aims to reduce the use of sugar.

MATERIALS AND METHODS

Making Sweet Potato Flour and Flour Testing

The first step is the selection of raw materials, cleaning sweet potatoes with water flow, and then peel the sweet potatoes skin. The next step is cut into thin then dried at 60°C for 4 hours in the dehumidifier. The dried sweet potatoes ready to be made into flour. Flouring done using blender and then sieved. Tests are performed include chemical sugars, beta carotene, and antioxidant levels.

Sweet Bread Making

The process of making sweet bread made by the straight dough method. The steps taken are all the ingredients mixed with dough mixer on low speed for ± 3 minutes, then after stirred at high speed for ± 7 minutes or until becomes smooth. The dough was rested for 15 minutes and covered with plastic / cloth and then disposed of by way of the gas is pressed. The dough was divided by the weight of 45 grams and rounded then arranged on a baking sheet. Mixture, allowed to expand in a confined space but moist (proofing, temperature of 40 ° C and RH 80-85%), for 45 minutes. Then most of the dough aside for testing the beta carotene and antioxidant activity. Others are baked in the oven at 180° C for ± 25 minutes, until golden brown color of the bread. The formulation can be seen in Table 1.

Table 1. Formulation of Sweet Bread

Item	Unit	Sweet potato flour substitution on Sugar and Flour				
		0% Control	15%	30%	45%	60%
Flour	Gram	500	484	468	452	440
Sweet bread flour	Gram	-	32	68	104	126
Sugar	Gram	124	108	88	68	48
Instant Yeast	Gram	12	12	12	12	12
Salt	Gram	8	8	8	8	8
Full cream milk	Gram	24	24	24	24	24
Margarine	Gram	80	80	80	80	80
Yolk	Gram	68	68	68	68	68
Improver	Gram	1.5	1.5	1.5	1.5	1.5
Water	Gram	± 240	± 240	± 240	± 240	± 240

Testing on Sweet Bread

Tests are performed in phsycochemical test, including sugars, beta-carotene, antioxidant levels, hardness, volume expansion, and color. Sensory testing conducted using rank test aims to determine the best treatment. Sensory evaluation conducted by 30 trained panelists drawn from student of Food Technology (Resurrección, 1998 and Meilgaard, 1999).

RESULTS AND DISCUSSION

Chemical Evaluation

In making sweet bread, made with flour sugar substitute sweet potato which has a total sugar content of 55.07 ± 1.58%.

Table 2. Composition of Beta-caroten, Antioksidant Activity, and Sugar in Sweet Bread

Treatment	Parameter		
	Beta-caroten mg/100 g sample	Antioksidant Activity (%)	Sugar (%)
0%	3,55±0,03[a]	5,88±0,09[a]	19,61±0,17[a]
15%	3,72±0,10[b]	6,78±0,13[b]	19,67±0,49[a]
30%	4,63±0,06[c]	7,41±0,13[c]	19,65±0,24[a]
45%	4,96±0,04[d]	8,07±0,09[d]	19,61±0,18[a]
60%	5,05±0,05[e]	8,27±0,09[e]	19,59±0,43[a]

Note:
a. All values are mean values ± standard deviation
b. Values with different superscript in each row indicate a significant difference between treatments at the 95% confidence level ($p < 0.05$) using Duncan test

Based on Table 2. below, we know that the increase in percentage because not a lot of sugar that can be processed by the yeast.

According Lutony (1993), it is known that the sugar content in the form of sweet potato starch, so not a lot of sugar that can be digested by the yeast. The final results of the testing of sweet bread, it is known that the sugar content in bread with a substitution of 15% to 45% sweet potato flour was higher than the control and the substitution of 60%, sugar content is lower compared to controls. This happens due to the substitution of 60% sweet potato flour, the amount of starch and simple sugars increasingly diminishing returns, so that the total sugar count becomes less and less. However, up to 60% substitution of the sugar content changes that occur are not significant.

According to the research, the content of beta-carotene in sweet bread dough was lower than that found in sweet potato flour. This is because the process that may lead to exposure to oxygen and light beta-carotene, beta-carotene becomes so damaged. According to De Man (1997), beta-carotene has properties not stable if there is no oxygen because of vitamin A has a molecular unsaturated so it is easily oxidized, especially when influenced by light. Once baked sweet bread dough, it turns beta-carotene still decreasing. According to the research Yusianti & Purwiyatno (2001) beta-carotene content of sweet bread is also affected by temperature and baking time, so that the heat from the oven makes beta-carotene were also damaged and the amount will be reduced. According to Potter & Hotchkiss (1996), sweet potato is one of the plants that contain beta-carotene. The increase in beta-carotene that occur will cause the dough antioxidant activity also increased.

The results obtained from testing the antioxidant activity of sweet bread dough with the substitution of 0% or controls had the lowest activity is worth 11.44 ± 0.87 than the other sweet bread with substitution. According to Pokorny et al. (2001) and Chang (2002), decreased antioxidant activity may be caused due to the reduced number of beta-carotene acts as an antioxidant. According to Dutta et al. (2005), carotenoid is one example of antioxidant compounds.

Color Evaluation

Table 3. Test the color on Sweet Bread

Treatment	Parameter	
	L*	b*
0%	73,55±0,52[a]	26,93±0,67[a]
15%	73,44±2,48[a]	27,94± 0,41[a]
30%	67,68±2,02[b]	27,94±1,02[a]
45%	67,55±2,23[b]	29,46±0,86[b]
60%	66,48±2,76[b]	30,11± 0,59[b]

Note:
a. + L means tested samples colored light (light), if it is negative (-L*) means dark samples. For b*, if it is positive (+ b*), the color of the sample tends toward yellow (yellowish), whereas if it is negative (-b*), the color of the sample tends toward blue (Bluish).
b. All values are mean values ± standard deviation

c. Values with different superscript in each row indicate a significant difference between treatments at the 95% confidence level (p <0.05) using Duncan test.

Decline in the value of L* or brightness can also be due to enzymatic reactions can also cause a decrease in the degree of white flour in the final sweet potato flour (Ambarsari, 2009). Colors are captured by the tool kromameter is yellow and green, but the yellow color is more dominant compared to the color green. This is because the beta-carotene content of 44.89 mg/100 g of sweet potato flour. According to Hendry and Houghton (1996) and Deman (1997) beta-carotene is one of the natural dyes with basic color yellow to reddish color, so with substitute of sweet potato flour can enhance the yellow color of sweet bread. This indicates that the increase in beta-carotene will lead to an increase in yellow color which is characterized by an increase in b*. The increase in the yellow color began to appear after the sweet potato flour substitution of more than 30%.

Texture and Volume Evaluation

Table 4. Hardness and Volume from Sweet Bread

Treatments	Parameters	
	Hardness (gf)	Volume (%)
0%	201,79±3,63[a]	93,80±1,09[a]
15%	217,27±17,51[a]	87,80±1,09[b]
30%	263,73±4,65[b]	87,40±0,55[b]
45%	269,75±9,32[b]	77,20±0,84[c]
60%	315,33±26,01[c]	68,00±0,71[d]

Note :
a. All values are mean values ± standard deviation
b. Values with different superscript in each row indicate a significant difference between treatments at the 95% confidence level (p <0.05) using Duncan test.

The results that the addition of sweet potato yield by 60% with the strongest hardness value of 315.33 ± 26.01, another case with the control bread (substitute 0%) have much lower hardness value is 201.79 ± 3, 63. This is due to the reduced content of gluten in substitution of 60% sweet potato flour bread that led to the ability to withstand the gas to be reduced so that the bread will lose gas CO_2 and causes the bread to be tough, so it will be more difficult to destroy. According to Bourne (1982), hardness is a response to the bread ingredients suppression with certain materials to change shape in the sample, resulting in a solid sample of the bread will be difficult to form when the subject changed the style of the first. This means the addition of sweet potato flour can affect the increase in violence after the substitution of 30%.

According Yusianti & Purwiyatno (2001) one of the parameters of sweet bread quality assessment is reviewed in terms of volume development. The results of the observations that have been done show that the volume expansion produced decreases with increasing substitution of sweet potato flour in bread sweet and results on different test also showed a significant difference between treatments. Decrease in volume expansion can be caused due to the

decrease in gluten that can assist the development of the dough. Gluten is a water insoluble protein complex that is only found in wheat flour (Matz, 1972).

In making sweet bread used high protein flour to help the development process, but in line with the increasing substitution of sweet potato flour is also made reductions to the high protein flour, which cause a reduction in the volume of bread on the end result. According to Bennion & Hughes (1975) and Matz (1992), the protein forming the dough consisting of flour gliadin and glutenin which will form an elastic mass with water (hydration) are often called gluten. Gluten is working to hold the CO2 gas fermentation due to the use of yeast in bread and this is what causes bread to expand. The higher percentage of protein in the wheat flour, the elastic mass that forms will be stronger so the ability to withstand gas will also be greater. The results of the observations that have been made of sweet bread with 0% or substitution has a volume control for the development of 93.80 ± 1.09% and based on different test, sweetbreads to the substitution of 30% sweet potato flour produces differences in the approach to the control of the 87, 40 ± 0.55% although still significantly different from controls.

Based on the above parameters can we know that the substitution of 30% to the line between sweet bread that is still preferred by the panelists, and that is not liked by the panelists. Based on the analysis, the panelists liked the sweet bread with a little more yellow color with low in hardness but the bread with a little harder still acceptable. In terms of taste is not liked by the panelists were not for the level of sweetness but because of the other flavors of sweet potato that is still foreign to the panelist tongue. Overall, all the attributes and parameters indicate that substitution of 30% sweet potato flour is the effective limit that can still produce sweet bread according to the control.

Sensory Evaluation

Table 5. Result of Rank Test

Treatment	Parameter		
	Color	Textur	Taste
0%	$4,40 \pm 0,72^{a}$	$3,97 \pm 1,13^{a}$	$3,90 \pm 1,12^{a}$
15%	$3,93 \pm 1,11^{ab}$	$3,40 \pm 1,16^{ab}$	$3,70 \pm 1,12^{a}$
30%	$3,13 \pm 0,94^{b}$	$3,23 \pm 1,36^{ab}$	$3,23 \pm 1,30^{ab}$
45%	$2,10 \pm 0,96^{bc}$	$2,37 \pm 1,10^{b}$	$2,47 \pm 1,04^{ab}$
60%	$1,43 \pm 0,68^{c}$	$2,03 \pm 1,45^{c}$	$1,77 \pm 1,28^{c}$

Note :
a. 5 = very like, 4 = like, 3 = intermediate, 2 = dislike, 1 = very dislike
b. All values are mean values ± standard deviation
c. Values with different superscript in each row indicate a significant difference between treatments at the 95% confidence level ($p < 0.05$) using Kruskal Wallis test and then Kolmogorof-smirnof test.

The results of sensory testing, especially test rankings can be seen that the treatment of the most favored by the panelists based on the attributes of color, texture, flavor, and overall is a substitution 0% sweet potato flour (control) and sweet potato flour substitution treatment 60% being the least

preferred. According to the sensory texture, this is probably due to the texture of the substitution of 15%, 30%, 45%, and 60% harder than the control, such as the texture of the test results by using a texture analyzer can be seen that control yield hardness values the smallest. Similarly, in sensory color, that the increased substitution of sweet potato flour, the panelists did not like. This is because the color yellow is also increased as the increasing substitution of sweet potato. In flavor and aroma attributes the decline is mainly due to the influence of the substituted sugar sweet potato flour.

In the aroma attributes, it is known that the most preferred by the panelists came from sweet potato flour substitution of 15%, but in the different test results found no significant difference with the control of sweet potato flour substitution. This is probably due to the aroma of sweet bread is also influenced by the sugar content also have the highest levels at 15% due to substitution by Matz (1992), a substance that affects the aroma of the bread is sugar and shortening. Decreased levels of preference panelists to smell because the aroma of bread loss arising as a result of fermentation that occurs in sweet bread. Fermentation in bread needs sugar, sugar is obtained from sucrose or can be derived from sweet potato starch in the wheat that is more complex. Sweet potato starch in the flour will be more difficult elaborated that the majority of 60% substitution, the resulting aroma becomes less.

Based on the observations can be seen also that the level of preference for sweet bread panelists to substitute sweet potato 30% there is no significant difference with the control according to the aroma attributes and the overall. In texture and flavor attributes, decreased level of preference panel is starting to look real on the substitution of 30%, but according to the test rating, the substitution of 30% of the panelists still receive textures and tastes like controls. This could be because your sense of taste is sweet, while the addition of sweet potato flour sugar levels decreased although not significantly. While based on the attributes of color, significant changes occurred in 30% substitution of sweet potato flour.

CONCLUSION

Sweet potato has potential as a substitute for sugar in sweet bread. Sweet potatoes that have been converted into powder form can be applied up to 30% substitution of sweet potato starch to sugar in the sweet bread.

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EFFECTIVENESS OF SWEET POTATO FLOUR AND SUGAR REPLACER IN THE MAKING OF SPONGE CAKE

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ABSTRACT

Processing of sweet potato is still conducted in traditional manner, even though sweet potato has some advantages, i.e. contains sugar with low glycemic index, highly content of beta-carotene and antioxidants to counteract free radical. Sweet potato can be processed into semi-finished product that is flour and applied into bakery products, for example sponge cake to replace the flour and sugar. Sponge cake is cake that use sugar and flour in the same quantities, so it can reduce the use of flour and sugar in the cake. The purpose of this research is to know the formulation of sweet potato substitutes as substitute of flour and sugar, which can produce the best sponge cake and be accepted by people from physical, chemical, sensory. In this research there are four treatments, that are 0%, 15%, 30% and 45%. From the results obtained, sponge cake 15% produce texture value more increase, the color being dark, and low volume. In the chemical testing, is obtained beta-carotene and antioxidants value which is more increase, which began appearad when the substitution 15% was conducted and was continue rising with more substitution of sweet potato flour. The existence of sweet potato flour substitution produce sugar content was not significantly different from control. From the sensory analysis, the highest grade of predilection to sponge cake with preference substitution of sweet potato flour was 15%.

Keywords: *sponge cake, sweet potato, sugar*

INTRODUCTION

The presence of sweet potatoes in Indonesia is abundant, especially Central Java, and is available at cheap price. Sweet potato has some advantages, i.e. sweet taste and rich in carbohydrate that has a glycemic index of 54 were included in the low category (low glycemix index) making it suitable for diabetics (Murtiningsih and Suyanti, 2011). The content of other nutrients that exist on the content of beta-carotene and antioxidants to counteract free radicals. Based on these advantages, sweet potatoes can be used instead of wheat flour as well

as sugar in bakery products like sponge cake. In the processing of sponge cake, sugar and flour used nearly the same amount, so that by the application of sweet potato flour, can reduce the use of flour and sugar on the cake so it will be cake with more nutrients, taste sweet with a low glycemic index and can improve the utilization of sweet potatoes there.

MATERIALS AND METHODS

Preparation Sweet Potato Flour

At the first process, the sweet potato will cleaned and peeled and then cut thin sheets. Sweet potatoes have such thin sheets, will dried with dehumidifier with temperature ± 60 ° C for 4 hours so that the water content is reduced. The next process is flouring with blender. Flour that has been formed will then be sieved to 80 mesh sieve. (Ambarsari et al., 2009 that has been modified).

Preparation Sponge Cake

In the process of making sponge cake, first egg yolks, egg whites, powdered sugar and ovalet whipped until expanding with high speed for 10 minutes. Then, add flour and sweet potato flour in accordance with the percentage substitution. In this study, there were 4 treatments were performed the substitution of 0%, 15%¸ 30%, and 45% substitution. Then the melted margarine that has added to the batter and stir until blended. Once the dough is evenly mixed, the dough is baked at 160 ° C for ± 35 minutes.

Table 1. Formulation Sponge Cake with Substitution of Sweet Potato Flour as Sugar Replacer

Material	% Substitution Sweet Potato Flour			
	0%	15%	30%	45%
Egg Yolk (g)	38	38	38	38
White Egg(g)	53	53	53	53
Ovalet (g)	3	3	3	3
Sugar (g)	40	34	28	22
Wheat Flour (g) (*	45	40	35	30
Sugar content(g)	-	6	12	18
Sweet potato flour (g)	-	11	22	33
Liquid Margarine (g)	55	55	55	55

(* Contains 55.072% cassava flour sugar. Sugar is used to substitute the use of sugar.

Hardness Crumb

Texture profile analysis (TPA) was performed to evaluate the texture of the cakes using a Texture Analyzer (Lloyd Instruments Ltd., UK). The cake samples were cut into 3x3x3 cm cubes before TPA measurement. A standard double-cycle program was used to compress the samples at a speed of 50 mm/min with 50% deformation using a 50 mm diameter probe. (Chaiya dan Pongsawatmanit, 2011).

Color Values

Using a colorimetric system (*Konica Minolta* (CR-400)), measurements was made for lightness (L), The mean values were presented. (Lebesi & Constantina, 2009).

Volume

For the cake volume measurements made using seed displacement method. This method is performed using the millet seeds. Millet seeds are put in a container measuring up to the full rate. Volume seed then moved on elsewhere. Furthermore cake into a container filled with measurements and millet seed to a full flat. The remaining millet seeds remaining volume was measured with a measuring cup to determine the volume of the cake (ml) (Subagio et al., 2003).

Beta-Carotene

Extraction of Beta-Carotene

A total of 5 grams of sample pulverized and combined with 40 ml of acetone and 60 ml of hexane and 0.1 grams of MgCO3. Furthermore, the extraction process was performed by means shaker for 45 minutes. After that, the flask separation and decantation of washing with 25 ml acetone twice and 25 ml of hexane and 100 ml of distilled water. Separate and take or dispose of the acetone extract by washing with distilled water for several times until the bottom layer of translucent color. Furthermore, the top layer formed was transferred in 100 ml measuring flask that had contained 9 ml of acetone and dilute to the mark with using hexane.

Separation of Pigments

From the results of extraction has been done, the next stage of the screening process that is carried out using a filter paper that had contained one geam cellite, and Na2SO4 until cellite covered. Then the distillate obtained absorbance was measured with a wavelength of 436 nm. (Apriyantono *et. al.*, 1989)

Antioxidant Activity Analysis

Samples were crushed and weighed approximately 0.5 grams. Furthermore, the sample was then extracted with 5 ml of methanol for 2 hours. The extraction of 0.1 ml was taken and treated with 3.9 ml solution of DPPH (2,2-diphenyl-1-picrylhydrazyl) for 30 minutes. The absorbance of the solution was then measured at t = 0 and t = 30 with a spectrophotometer at a wavelength of 515 nm. As a blank, use of methanol was treated with 3.9 ml of DPPH (2,2-diphenyl-1-picrylhydrazyl). The antioxidant activity measured as % discoloration which is calculated using the formula:

$$\%\,\text{discoloration} = \left[1 - \left(\frac{\text{At}_{30}}{\text{At}_0}\right)\right] \cdot 100\%$$

where is the absorbance of the sample AT30 at minute 30 and At0 is the absorbance of the control (Apriyantono et. al., 1989).

Analysis Sugar Levels

A total of 0.1 gram sample crushed and added with 80% alcohol as much as 1:2. Then filtered and the filter washed with the remaining 80% alcohol. Furthermore, we measured the pH of the filtrate, when coupled acidic pH with NaOH or CaCO3 using pH paper and then heated in a water bath at a temperature of 100 ° C for 30 min. The next stage, carried out screening again using filter paper and filter results dipenangas heated water with a temperature of 85 ° C, and supplemented with Pb acetate or aluminum hydroxide slurry until a clear solution was then filtered again and diluted to 25 ml. Further dilution by taking 1 ml and added 9 ml aquabides. After that, from the last dilution 1 ml was taken and added with 5 ml anthrone reagent and then heated in a waterbath at 100 ° C for 12 min. The next step, made fast cooling phase and absorbance measurements with a wavelength of 630 nm (Apriyantono et al., 1989).

Sensory analysis

Sensory analysis was performed using the method of sensory ranking. This was done on 30 sensory panelists who are students of Food Technology Studies Program. Attributes analyzed include aroma, color, texture, flavor, and overall. In the analysis of the rankings, panelists should compare each sample and gives a score that should not be the same for each sample. Scores given for each sample that is 4 (really like) to 1 (very dislike) (Meilgaard, 1999).

RESULTS AND DISCUSSION

Analysis of Sweet Potato Flour

Table 1. Beta-carotene, antioxidants, and Sugar Analysis in Sweet Potato Flour

Parameter	Content
Beta-carotene (mg/100 g of material)	44,89±0,12
Antioxidant activity (%)	20,35±0,59
Sugar (%)	55,07±1,58

Based on the result, the content of beta-carotene in the sweet flour is 44,89±0,12 mg/100 g material that also content antioxidant activity 20,35±0,59 %. Sweet potato flour have have high levels of sweetness 55,07±1,58 %.

Analysis physical of sponge cake

From the results obtained, sponge cake without the addition of sweet potato flour produced the hardness values lower than sponge cake with the addition of sweet potato flour, which is 128.30 ± 3.85 gf and significantly different sponge cake with sweet potato flour substituted. The use of sweet potato flour will cause the sponge

cake hardness increases, which began to appear when the substitution rate of 15%, and will continue to increase up to 45% substitution.

Table 2. Hardness, Color and Volume Analysis of Sponge Cake

Treatment	*Hardness* (gf)	Color L*	Volume Expansion (%)
0%	128,30±3,85[a]	77,37±0,52[a]	121,48±2,07[a]
15%	145,66±3,23[b]	68,46±0,18[b]	101,82±1,00[b]
30%	202,24±5,21[c]	66,45±0,34[c]	83,51±1,15[c]
45%	284,15±11,05[d]	65,30±0,24[d]	63,61±0,27[d]

The increase of hardness, caused in the sweet potato flour does not has gluten. According Subagio et al., (2003), gluten can affect the level of hardness, so if the gluten matrix is disrupted, it will cause the distribution of cake cavities become not good and ultimately increasing hardness on the cake. This is reinforced by the opinion Nisviaty (2006), that the high content of sweet potato flour will cause the cake texture tend to be dense (sodden) and required a greater burden to penetrate.

The existence of sweet potato flour substitution impact on the decline in the value of L *, which indicates that, the color of sponge cake with sweet potato flour tends darker than the control sponge cake. The addition of sweet potato flour exceeds 15%, it will have an impact on the level of brightness of sponge cake that will decrease as the amount of substitution of sweet potato flour. Colors of sponge cake tend to be dark with sweet potato flour substitution, it can be caused by the use of sweet potato flour that are colored tend to be darker than wheat flour due to the processing of sweet potato into flour, there is enzymatic reaction (enzymatic browning) (Ambarsari et al., 2009). This Enzymatic reaction is occurs because fenolase enzyme that cause browning so the color of flour becomes darker (Erawati et al., 2006). Thus, more and more use of sweet potato flour (45% substitution), it will produce cake that has a lower brightness levels.

Sweet potato flour substitution causes a decrease volume expansion that appears when the substitution rate of 15% and will continue to decrease with the high of sweet potato flour substitution. According Subagio et al., (2003), the development of cake volume occurs from the expansion of gases formed and trapped during the agitation. Decrease in volume development sponge cake with sweet potato flour substitution can occur because, sweet potato flour does not contain gluten, so the gas is trapped during shaking slightly, so that the resulting cake low volume development.

Chemical Analysis of Sponge Cake

Table 3. Chemical Analysis of Sponge Cake

Treatment	Betakaroten (mg/100 g material)	Aktivitas Antioksidan (%)	Gula (%)
0%	6,52±0,15[a]	5,28±0,18[a]	21,00±0,17[a]
15%	6,95±0,08[b]	6,77±0,10[b]	21,21±0,19[a]
30%	7,81±0,12[c]	7,76±0,1[c]	21,08±0,23[a]
45%	9,06±0,10[d]	9,21±0,42[d]	20,96±0,13[a]

Beta-carotene content of the test results, it is known that the beta-carotene content of sweet potato flour at 44.895 ± 0.129 mg/100 g of material, which turned out to have a value greater than beta-carotene on sponge cake produced. Baking with a temperature of 160 ° C for 35 minutes, causing damage to the beta-carotene produced sponge cake. According Erawati et al., (2006), beta-carotene has a lot of double bonds in their chemical structure that is very sensitive to oxidation when exposed to air (02), light, metal, peroxide, and heat well during the production process and application. The use of high temperatures and contact with oxygen in the baking process, will affect the reduction beta-carotene content. From the analysis, it turns out, the higher substitution, the content of beta-carotene also increased. In the opinion Erawati et al., (2006), sweet potato (Ipomoea batatas L.), especially orange or yellow fleshed tubers contains high beta carotene (provitamin A). Based on these opinions, the higher substitution of sweet potato flour will increase the content of beta-carotene on the sponge cake, because the sweet potato flour containing beta-carotene.

Based on this research, it is known that the antioxidant activity resulting in sweet potato flour is equal to 20.353 ± 0.598%, and, like beta-carotene, the antioxidant activity of sweet potato flour will also decrease when applied to the process of making sponge cake. The treatment process will also affect the activity of antioxidants in food. The existence of a high temperature baking process, will impact on the decrease in antioxidant activity. This is in accordance with the opinion of Chang (2002) that, antioxidant activity decreases with increasing temperature food processing. Trilaksani (2003) reinforce that high temperatures would damage the stability of antioxidants. Based on these opinions, it is also known that, with a temperature of 160 ° C, decreased antioxidant activity and stability. The higher use of sweet potato flour in a sponge cake, will lead to an increase in antioxidant activity. The cause of the increase is due to the antioxidant activity in sweet potato flour contains beta-carotene which is one of the antioxidants, so that when the sponge cake is substituted with sweet potato flour, the antioxidant activity will also increase. In addition, increased antioxidant activity, may also occur due to the presence of antioxidants other than beta-carotene found in sweet potato flour, which affect the

antioxidant activity when substituted. This is in accordance with the opinion of Dutta et al., (2005), who said that one example is a carotenoid antioxidant compounds.

Based on the analysis of sweet potato flour, it is known that the sugar content in sweet potato flour ranges from 55.072 ± 1.585%. By knowing the sugar content in sweet potato flour, flour substitution will be made to replace the sweet potato flour and sugar in sponge cake. The control of sugar in cake and cake with yam flour substitution there is no real difference and have values similar to the controls 21.006 ± 0.179. This means sweet potato flour can replace sugar in the manufacture of sponge cake and not significantly different with the use of regular sugar. The sweet taste produced from sweet potato flour is due to a change of starch into sugars during storage and carbohydrate composition will determine the taste of sweet (Onggo, 2006).

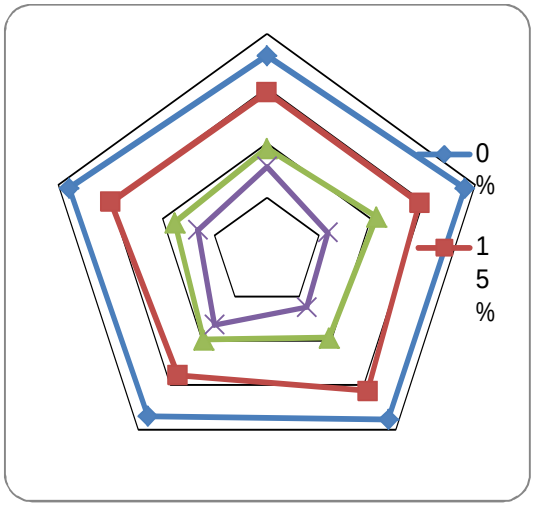

Figure 1. Sensory Analysis of Sponge Cake

From the results of the sensory ranking, it is known that the rank of the parameter testing aroma, color, texture, taste and overall significant differences occurred between the sponge cake with sweet potato flour substitution on a variety of sponge cake with a control treatment. Level of preference panelists on sponge cake with sweet potato flour substitution is the most preferred substitution is sponge cake with 15%, although 15% is significantly different from the control. The addition of more than 15% sweet potato flour will influence significantly when added to the sponge cake in terms of flavour, color, texture, taste and overall. Substitution of sweet potato flour in a sponge cake will affect the texture of the cake is produced, where the more sweet potato flour substitution will produce a harder texture that also affect the volume of the resulting cake will decrease. Level of preference for color panelists sponge cake produced will decrease when the sweet potato flour substitution increased, due to the resulting color will be darker. Increasing substitution would cause the flavour and taste sponge cake produced will be more typical sweet potato tastes and flavour, are even more disliked by the panelists.

CONCLUSIONS

Sweet Potato potential as a sugar substitute in a sponge cake. Effectiveness sweet potato as flour and sugar replacer on a

sponge cake that is acceptable to the panelists that the substitution rate of 15% only. The use of sweet potato flour, causing the content of beta-carotene and antioxidants increases, which began when the substitution of 15%. Substitute sweet potato flour as a substitute for sugar in sponge cake 15%, will produce a cake with higher hardness, darker color, and volume expansion was lower than controls Sponge cake.

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HEALTHY ICE CREAM USING NATURAL SWEETENER AND COLOURANT

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ABSTRAK

Ice cream is a dessert that is quite popular among the consumers, ranging from children to adults. However the dessert is often seen as unhealthy food, because of the excessive sweetness. Therefore it needs to be made of ice cream that uses natural sweeteners, making it safer for the health of consumers. To meet this end, this study aimed to produce safe for consumption ice cream, using *kurma* fruit (*Phoenix dactylifera*) as the sweetener, and carot (*Daucus carota* L.) to improveme the colour and nutrition as well, and all are still acceptable to consumers. The study was conducted in two stages. The first stage was addressed to obtain the composition of kurma, based on respondents sensory. These results were used to conduct main research that addressed to determine the composition of ingredients to making ice cream. The main research was conducted by making 2 samples of ice cream, each using 29.17% of the total composition of the material dates, and carrots concentration of 41.67% (Sample A) and 25% (Sample B). A commercially sold ice cream was used as the control (Sample C). The evaluation was conducted by the organoleptic parameters of aroma, flavor, and texture to 32 respondents randomly selected students. Research laboratories was made using parameters of overrun, melting rate, time to melt, viscosity, and pH. The results showed that the overrun of ice cream samples A, B, and C were 32.1%, 34.2%, and 35.2% respectively, the melting rate of ice cream samples A, B, and C are 0.2 grams / minutes, 0.33 g / min, and 0.54 g / min respectively; time to melt out of 5 gram sample of ice cream A, B, and C is 25 minutes, 15 minutes, and 9 minutes 26 seconds respectively; viscosity samples of ice cream A , B, and C are 30 dPas, 45 dPas, and 0.1 dPas respectively; and the pH of the ice cream samples A, B, and C are 5.84, 5.86, and 6.20 respectively. Organoleptic evaluation resulted that the aroma ice cream sample A is favored by 53.125% of respondents, sample B is preferred by 75% of respondents, and sample C is preferred by 93.75% of respondents; flavors of ice cream sample A is favored by 46.875%, sample B is preferred by 93 , 75% of respondents, and sample C is favored by 78.125% of respondents; texture of the ice cream sample A is favored by 53.125% of respondents, sample B is favored by 90.625% of respondents, and sample C is preferred by 81.25% of respondents, while the overall ice cream samples A favored by 62.5% of respondents, sample B is favored by 100% of respondents, and sample C is preferred by 81.25% of respondents. It can be concluded that the concentration of ice cream with 25% carrot and 29.17% kurma out of the total material composition can be accepted by most people.

Keywords: *ice cream, kurma, carot, natural sweetener, natural colourant, consumer acceptance*

INTRODUCTION

Ice cream is a food derived from milk nutrient dense, rewarding and delicious. The basic ingredients are milk ice cream. Milk as a result of female mammal's udder gland secretion, a complex fluid composed of carbohydrates, protein, fat, lactose, minerals, vitamins, and some other materials that are soluble in water (Marliyati et al., 1992). The main component of milk is 87.10% water, 3.40% protein, 3.90% fat, 4.80% lactose, vitamins and minerals (Buckle et al., 1987).

On this occasion the ice cream from natural ingredients will be created using carrots and dates. Parameters of this natural ice cream are aroma, flavor, and the color of the ice cream. In terms of carrots, carrots have the texture, color, and tastes are both used in the manufacture of ice cream. While the dates had a natural sweetness and aroma that can attract customers.

Levels of nutrients flour carrot 6.73% moisture content, carbohydrate content of 13.15%, protein7 levels, 7%, 1,15% and the fat content levels of beta-carotene 33.74 mg / kg (56.18 SI/100 gram flour). Carrots contain a lot of vitamin A, energy yield, and prevention of diarrhea in infants. A date containing simple sugars like fructose and dextrose are easily digested and quickly recharge the body's energy (Jahromi et al. 2007). Dates contain sugar cooked about 80%, the rest is made up of protein, fat and mineral products including copper, iron, magnesium and folic acid. Dates are rich in fiber and are an excellent source of potassium. Five dates (+ / - 45 g) contains about 115 cal, nearly all from carbohydrates (Mansouri et al. 2003).

From these two basic ingredients that we will innovate to make ice cream naturally acceptable to consumers and contain a lot of nutrients in it. Therefore, we chose these materials because it can improve the taste and also good for health. Besides it is not containing preservatives, we made ice cream that also derived from natural ingredients. So by eating this natural ice cream consumers experience less worry than eating ice cream on the market.

METHODOLOGY

In this process of making ice cream is done through two stages of testing. The first stage is a trial to get the level of sweetness, and the second phase to get the ice cream that is most preferred by consumers. The first stage is done by materials 100 grams of milk, 250 grams of whip cream, 125 grams of dates, 75 grams of carrot mixed using ice cream maker, in order to obtain the first ice cream. Then the second ice cream is made with 75 grams of milk, 275 grams of whip cream, 175 grams of dates, and 75 grams of carrot. Both ice creams were then tested on 10 respondents to

determine the level of sweetness that will be used. Of questionnaires that have been distributed the result that respondents preferred to the second type of the ice cream.

The results of this first study continued into the second study, namely to determine the admissibility of natural ice cream in the community. The second study was done by making two kinds of ice cream, the difference is in the amount of carrots that are mixed. The first ice cream was made with 75 grams of milk, 100 grams of whip cream, 250 grams of carrots, and 175 grams of dates mixed using ice cream maker for 25 minutes. And the second ice cream was made by mixing 75 grams of milk, 100 grams of whip cream, 150 grams of carrots,175 grams of dates, and 100 grams of water for about 25 minutes. It is also used strawberry ice cream bought at the store as a positive control.

Then it was given labeling, for the first ice cream samples labeled as sample A, the second ice cream samples labeled as B, and the ice cream that is purchased in stores are labeled as sample C. Thereafter the questionnaire that was made before is distributed to 32 respondents who were all college student. Questionnaires that were distributed containing question about whether consumers like ice cream or not, the intensity of the consumption of ice cream consumers in the first month, then the test parameters (taste, texture, aroma, overall). These parameters can be assessed by choosing between VB = Very bad, NB = Not bad, D = Delicious, VD = Very Delicious. The samples that are given to the respondent are ice cream samples A, B, and C. Sample A is a natural ice cream with 250 grams of carrot, sample B is a natural ice cream with 150 grams carrot, sample C is the strawberry ice cream which is bought in store.

Then the data obtained from questionnaires that have been distributed earlier presented in the tabulation. To compare the level of acceptance by the respondent of any sensory from the parameters of sensory tested with statistics nonparametric mann whitney with 95% confidence level. This method is done by the annotation of Very bad, Not bad, Delicious, Very Delicious is numbered 1, 2, 4, and 5, then the number of people who answered for example very bad (1) multiplied by the number of people who respond and then averaged.

OBSERVATION RESULTS

Table 1. Result of Laboratory Test from 3 samples of Natural Ice Cream

	Sample A	Sample B	Sample C
Overrun (%)			
Viscosity (dPas)	32,1	34,2	35,2
pH	30	45	0,9
Time to Melt	5,84	5,86	6,20
(minutes/5 gram)	25	15	9,43
Melting rate	0,2	0,33	0,54
(gram/minutes)			

On Table 1 it can be seen that the results of overrun sample A, B, and C were respectively 32.1%, 34.2%, and 35.2%. The results of the viscosity of the sample A, B, and C respectively are 30 dPas; 45 dPas, and 0.9 dPas. The results of pH measurements on sample A, B, and C are respectively 5.84; 5.86, and 6; 20. The time required melting 5 grams of ice cream in the sample A, B, and C respectively are 25 minutes; 15 minutes, and 9.43 minutes. Melting rate of sample A, B, and C respectively were 0.2 grams / minute; 0.33 g / min, and 0.54 g / min.

Table 2. Result of Smell Test from 3 samples of Natural Ice Cream by Respondents

Sample	Smell Score
Sample A	3,03 a
Sample B	3,66 ab
Sample C	4,22 b

On Table 2 it can be seen that the average score of scent samples A, B, and C are respectively 3.03; 3.66, and 4.22. Figures followed by the same letter indicate no significant difference at 95% confidence level. Sample A showed no significant difference compared to sample B, but showed significant differences with the sample C. While sample B do not show significant differences with sample C.

Table 3. Result of Taste Test from 3 samples of Natural Ice Cream by Respondents

Sample	Taste Score
Sample A	2,91 a
Sample B	4,22 b
Sample C	4,03 b

On Table 3 it can be seen that the average score of a sense of sample A, B, and C are respectively 2.91; 4.22, and 4.03. Figures followed by the same letter indicate no significant difference at 95% confidence level. Sample A showed significant differences compared to sample B and sample C. While sample B do not show significant differences with sample C.

Table 4. Result of Texture Test from 3 samples of Natural Ice Cream by Respondents

Sample	Texture Score
Sample A	3,09 a
Sample B	4,16 b
Sample C	3,91 b

On table 4 it can be seen that the average score of a texture of sample A, B, and C are respectively 3.09; 4.16, and 3.91. Figures followed by the same letter indicate no significant difference at 95% confidence level. Sample A showed significant differences compared to sample B and

sample C. While sample B do not show significant differences with sample C.

Table 5. Result of Overall Test from 3 samples of Natural Ice Cream by Respondents

Sample	Overall Score
Sample A	3,25 a
Sample B	4,41 b
Sample C	3,97 ab

On Table 5 it can be seen that the average overall score of sample A, B, and C are respectively 3.25; 4.41, and 3.97. Figures followed by the same letter indicate no significant difference at 95% confidence level. Sample A showed no significant difference compared to sample C, but showed a clear difference with sample B. While sample B do not show significant differences with sample C.

CONCLUSION

- Natural ice cream is healthy and suitable for consumption.
- The smell of natural ice cream is still inferior when compared to ice cream sold in the market.
- The taste of natural ice cream is not inferior to the taste of ice cream sold in the market, even more preferred.
- The texture of the natural ice cream is good enough.
- Natural ice cream can naturally be accepted by society.
- The content of the stain in carrots give a little orange color to the natural ice cream.
- The sweet taste of the natural ice cream came from the sweet taste of the dates.
- Carrots contain vitamin A which is good for eye.
- Dates contain glucose which can be processed into energy by the body.

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STUDIES ON THE LEVEL OF CONSUMPTION, ENERGY EXPENDITURE AND ENERGY BALANCE FEMALE BADMINTON ATHLETES AT DJARUM'S BADMINTON TRAINING CENTER KUDUS

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ABSTRACT

There are many factors determine the achievement badminton athletes, one of which is the consumption of nutrients through proper food intake. Nutritious food intake given at the appropriate quality and quantity, will support the physical condition and energy of athletes. Research on consumption levels and energy balance of the activity of badminton athletes in Indonesia has not been made. Therefore it was necessary to conduct a series of studies to identify the level of consumption of athletes in relation to age, level of education, nutrition knowledge, and BMI with energy expenditure athletes. The study was conducted at Djarum's badminton training center, Kudus, Central Java. The study was conducted to 30 female badminton athletes, in a 24-hour recall, for a month. The study covering of observations on the level of consumption, energy released, and the energy balance of the athletes. Due to the facts that there is no appropriate procedure in calculating energy intake, energy released as well as dietary measurement published by Indonesian government, the calculation of energy intake and output, i.e. energy released, was conducted using calculation provided by FAO, whereas for the dietary measuremet was using procedure provided by USDA. The results showed the average of energy intake was 3,954.09 kcal/cap/day, whereas the energy release was 3,410.50 kcal/cap/day; energy balance was 543.60 kcal/cap/day. Some variation was found in term of age, education levels, knowledge on nutrition and Body Mass Index (BMI). The higest variation was found in the variable of age; young athletes, 10 – 12 years old in average consumed 3,724.98 kcal/cap/day, whereas the oldest, 19 – 29 years old, consumed 4,344.29 kcal/cap/day. It was apparently the older, higher education levels, better knowledge on nutrition and higher BMI, the consumption levels was higher, and the energy released was also higher, however the energy balance was lower. These results might be due to the growth factor of the younger athlets that was higher than the older ones. This study also faound that BMI also a major factor that affects the energy balance, beside age. In order to provide more accurate calculation and the measurement to Indonesian athletes, the Government is expected to soon issue a calculation standard of input and output energy for athlet as well as dietary measurement, which is more suited to the climate and conditions in Indonesia.

Keywords: *level of consumption, energy intake, energy release, energy balances, badminton, athletes, Djarum's training center*

INTRODUCTION

There are many factors that have to be considered in developing the sport quality. In developing the sport quality, there must be a management of practice schedule and other routines in order to suit the physical and psychological condition of each athlete. There is another factor that usually be neglected in training and coaching process of athlete, such as the consumption pattern. The consumption level of athlete is lot more than non-athlete because the activity and energy needed of athlete is higher that non-athlete. The high consumption level needed would cause higher cost in supporting the continuity of good coaching and achievement.

One of the badminton training institutions in Indonesia is PB Djarum which has delivered many athletes by national and international accomplishments. Those achievements are really important to be maintained and improved, and it can not be separated with regular, systematic, and sustainable coaching.

The athlete has a heavy training schedule. They have to practice badminton for 6 hours in one day with adjusted schedule. They also have to do physical training such as swimming, running, jumping and weight lifting for 2 hours every day. So the total time needed to do the training is 8 hours for each day. These hectic schedules make the study time at school become shorter, i.e. 3-4 hours per day.

A good training and coaching in psychological training material and nutritive consumption is expected to develop the athlete with good strategy, strength of mental, and physical.

One way to create a good consumption pattern is through balanced nutrition. Balanced nutrition means the energy expended for sport must be balance or equal with the energy from the food intake. Food for the athlete must contain a suitable nutrition for daily and sport activity, such as carbohydrate, protein, and fat as the energy source with the certain amount. Consumption level of non-athlete is 2000kcal/day for the 10-12 years old girl and 1900 kcal/day for the 19-29 years old woman.

Badminton is one of the greatest sport branches which have gained many achievements from national until international event. However, there are only a little information provided related to the consumption level of athlete in Indonesia. In fact, there is difference of nutrition needed and consumption level from athlete and common people.

Nutritional and balance energy an athlete very support performance. Therefore this

research necessary to determine the level of consumption athletes badminton daughter pb djarum holy. Study the study is done with analyzed levels of energy consumption, protein, fat, carb, and the rebuilding of expenditure of energy and other factor that related standard uses usda national nutrient database for standart referece, because indonesia has yet to obtain raw standard to count nutritional intake food of the athletes. So the writing is expected to add documentation regarding consumption athletes especially athletes badminton and can become input that the government can make standard raw about nutritional intake of the athletes in indonesia.

MATERIALS AND METHODS

Material

Respondents in this research is athletes daughter pb djarum holy in the training and boarding in gor djarum holy namely a number of 30 people. Respondents being included has character age, the level of education, knowledge nutrition and bmi of mythology. Research that included respondents athletes badminton daughter pb djarum holy done in gor jati holy central java. All respondents will grouped based on age group, the level of education, knowledge nutrition and BMI.

Data used in form of data primary covering age, weight and height. Besides bye primary also obtained by using kuisioner. In general kuisioner made to know:

- Personal identity of respondent includes age, sex, weight, height, and latest education.
- Nutrition knowledge of respondent.
- Recall diet for 25 days continuously.

Methods

Methods used were observation method. This method was chosen consider the illustration of consumption level and the nutrition balance of PB Djarum's athlete.

Concept research in form of study observation it may be regarded as a method enough relevant and picture representing data objective. It was because method observation was a procedure that assure direct observation and performed with planning, namely covering sample observations and various variable existing coupled with process live interview, then do registration data obtained from the observation, and next count or cultivate the data in accordance with parameters needed relating to problem (Notoatmodjo, 2002). In observation also done recall diet 24 hours for 25 days at rest exercise and when time.

This research took place at *GOR bulutangkis Djarum (GOR Jati)* which located at *kabupaten Kudus Jawa Tengah*. In this research, there were direct observation at GOR Jati, include the athlete's dorm and

badminton court. Primary data was obtained by recording the respondent's weight (Almatsier, 2001). Personal identity was collected by interview using questionnaire. Interview is a method used in order to get the oral information from respondent (Notoatmodjo, 2002).

Apart of direct interview, there was also an indirect interview by using a questionnaire to record the consumption at the morning and night of the day when questionnaire is distributed. The information obtained from that questionnaire were personal identity, anthropometry index, nutrition knowledge, physical activity, and the consumption level. The personal identity includes name, age, sex, weight, and latest education. The height and weight information can be used to calculate the body mass index (BMI) for each athlete. The nutrition knowledge of respondent was obtained by the score from questionnaire distributed during observation. The physical activity information (custom pattern and

duration of physical activity) and consumption level (protein, fat, and carbohydrate intake) would be converted to kcal unit. All data obtained were tabulated and analyzed by using SPSS ANOVA Unequal Statistic and Microsoft Excel 2007.

RESULTS AND DISCUSSION

The Level of Consumption of Respondents

The level of consumption of calories, protein, fat and carbohydrates are expressed in total per day. The level of consumption is divided based on the age of respondents, i.e. a group of children (10-12 years), teen (13-15 years), youth (16-18 years), and the early adult (19-35 years). Data more details can be seen in table 1.

Table 1. The Level of Consumption of Energy, Protein, Fat and Carbohydrates Based on Age

Usia (tahun)	Responden (orang)	Energi (kkal/hari)	Protein (g/hari)	Lemak (g/hari)	Karbohidrat (g/hari)
10 - 12	12	3724,98[a]	167,66[a]	125,77[a]	480,61[a]
13 - 15	10	4038,39[a]	181,40[b]	139,99[b]	513,22[b]
16 - 18	4	4040,55[a]	186,00[b]	141,66[b]	505,40[b]
19 -29	4	4344,29[a]	200,02[b]	150,23[b]	548,03[b]
Average		3954,09	178,99	135,88	503,77

Description: there is a real difference between the age of respondents expressed in letters superscript difference in the level of trust 95 %. No real difference between age respondents expressed with superscript the same letter at level of trust 95 %.

Data shows over age increases followed by the consumption level which also increases. Energy highest intake owned by respondents adult age beginning of 4344,29 kcal / day with protein highest intake of 200,02 g a day fat intake highest for 150, 23 g day and

intake carbohydrates highest of 548,03 g day. On a table 42 can be known that the different age affecting the consumption level protein, fats and carbohydrates on respondents. For consumption protein, fats and carbohydrates respondents age 10-12 year markedly dissimilar with age 13-15 years, 16-18 19-29 years and years, but respondents age 13-15 years no markedly dissimilar with respondents age 16-18 19-29 years and years, so it is with age 16-18 year which is not dissimilar real with age 19-29 years.

On this research, respondents divided into ages jerusalem--the age children (4), twelve years early adolescence (13-15), early years early adolescence end (16-18 year) and early adulthood (19-29 year). Research showed that age respondents having real difference kosumsi, with a protein fats and carbohydrates as a whole. The high activity eveyday tertutama jocks with adult age high levels of consumption, is the cause both consumption of energy proteins, fats and carbohydrates. In fulfillment of consumption, food and nourishment pb djarum holy also do drafting a menu makan varying. A kind of food made and used to compensate your appetite, different the athletes and could not get bored fulfill the intake nutrition. This is in accordance with the opinion of the Sihadi (2006), which States that a number of factors such as the fulfillment of the conditions of nutrition, an attractive appearance, according to his taste, and types vary from being boring. These factors affect food serving that can be beneficial to health and able to support the achievements of the athletes. All activities by athletes on a daily basis requires energy, so that energy intake requirement fulfillment varies according drajat activites (Irawan, 2007). The high consumption on the respondent's early adulthood due to high activity so that it can support the required intake of energy is expended for activities mainly physical exercise and sports.

Energy Expenditure of Activity Respondents

Daily activities are carried out reponden are classified into 6 groups of activities, namely, physical exercise, sleep, academic activities, relaxing activity, personal activity and spiritual activity. On the basis of age, is divided into four divisions, namely the age of children (10-12), teens (13-15 years old), teens (13-18 years) and early adulthood (20-29 years).

Table 2. Expenditure of Energy Activity Based on Age

Usia (tahun)	Lat,fisik (kkal/hari)	Tidur (kkal/hari)	Akademis (kkal/hari)	Santai (kkal/hari)	Pribadi (kkal/hari)	Rohani (kkal/hari)
10-12	1404,64±196,71[a]	374,14±77,87[a]	340,63±68,74[a]	273,09±56,31[a]	153,71±30,63[a]	3,47±4,72[a]
13-15	1495,34±214,79[a]	431,92±67,62[b]	345,63±88,16[b] c	346,19±97,76[b]	190,00±30,07[b]	3,98±4,77[a]
16-18	1533,12±238,72[a]	475,92±20,72[bc]	304,05±81,97[c]	340,63±41,66[a] b	207.56±12,08 b	0,00±0,00[a]
19-29	1749,98±114,83[b]	507,58±22,33[c]	96,00±45,16[c]	411,91±87,20[b]	243.45±16,00[c]	13,90±6,10[b]

Description: there is a real difference between the age of respondents expressed in letters superscript difference in the level of trust 95 %. No real difference between age respondents expressed with superscript the same letter at level of trust 95 %.

On a table 46 can be known that the different age are affecting energy activity physical exercise, sleep, academic, relax, personal and spiritual respondents. On expenditure of energy physical exercise and activity spiritual respondents age 10-12 year markedly dissimilar with respondents 19-29 years, but not markedly dissimilar with respondents age 13-15 16-18 years and years. So it is with respondents age 13-15 different years manifest to respondents age 19-29 years but no different real with age 16-18 years. To activity sleep, respondents age 10-12 year markedly dissimilar with age 13-15, 16-18 and 19-29 years, but age 16-18 years no markedly dissimilar with age 13-15 19-29 years and years. To activity academic, respondents age 10-12 year markedly dissimilar with age 13-15, 16-18 and 19-29 years, but age 13-15 years no markedly dissimilar with age 16-18 and 19-29 years. For a relaxing activity, respondents aged 10-12 years of age with different 13-15 and 19-29 years old, but no different from the age of 16-18 years old. For private activity, respondents aged 10-12 years of age, the different ages 13-15 years real different with age 19-29 years old but does not differ markedly with age 16-18 years. For spiritual activity, respondents aged 10-12 years a real different with respondents aged 18-29 years old but no real difference with respondents ages 13-15 years and 16-18 years old.

Athletes need energy to perform daily activities, the research activity classified into physical exercise, sleep, academic activities, casual aktivtas, private activity and spiritual activity. Based on the character's age, is divided into four age groups: age of children (10-12), teens (13-15 years old), teens (13-18 years) and early adulthood (20-29 years). In the table there are 46 activity energy expenditure data for physical exercise, sleep, academic activities, relaxed, personal and different real spiritual with age. Look at the data, the age of adult respondents had a higher energy expenditure in almost all activities except academic activity, since athletes PB Djarum Kudus have an intensive workout schedule so that hours of learning in school to be more brief. In this case the

age effect in energy expenditure activity a person is, the more mature a person then gets progressively higher activity of physical exercise that is done so that the activities of the energy expended is getting bigger. Results of the study in accordance with Proverawati (2010) that the presence of hormonal conditions on a teenager to adult physical activity causes further increase and can increase their energy needs.

The Energy Balance of Respondents

Balance input energy output is balance of daily food and energy consumption expenditure of energy from activity undertaken as physical exercise. Whole data can be seen on a table 3.

Table 3. Energy Balance Based on The Age

Usia (tahun)	Responden (orang)	Energi input (kkal/hari)	Energi output (kkal/hari)	Keseimbangan (kkal/hari)
10 - 12	12,00	3724,98[a]	3623,60[a]	101,38[a]
13 - 15	10,00	4038,39[a]	3922,93[a]	115,46[a]
16 - 18	4,00	4040,55[a]	2385,38[a]	1655,17[b]
19 -29	4,00	4344,29[a]	2515,25[a]	1829,04[b]
Average		3954,10	3410,50	543,60

Description: there is a real difference between the age of respondents expressed in letters superscript difference in the level of trust 95 %. No real difference between age respondents expressed with superscript the same letter at level of trust 95 %.

On the table 50 can be aware that age differences affect the energy balance of input and output of the respondents. The energy balance of the above respondents are quite varied for each age. Respondents with the highest age showed the highest energy balance anyway, overall all respondents having an excess of energy. The differences seen in the energy balance of respondents by age 10-12 years with different respondents aged 16-18 and 19-29 years old, but not different from respondents ages 13-15 years old.

According to the level of nutritional state, can be classified in three levels, namely the state of nutrition more, a state of good nutrition and circumstances malnutrition. Good nutrition can be achieved with give food imbalanced to body according to kebutuhan.gizi lacking and nutrition more represent the imbalance food consumption to the needs of the human body. So balance is affected by energy coming through intake of food equal with energy expenditures for exertion (Seto, 2001). To research result obtained balance energy input and output based on age can be seen on a table 50. Research showed that ages at real by balance

energy input and output. Balance energy achieved if energy that enters the body through the equal with energy issued (Almatsier, 2002). Age factor is a factor that cannot be changed, then the energy intake ought to look more closely. Energy intake must be managed properly to match the energy expended. The manner in which the distinction between providing food based on age and drajat activities by, can then be carried out nutrition education as self control in choosing and consuming food, in addition to monitoring carried out by a nutritionist to support it. he possibility of these factors that cause excess energy on balance energy above.

CONCLUSIONS

- The high energy activity athletes category adult age influenced early condition hormonal that causes energy needs is also high, so happen excess on balance its energy.
- Management of weight and height affect the balance of energy.
- Arrangement weight and height that deals with bmi affect balance energy input and output and a factor in support performance and physical health of athletes.

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THE COMMERCIALIZATION OF NONI FRUIT (*Morinda citrifolia, L.*) IN THE FORM OF SOFT CANDY

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ABSTRACT

Noni fruit (Morinda citrifolia, L.) locally called as "Mengkudu" has been believed contains nutrition substances such as protein, vitamin, mineral, selenium as a great antioxidant, antibacterial and anticancer substances. Empirically, this is proved by scientific researches and has been documented. It has been used for illness as currative action, not preventive one, because of its strong smell. In fact, if the fruit is consumed daily, it will give many benefits. In attempt to providing foods for daily consumption, particularly for teenagers, a soft candy was made using the following composition: juice of noni fruit 200 ml, gelatin 5 gram, sugar 200 gram, agar-agar powder half sachet. The produced candywas not accepted by teenagers because the sting smells was still strong and too chewy. The smells was basically due to volatile compounds in the fruit, which is basically easy to evaporate. Based on this facts, some improvement was made in order to obtain a better product. The first improvement was run to evaporate the volatile compounds and the second improvement was changing the compositions. The separation of volatile agents was made by doing some extraction using etanol and then evaporated it. The composition of the soft candy was changed to gelatin 100 gram, juice of noni fruit 75 ml, glucose 150 gram, citrate acid 1 gram, and strawberry essence 5 ml. The candies produced from these two-stage production process produces candy that has a weaker smell of noni fruit and would be accepted by consumers.This laboratorial soft candy products were then evaluated the consumer acceptance in term flavor, texture, and smells using similar commercial jelly candy which contain ginger-based active compounds as the control. The results of the comparison were discussed.

Keywords: *Noni fruit, soft candy, smell, volatile, extraction*

INTRODUCTION

Noni fruit is one of natural phenolic sources. phytochemicals in fruits and vegetables have been receiving increased interest from consumers and researcher for the beneficial health effects on coronary heart disease and cancer mainly due to their antioxidant activities (Kim et al., 2002). A number of phenolic compounds mainly flavonoid and phenolic acids are among the antioxidant compounds which present in fruits and vegetables (Madhujith and Shahidi, 2005). Antioxidant are compounds that can delay, inhibit, or prevent the oxidation of lipids or other molecules by inhibiting the initiation or propagation of

oxidative chain reactions (Javanmardi et al., 2003).

The presence of noni fruit is nowadays almost extinct, because the fruit is less desirable by the community, due to the taste and smell and some people consider as useless. Though noni fruit has various properties because it contains some active compounds. Therefore it is important to present the alternative products that can increase public demand on noni. One type of alternative products is makin candy jelly from the fruit of Morinda citrifolia. Noni active compounds, including flavonoids, xeronine, scopoletin, terpene compounds, vitamin C and selenium obtained from the extraction process using a solvent such as ethanol.

From the results of the study by Chang and colleagues, that antioxidants are extracted with ethanol from rosemary and sage have the best activity (Tensiska et al, 2003). Comparison between the solvent with the material to be extracted (noni) greatly affect the number and type of active compounds to be produced, hence the importance of research on the comparison to get the maximum active compounds.

Chewy material types affect the quality of the resulting jelly candies. According to Anonymous (2007 a) or chewy gelling materials commonly used for making jelly candies are gelatin, carrageenan and agar-agar. Of the three types of chewy materials, the importance of conducting further research on the chewy material corresponding to noni fruit jelly sweets. The aim from the manufacture of jelly sweets noni fruit is increasing utilization in heal disease and make the noni fruit as a healthy diet is a popular community.

MATERIAl AND METHOD

Fresh and ripe noni fruit were collected, then cleaned it with clean water, put it into the blender until all fesh was dissolved. The obtained noni juice was filtered using a cloth filter to get the pure juice. The composition of ethanol and the fruit that we used is 2:1. Initially 75 grams of extract noni fruit has been determined then cooked until it reached a temperature 800C,t hen add sucrose, gelatin, sugar, and sitrat acid stirring until the temperature 90-1000C.Gelatin is dissolved into the hot water (50-600C) and stirring it until the temperature, then put the dough into a baking dish and put the dough at room temperature for 1 hour. After cool enough, cooled it into refrigerator temperature 50C for 24 hours. Once removed from the refrigerator, left at room temperature for 1 hour to neutralize the temperator. Cut it into rectangle,and then packed it into plastic bag.

In this studied , we randomly select 30 students to conduct testing of noni candy. Ginger candy are the control variables of this experiment and the parameters measured were flavor and elasticity. How tabulation is used in this experiment is divided into three kinds. First how often consume candy, the preferred type of candy, and a liking for sweets noni value.

RESULT AND DISCUSSION

Table 1. The frequency of candy's consumption per week

Frequency per week	Numbers of respondent
1-5	17
5-10	10
Not at all	3

Based from the result of the quisioner to 30 students, it can be seen that, for 1-5 candies per week, there are 17 students, for 5-10 candies per week, there are 10 students, and for not consumption candies per week, there are 3 students. We choose this question as a beginner to know the amount of candy consumed per week as a basis to determine the favorite candy is consumed. So, this respondent enought to be the sample because they consumed candy minimally one / week.

Table 2. Respond of Respondent in Term of Taste and Aroma for Original and Strawberry Noni-Candy

Criteria	Numbers of original noni-candy	Numbers of strawberry noni-candy
Poor	1	1
Bad	1	5
Fair	15	16
Good	11	6
Very good	2	0
Average	3,4	2,2

Based on the average results of the questioner, most students prefer original noni-candy than strawberry noni-candy it can be proved from the table that the average of original noni candy is 3,4 and the strawberry noni-candy is 2,2. Noni original candy is just an added glucose and sugar as a sweetener, without providing additional sweetening or other scents. If The noni-candy we add strawberry essence as hardening and aroma enhancer, in addition to sugar and glucose. By looking at other values and compared with the results of candy noni original value, it can be seen that the candy noni original demand more and more acceptable among students than candy noni with the addition of strawberry essence. And following is the Figure of numbers respondent with noni-candy.

Figure 1. Grafik of respondent prefer with noni-candy

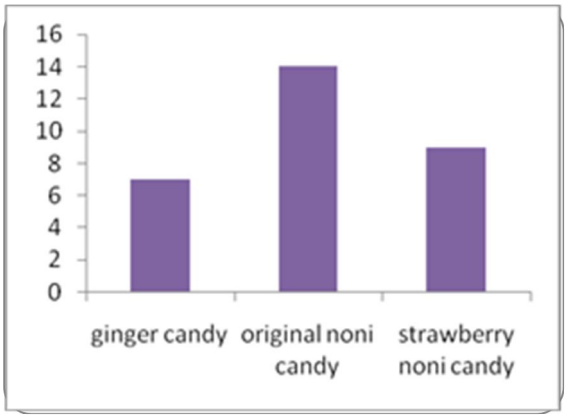

Table 3. The type of candy's consumption

Types of candy	Number of ratio
Hard candy	7
Soft candy	14
Jelly candy	9

Based on the results of the questioner, of the 30 students, it can be seen that most consumption is soft candy, with 14 students, and the second is jelly candy with 9 students, and hard candy 7 students. Incidentally, type of candy we make is soft candy, so we will develope our experiment with soft candy.

CONCLUSION

First of all, we would like to present that our results are highly beneficial for the manufacture of jelly sweets noni fruit is increasing utilization in heal disease and make the noni fruit as a healthy diet is a popular community. As describe above, the manufacture of jelly sweets noni fruit can be the best part to get optimal productivity of noni fruits that people think useless. Jelly sweets noni fruit is the herbal candies because the noni active compounds including flavonoids, xeronine, scopoletin, terpene compounds, vitamin C and selenium of antioxidant. In the making of this noni, noni juice we use as the main material without losing the content of any of the noni fruit. In the manufacturing of noni in, we use the extraction process using rotavapour machine that aims to eliminate the odor native noni, noni where odor is the main cause why people do not like fruit. We provide additional glucose and sugar as a sweetener for candy noni original, and added strawberry essence for noni strawberry candy, with the goal of providing a sense of the candy noni, where the public believe that the taste of the noni fruit is bad or bitter. Of making this candy, we want to introduce a wider noni fruit, that fruit has high antioxidant can be processed into products that are tasty and healthy. In addition, the plant is easily cultivated and developed in tropical regions such as Indonesians. The presence of these antioxidants, noni means it can serve as an antioxidant to free radicals and cancer prevention, which can be consumed for all ages not just for old people who consume noni candy is usefull because of abortion, but we can add a variety of flavors and packaging are made as attractive as possible so that small children were also more

interested. in testing candy, the variables tested is the texture and flavor.

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IMPROVING COLOR AND FLAVOR OF QUALITY FRUIT JUICE WITH β-CYCLODEXTRIN

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ABSTRACT

Fruit juice products (fruit juice) is a soft drink made from fruit and drinking water with or without addition of sugar and permitted food additives. It still has good color and flavor of the used fruit. Pasteurization in the manufacture of fruit juices can reduce the quality of color and flavor of fruit juice during storage, due to enzymatic browning reaction which made the color darker and make the flavor intensity decreased. This condition happened in fruit juice produced by small scale industry commonly rather than the larger ones. Color and flavor of fruit juices produced by small scale industries is severely degraded faster than fruit juices are produced in large industries. Fruit juice during storage can suffer enzymatic browning due to phenolic compounds in the fruit which act as a substrate that can undergo enzymatic browning. Addition of additives such as β-cyclodextrin is used to maintain the quality of color and flavor fruit juice during storage. β-cyclodextrin molecules could be binded to the β-cyclodextrin and could form an complexes with some aromatic volatile compound, so quality fruit juice about color and flavor can be maintained.

Keywords: *fruit juice, flavor, color, β-cyclodextrin, inclusion complexes*

INTRODUCTION

Fruit juice products is a soft drink made from fruit juice and drinking water with or without addition of sugar and permitted food additives (SNI 01-3719-1995). It still has good color and flavor of the used fruit. Pasteurization in the manufacture of fruit juices can reduce the quality of color and flavor of fruit juice during storage, due to enzymatic browning reaction which made the color darker and make the flavor intensity decreased. This condition happened in fruit juice produced by small scale industry commonly rather than the larger ones. Color and flavor of fruit juices produced by small scale industries is

severely degraded faster than fruit juices are produced in large industries.

Making fruit juice in a large industry can anticipate problems deterioration of color and flavor of fruit juices by using High Pressure Processing (HPP), the addition of antioxidants and the addition of additives. Fruit juices are produced in small scale industries more rapid decline in the quality and flavor of fruit juice than fruit juice produced in large factories. That is because the equipment used in small industries simpler and control the manufacturing process fruit juice was not as tight as the manufacture of fruit juices in a large industry. The addition of additives can be a solution for the problems of fruit juice in a small industrial faster decrease the quality and flavor of fruit juice so it can compete with fruit juice produced in large factories. The addition of additives that can be used to maintain the quality of the color and flavor of fruit juice during storage is to use β-cyclodextrin.

Fruit juice during storage can suffer enzymatic browning due to phenolic compounds in the fruit which act as a substrate that can undergo enzymatic browning. Enzymatic browning reaction will occur if the reaction between the enzyme polifenoliksidase (PPO) and the oxygen and substrate. Polifenoloksidase enzyme (PPO) which cause browning in fruit juices are often called tyroninase and cathechol oxidase.

Addition of additives such as β-cyclodextrin is used to maintain the quality of color and flavor fruit juice during storage. β-cyclodextrin molecules could be binded to the β-cyclodextrin stable inclusion complexes must have an appropriate size entirely in the β-cyclodextrin cavity. If the molecules size which bind to the β-cyclodextrin is too small, will through out of the cavity. Mechanism of β-cyclodextrin inclusion complexes are formed by trapping a substrate-containing group monophenolic and volatile flavor compounds that have proper size and shape to the β-cyclodextrin. The substrate which has contains monophenolic group and volatile flavor compounds will substitute the polar water molecules in the β-cyclodextrin cavity which is hydrophobic.

RESULTS AND DISCUSSION

Fruit juice is a fruit juice obtained from the extortion juicer machine that will be obtained liquid juice. Fruit juice during prolonged storage may decrease the quality of the color and flavor caused by enzymatic browning reactions and volatilization of flavor compounds of fruit juices. Enzymatic browning reactions will change the color of the

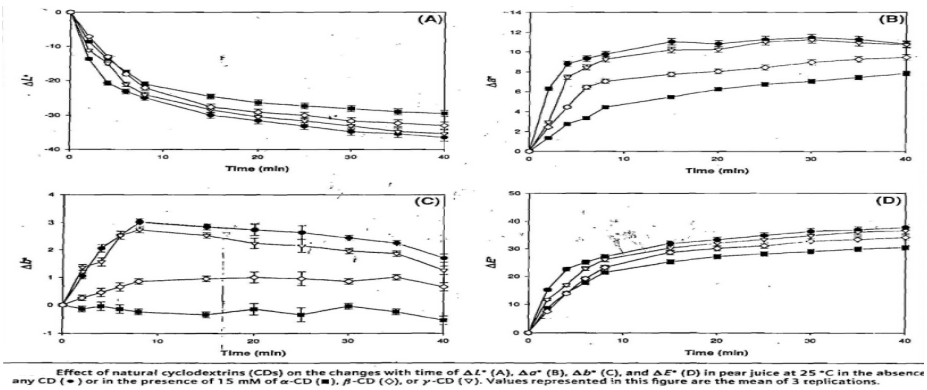
fruit turn brown so from the appearance, unattractive fruit juices to be consumed. Additives that can be used to address the problem of color and flavor deterioration during storage of fruit juice is β-cyclodextrin.

Monophenolic group-containing substrates and volatile flavor compounds of fruit juices are susceptible to enzymatic browning reactions and volatilization of flavor compounds during storage can be protected by the addition of β-cyclodextrin. The compounds that are vulnerable such as hydrocarbons, alcohols, carbonyls, acids and esters will form inclusion complexes with β-cyclodextrin, so as to maintain the quality of fruit juice during storage.

Effect of use of β-cyclodextrin on the Quality of Color Fruit Juices

Fruit juice has a group-containing substrate monophenolic so susceptible to enzymatic browning reactions when in contact with the enzyme polifenoloksidase (PPO). The addition of β-cyclodextrin on the fruit juice to form inclusion complexes between β-cyclodextrin with a substrate that has a cluster of fruit juices such monophenolic. Substrates that have monophenolic group will be bound in the cavity of β-cyclodextrin by water molecules so that there is no room for polifenoloksidase enzyme (PPO) to be able to interact with the group monophenolic. There is no interaction between the enzyme polifenoloksidase (PPO) and the substrate has monophenolic force will protect the fruit juice of enzymatic browning during storage. Effect of β-cyclodextrin on color quality pear juice and grapefruit juice during storage sequence is shown in Figure 1 and Figure 2.

ΔL * values pear juice with the addition of β-cyclodextrin for storage of 40 minutes less than pear juice without



Effect of natural cyclodextrins (CDs) on the changes with time of ΔL^* (A), Δa^* (B), Δb^* (C), and ΔE^* (D) in pear juice at 25 °C in the absence any CD (•) or in the presence of 15 mM of α-CD (■), β-CD (○), or γ-CD (▽). Values represented in this figure are the mean of 3 replications.

Figure 1. Effect of β-cyclodextrin on the Quality of Pear Juice Color with Temperature 25 ° C During StorageSource: Sevilla *et al.*, 2011

the addition of β-cyclodextrin which shows that the juice with the addition of β-cyclodextrin brighter still for storage of 40 minutes compared to the pear juice without the addition of β-cyclodextrin.

Δa * value of pear juice with the addition of β-cyclodextrin for 40 min storage lower than pear juice without the addition of β-cyclodextrin which shows that pear juice with the addition of β-cyclodextrin has a red color intensity lower than pear juice without the addition of β -cyclodextrin. Δb * values pear juice with the addition of β-cyclodextrin for 40 minutes of storage was also lower than the pear juice without the addition of β-cyclodextrin which shows that pear juice with the addition of β-cyclodextrin has a yellow color intensity lower than that without the addition of pear juice β-cyclodextrin.

The above description shows that pear juice with the addition of β-cyclodextrin for 40 minutes of storage will have a brighter color and has a red and yellow color intensity is low compared with the pear juice without the addition of β-cyclodextrin. This means that the intensity of the brown color of pear juice is reduced. Conditions pear juice color shows that pear juice with the addition of β-cyclodextrin be able to inhibit the enzymatic browning compared to controls. The ability of β-cyclodextrin to form inclusion complexes will be reduced in a certain time limit caused by β-cyclodextrin long will change the structure of the cavity and therefore can not form inclusion complexes with substrate fruit juice.

Figure 2. Effect of β-cyclodextrin Against Quality Color Mandarin Orange Juice with 4° C Temperature During Storagel

Color Coordinates

	L*			a*			b*			C_{ab}*			Color		
Storage time (d)	Control juice	Juice + β-CD	Juice + HP-β-CD	Control juice	Juice + β-CD	Juice + HP-β-CD	Control juice	Juice + β-CD	Juice + HP-β-CD	Control juice	Juice + β-CD	Juice + HP-β-CD	Control juice	Juice + β-CD	Juice + HP-β-CD
BTT*	39.9 a A*	39.9 a A	39.9 a A	28.3 a A	28.3 a A	28.3 a A	44.2 a A	44.2 a A	44.3 a A	52.4 a A	52.4 a A	52.4 a A	8.6 a A*	8.4 a A	8.8 a A
ATT*	39.5 a A	39.7 a A	39.0 a A	26.3 ab AB	25.8 be B	27.9 ab A	43.2 a A	43.4 a A	44.1 a A	50.6 bc B	50.5 b B	52.2 a A	8.0 a A	7.8 b A	7.7 b A
7	39.5 a A	39.8 a A	38.8 a B	24.9 b B	24.8 c B	26.4 b A	43.0 a AB	40.9 b B	44.1 a A	49.7 bc AB	47.9 cd B	51.4 ab A	8.1 a A	7.7 b A	7.8 b A
30	39.6 a A	40.0 a A	38.7 a B	23.9 b B	24.4 c B	26.4 b A	41.7 b B	39.3 c B	44.2 a A	48.1 c B	46.3 d B	51.4 ab A	6.5 b B	6.5 c B	7.8 b A
46	39.6 a A	40.0 a A	38.4 a B	24.0 b B	24.5 c B	26.3 b A	41.1 b B	39.3 c B	43.6 a A	47.6 c B	46.3 d B	50.9 b A	6.5 b B	6.4 c B	7.8 b A
										47.5 c B	46.2 d B	50.6 b A	6.4 b B	6.3 c B	7.6 b A

Note: Values followed by the same "small" letter, in the same column (effect of thermal treatment and storage time), were not significantly different (P <0.05), Tukey's multiple-range test Values Followed by the same "capital" letter, in the same row (effect of CD addition) and within the same coordinate color, were not significantly different (P <0.05)

It also showed the same effect of the use of β-cyclodextrin on fruit juices, although the study sample was mandarin orange juice. Value of L * (lightness), a * (Redness) and b * (yellowness) mandarin orange juice with the addition of β-cyclodextrin will produce color mandarin orange juice will have fewer enzymatic browning or brown color formation compared with no addition of mandarin orange juice β-cyclodextrin for 75 days of storage (Table 4.1). L * value of mandarin orange juice with the addition of β-cyclodextrin for 75 days storage is relatively the same as mandarin orange juice without the addition of β-cyclodextrin which shows that the mandarin orange juice with the addition of β-cyclodextrin has a brightness level similar to orange juice without the addition of β-cyclodextrin.

Value of a * and b * mandarin orange juice with the addition of β-cyclodextrin for 75 days of storage has a pattern similar to values mandarin orange juice without the addition of β-cyclodextrin, ie it decreases in value. This shows that the mandarin orange juice with the addition of β-cyclodextrin and β-cyclodextrin without the addition had the same intensity of red and yellow which decreased during storage of 75 days.

Mandarin orange juice with the addition of β-cyclodextrin and β-cyclodextrin with no increase during storage of 75 days will have a bright color and has a red and yellow color intensity is low, so the color of grapefruit juice has brown low intensity. Conditions mandarin orange juice color indicates that grapefruit juice will still undergo enzymatic browning, but at a low speed so the color is light brown during storage of 75 days.

This indicates that the substrate containing mandarin orange juice monofenolik group will be bound by β-cyclodextrin into the bay, so that the color quality of fruit juice during storage can be maintained.

Effect of use of β-cyclodextrin on the Quality of Flavor Fruit Juices

The flavor of fruit juice during storage can decrease the quality of the resulting fruit juice flavor derived from compounds that are volatile. The nature of fruit juice flavor volatiles that are causing flavor of fruit juice are easily lost during processing or during storage. Flavor fruit juices will run volatilization during storage, resulting in fruit juice will decrease the quality of the scent.

Fruit juice has a volatile compound susceptible to volatilization during

storage. The addition of β-cyclodextrin on the fruit juice to form inclusion complexes between β-cyclodextrin with volatile compounds such. The formation of inclusion complexes will be trapped volatile compounds from the fruit juice into the cavity of β-cyclodextrin. Volatile compounds of fruit juices trapped in the β-cyclodextrin cavity will be protected from unwanted scents volatilization during storage. The ability of β-cyclodextrin trap hanging fruit juice flavor compounds compliance structure of the compound with β-cyclodextrin cavity. Effect of β-cyclodextrin on flavor quality pear juice and grapefruit juice in a sequence is shown in Table 1. and Figure 3.

The flavor of pear juice with the addition or without addition of β-cyclodextrin has a noticeable difference, the more volatile compounds can be maintained even without the addition of β-cyclodextrin (Table 1.). That is because the inclusion complexes between β-cyclodextrin with volatile compounds do not occur for some volatile compounds of fruit juices which are volatile compounds have a size that does not match the size of the β-cyclodextrin cavity.

Table 1. Volatile Compounds Concentration (mg L-1) in Pear Juice During Storage.

Volatile Compounds	Control (mg L^{-1})	*β-cyclodextrin* (mg L^{-1})
1-butanol	0,80 a[A]	0,43 b
Propyl acetate	0,82 a	0,35 b
Hexanal	3,20 a	2,24 b
Butyl acetate	5,03 a	5,15 a
trans-2-Hexenal	2,54 ab	1,60 bc
1-Hexanol	0,29 c	0,23 c
Hexyl acetate	1,80 a	1,05 b
Nonanal	0,11 a	0,08 a
Hexyl 2-methylbutanoate	0,10 a	0,06 a
1-Decanol	0,91 a	0,35 b
2,4-Decadieanal	0,04 a	0,08 a
trans-α-Bergamotene	0,03 a	0,04 a
α-Farnesene	1,36 a	0,65 b
Coniferol	0,20 a	0,19 a
2-Methyl-1-butanol	0,22 b	0,22 b
TOTAL	17,4 a	12,7 b

Note: [A]values (mean of 3 replications) followed by the same letter, in the same row, were not significantly different (P<0,05), Turky's multiple range test

Source: Sevilla *et al*., 2011

Incompatibility measure volatile compounds with β-cyclodextrin cavity size is causing volatile compounds are not protected from volatilization. That phenomena will lead to the concentration of volatile compounds in pear juice during storage will be reduced.

Volatile compounds remaining higher concentration in mandarin orange juice without the addition of β-cyclodextrin than the mandarin orange juice with the addition of β-cyclodextrin (Figure 3.). This shows that the scent of grapefruit juice with the addition of β-cyclodextrin will give significantly different results without the addition of β-cyclodextrin, which is more volatile compounds can be maintained even without the addition of β-cyclodextrin.

β-cyclodextrin can not bind all fruit juice flavor volatile compounds form inclusion complexes with volatile compounds during long storage. That is because the structure of volatile compounds in fruit juice is not in accordance with the β-cyclodextrin cavity causing volatile compounds are not protected from volatilization.

That phenomena will lead to the concentration of volatile compounds in pear juice during storage will be reduced, so that the flavor of fruit juice can not be maintained during storage with the addition of β-cyclodextrin.

	Fresh mandarin flavor		
Storage time (d)	Control juice	Juice + β-CD	Juice + HP-β-CD
BTT	9.0 a A	8.0 a A	7.9 a A
ATT	8.5 b A	8.1 a A	7.3 a B
7	8.5 b A	7.7 b AB	7.3 a B
30	8.4 b A	7.8 b AB	7.2 a B
46	8.4 b A	7.5 c B	7.2 a B
60	8.3 b A	7.5 c B	7.1 b B
75	8.2 b A	7.4 c B	7.0 b B

Figure 3. Effect of β-cyclodextrin Quality Flavor Of Mandarin Orange Juice with 4 ° C Temperature During Storage

Note: Values followed by the same "small" letter, in the same column (effect of thermal treatment and storage time), were not significantly different (P <0.05), Tukey's multiple-range test Values Followed by the same "capital" letter, in the same row (effect of CD addition) and within the same coordinate color, were not significantly different (P <0.05)

Source: Navarro et al., 2011

CONCLUSIONS

β-cyclodextrin can maintain the quality of the color and aroma of the fruit juice during storage. The addition of β-cyclodextrin on the fruit juice will retain more color quality due to enzymatic browning than fruit juice aroma volatile compounds due to volatilization during storage.

Need to research on the use of β-cyclodextrin combined with other additives in order to maintain better quality of fruit juice aroma volatile compounds due to volatilization during storage.

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FOOD PROCESSING TECHNOLOGIES BEHIND THE CULTURAL HERITAGE OF SAM PO KONG RITUALS

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ABSTRACT

Sam Po Kong temple built in honor of Admiral Zheng He visited by visitors of different age, religion, place of origin, ethnic origin and the knowledge that came to pray with a variety of motives. In prayer ceremony like other indigenous traditions celebrations its also using some types of offerings. The offerings in the form of food are based on the belief that food is offered to the spirits of religious leaders. The offerings in the form of food are a common thing for the community. The background of each different visitors sometimes influence the selection of offerings are used. Visitors of different ages, religions, place of origin, ethnic origin and knowledge tend to use different types of food. The purpose of this study was to determine the type of food and beverage that were used in the offerings and the influence of different visitors' backgrounds to the choice of offerings and also the way to prepare the foods. The study was conducted by distributing questionnaires and interviews to visitors as well as the the caretakers and trustees of the Sam Po Kong. The results showed that the type of food used in Chinese New Year celebrations were moho, wajik, miku, kue keranjang, jay, samsing, ngosing, tea, orange, banana, apple, dan pear. Types of foods and beverages that are commonly used at the time of the celebration of Je It were tea, oranges, apples, and pears. And the types of food and drinks are always used at the celebration of Cap Go was lontong cap go meh, tea, and apples, whereas for Jumat-Kliwonan event, the visitors did not use the food offerings. Background visitors influence the selection of certain types of food and drink on each occasion. Each kind of food was prepared in a different way. Since the offerings at those mentioned events was sacred ritual, this paper examined the cultural aspects in the making food processes.

Keywords*: Sam Po Kong temple, food and beverage offerings, visitor's background, food processing, cultural heritage*

INTRODUCTION

Sam Po Kong is the biggest temple in Semarang. This temple was built in honor of Admiral Zheng He a traveler of Chinese Muslims who undertook an expedition cruise and some crew. Some cruise's crew stopped and settled in Semarang, and mingle with the local community (Susanto, 2006). Admiral Zheng He played a role in the spread of Islam in the area of Semarang. Admiral Zheng He's well respected by the people of Chinese descent or indigenous descent. In the Sam Po Kong religions such as Islam, Taoism, and Buddhism, mingled

and created three groups of different temples. In the first temple, which is worshiped by Admiral Zheng He Sam Po Kong Holy Cave. Meanwhile, followers of the second temple worship "Mbah juru mudi". The temple was last filled by those who want to pray to God of Earth (Safitri,).

Visitors who arrive at Sam Po Kong consisted of the inter-religious like religious visitors Confucianism, Buddhism, Catholicism, and Islam, and cross-ethnic, like visitors ethnic Chinese descent and indigenous descent (Safitri, -). Rituals were held at the temple Sam Po Kong temple is generally the same as the other, which includes the celebration Je It (the 1 calendar tionghoa), the Cap Go (15 th calendar tionghoa), and the celebration of Chinese New Year (1 month 1 calendar date tionghoa), but with the effect of Javanese tradition in this temple, there is a ritual celebration Friday Kliwon adaptation of Javanese tradition are much frequented by the Muslim visitors (Winarso, 2002).

In a ceremony praying indigenous beliefs should the other tribes, also known in Chinese ethnic several types of offerings. Ranging from the relatively mild, moderate, and high. Under the designation, the type of cultural offerings in tionghoa divided into three types, namely for the universe, the holy figures, and the ancestors. The offerings in tionghoa culture is a form of expression of gratitude and a symbol of devotion to the ancestors, nature and holy figures. Of the three types of designation are different from each well and the various ways of presentation. Shape offerings usually a fruit, food, and drinks .. The offerings of fruits such as apples, pears, and oranges while the type of food can be shaped snacks, processed foods, and vegetables. For beverage offerings typically used tea and rice wine. But to be a beverage offerings sometimes can manifest anything depending craze of the sacred and ancestral figures who prayed (Sartini, -).

MATERIALS AND METHODS

1. Research object

The object of the research is the type of food and beverage offerings in the event used as praying in the temple Sam Po Kong, Semarang, the snack consisting of moho, wajik, miku, onde, ondo, sweets, layer cake, kue keranjang, bak cang, sentiling, nagasari, cupcakes, hwat kue and turtle cake. Processed foods consist cin pork, chicken o, ca bamboo shoots, tofu pong, opportunistic, sambal goreng, jay, Samsing, and ngo sing. Consists of orange, bananas, watermelon, longan, apples, pears, pineapple, mangosteen, sirkaya, grapes, star fruit and dragon fruit. Type of drink consisting of white rice wine, tea, and water.

2. Population and Sampel

The research was conducted in the temple Sam Po Kong at the time held a prayer. The population of this study was the visitors who pray at the temple of Sam Po Kong. Sample was determined by a celebration in the temple Sam Po Kong. The celebration was divided on the celebration of the Chinese New Year, Je It, Cap Go, and Friday POND with each celebration is determined by 30 visitors drawn randomly on people who met, so that the overall total visitors was 120 visitors.

3. Data collections technique

The methods used to collect the data, namely:

- Library Study

The data and information obtained through literature books and journals to know the latest developments in research related to this study.

- Interview

Data and information obtained by going directly to the field which may be obtained through the provision of data and direct observation quesioner. Interviews filed in some people, Mr Tan Tiong Heng and Mr Sadiyo about the types of foods and beverages that are used in ritual prayer, and Mr. Ir. Priambudi the Sam Po Kong temple and the foundation.

RESULTS AND DISCUSSION

1. Celebrations at Sam Po Kong

Celebrations are the subject of research is the celebration of Chinese New Year, Je It, Cap Go, and "Jumat Kliwon". In addition to Chinese New Year celebrations held once in a year, three other celebration is a celebration held regularly every month and has involved cross-ethnic society, religion, and culture. In addition to these celebrations, there are still other big celebrations, just inside the Sam Po Kong temple rarely implemented celebration, because basically the Sam Po Kong temple was built in honor of Admiral Cheng Ho who truly embrace Islam so that the implementation of other major celebrations semeriah no other temple. Hence the celebration of Chinese New Year, Je It, Cap Go and "Jumat Kliwon" considered representative celebrations at Sam Po Kong temple

1.1. Chinese New Year celebration

According Winarso (2002), the Chinese New Year celebration held annually on 1 month 1 according tionghoa calendar. Lunar New Year is a celebration of antiquity by farmers in welcoming the spring after a winter. Chinese New Year celebrations at the temple Sam Po Kong usual enlivened by the lion dance performances, in addition, the Foundation Sam Po Kong also provide food and drinks for the people who pray.

According Handayani (2006), Chinese New Year celebrations generally followed by Chinese ethnic communities both religious Confucianism or not. This culture is the glue in the middle so that not a few people who also enjoy the indigenous ethnic celebrations. This is indicated by the height of Sam Po Kong temple during Chinese New Year celebrations. People usually come to this temple to pray. Not a few indigenous people who came to pray even if they are not religious Confucianism and Buddhism and not celebrating Lunar New Year.

1.2. Perayaan Je It dan Cap Go

Je It celebration held every 1st calendar tionghoa while Cap Go celebration performed every 15 calendar tionghoa. Both celebrations held regularly every month. No specific activities that enliven the event. On each occasion, the caretaker on duty at each temple will prepare food offerings. The strong cultural influence tionghoa use of existing offerings.

The celebration Cap Go which falls on the 15th has a different meaning when the feast falls on the 15th lunar month according to penaggalan tionghoa, which is 15 days after the celebration of the lunar new year. The celebration is called the Cap Go Meh. In celebration of Cap Go Meh special meals are usually provided lontong Cap Go Meh is usually composed of "opor" and "sambal goreng". Use lontong Cap Go Meh is the result of acculturation tionghoa-Javanese culture.

1.3. Perayaan Jumat Kliwon

"Jumat Kliwon" celebration is a celebration of tradition, adapted from Java. Friday Night Kliwon considered sacred by indigenous people. Many visitors come both from outside Semarang and Semarang. Visitors from outside Semarang usually stay at the pagoda.

2. Characteristics of visitors

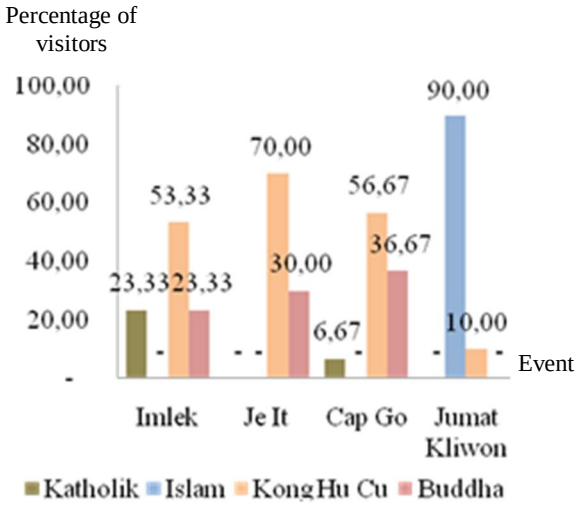

Figure 1. Percentage of visitor's religion

Based on the figure above, it can be seen that the visitors who come and celebrate Chinese New Year with prayers at Sam Po Kong temple is a religious visitor Confucianism with the highest percentage of 53.33% and Buddhism and Catholicism have the same percentage is 23.33%. Visitors celebration Je It was the visitors

who are Confucianism with percentages 70% and Buddhism with a percentage of 30%. Visitors who come and celebrate Cap Go to pray at the temple of Sam Po Kong was the visitors who are Confucianism with the highest percentage of 56.67% and Buddhism as well as the percentage of Catholics who had 36.67% and 6.67%. Based on the picture above, it can be seen that the visitors who took part in the celebration Friday night Kliwon to pray in the temple Sam Po Kong was the visitors who are Confucianism with a percentage of 10% and the religion of Islam with a percentage of 90%.

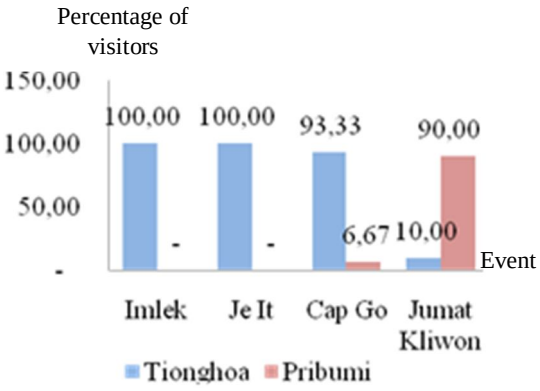

Figure 2. Percentage of visitor's ethnic

In Figure 2 we can see that the Chinese New Year celebrations and Je It, all visitors who come have a Chinese ethnic, while on the Cap Go and "Jumat Kliwon" visitors who come have a Chinese ethnic and indigenous. In celebration of Cap Go, visitors have a percentage of the Chinese ethnic indigenous ethnic 93.33% while 6.67% have a percentage. Unlike other festivals, celebrations Friday Kliwon have visitors indigenous ethnic majority with 90% while the percentage of visitors with only 10% of the Chinese ethnic.

With the visitors of different religions and different ethnicities, it is shown that the Sam Po Kong temple is not only visited the Confucian religious and ethnic tionghoa descendants are closely related to the temple, but also visited by people across religious and inter-ethnic.

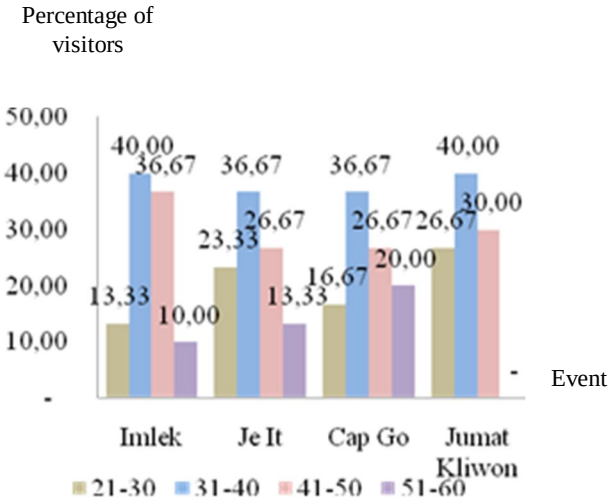

Figure 3. Persentase usia pengunjung

In Figure 3 shows that on each occasion in the temple Sam Po Kong, visitors who have a range of 21-30 years of age with the highest percentage of visitors who came to the celebration "Jumat Kliwon" is equal to 26.67%, while those with the lowest percentage of visitors who Chinese New Year celebrations come at the rate of 13.33%. In celebration of Je It and Cap Go

visitors with a range of 21-30 years of age have a percentage of their respective 23.33% and 16.67%. Visitors who have a range of 31-40 years of age had the highest percentage on each occasion. In celebration of Chinese New Year and "Jumat Kliwon", the number of visitors to the age range of 31-40 years some 40%, while for the celebration Je It and Cap Go has a percentage of 36.67%. Visitors with an age range of 41-50 years visitors with the second highest percentage. The percentage of visitors with a range of age 41-50 years were highest for visitors who come during the celebration of Chinese New Year, with a percentage of 36.67%. The second highest was the visitors who came during the "Jumat Kliwon" celebration with a percentage of 30%. In celebration Je It and Cap Go, visitors to the 41-50 age range mmiliki same percentage is 26.67%. Visitors to the percentage of visitors age 51-60 years is the lowest percentage in the overall celebration except on the Cap Go where visitors to the percentage aged 21-30 years had a lower percentage than the visitor with age range 51-60 years. The highest percentage of visitors who have a range of age 51-60 years were visitors at the celebration of Cap Go is 20%. In celebration of Chinese New Year and Je It, visitors with a range of 51-60 years of age have a percentage of respectively 10% and 13.33%, while the celebration Friday Kliwon, no visitors around the age of 51-60 years.

The percentage of visitors age 21-30 years is not so high compared to other age ranges, but by the presence of young diners, indicating that the younger generation is still active in following celebrations there.

3. Foof offerings

Table 1. Percentage of snack used

Snack	% of using from 30 visitors		
	Imlek	Je It	Cap Go
Moho	100.00	76.67	86.67
Wajik	100.00	53.33	60.00
Miku	100.00	73.33	90.00
Onde	56.67	0	0
Ondo	43.33	0	0
Sweets	100.00	60.00	76.67
Layer cake	50.00	36.67	43.33
Kue keranjang	100.00	0	0
sentiling	0	20.00	16.67
Nagasari	23.33	10.00	10.00
Cupcake	76.67	50.00	76.67
Watkue	56.67	46.67	16.67
Kue kura	76.67	0	16.67

From the above table it is known that type of snack which is used by visitors who pray during Chinese New Year celebrations are moho, diamonds, miku, sweets and kue keranjang with a percentage of 100%. At the time of the Je It celebration snack used is moho, diamonds, miku, sweets, cake layer, sentiling, nagasari, cupcakes, and hwat kue. From the type of snack, the most widely used is the percentage moho 76.67%, with a percentage of 73.33% miku and sweets with a percentage of 60%, wajik

with a percentage of 53.33%, cupcakes with a percentage of 50%, hwat kue with percentage of 46.67%, layer cake with a percentage of 36.67%, sentiling with a percentage of 20%, and the with a lowest percentage was 10% is nagasari. At the time of the celebration of Cap Go is moho, wajik, miku, sweets, cake layer, sentiling, nagasari, cupcakes, hwat kue and turtle cake. The most widely used is the percentage of 90% miku, moho with a percentage of 86.67%, sweets and cupcakes with a percentage of 76.67%, wajik with a percentage of 60%, layer cake with a percentage of 43.33%, sentiling, hwat cake, and turtle cake with a percentage of 16.67%, and the lowest was 10% is nagasari.

Table 2. Percentage of processed food used

Processed Foods	% of using from 30 visitors		
	Imlek	Je It	Cap Go
babi cin	50.00	0	0
ayam o	50.00	0	0
ca rebung	43.33	0	0
tahu pong	36.67	0	0
opor	30.00	0	100.00
sambal goreng	30.00	0	100.00
jay	100.00	26,67	40.00
sam seng	100.00	63.33	66.67
ngoseng	100.00	0	0

From the above table it is known that processed foods commonly used by people who pray during Chinese New Year celebrations is jay, sam sing and ngo sing with a percentage of 100%. Types of processed foods that are commonly used by people who pray at the celebration Je It is jay with a percentage of 26.67% and sam sing with a percentage of 63.33%. From the above table it is known that processed foods commonly used by people who pray at the time of the celebration of Cap Go is opportunistic with percentage 100%, "sambal goreng" with a percentage of 100%, jay with a percentage of 40% and sam sing with a percentage of 66.67%.

Several types of fruit used routinely at each event, including oranges, apples, pears must have meaning. Meaning in the food offerings are divided into several major elements that are represented in any food either through the form, name, and content. These elements include health, happiness, prosperity, and a symbol of life.

- Health

Type of food offerings that represent the elements of health including kue ku or turtle cake that has meaning longevity based shape resembles the shape of a turtle, and miku that has meaning long life and bananas and oranges (kuo bhin) that have meaning to ask safety is seen by its name.

- Happiness

Types of offerings that represent elements of happiness are citrus, cupcakes, moho, and hwat kue. Oranges (kiet) presented no meaning adjacent to banana bliss. Cupcakes, moho, and hwat kue has

meaning hopefully what will be planted will bear fruit or bloom into happiness is seen through its bloom like flowers.

- Prosperity

Types of offerings that represent the element of prosperity such as layer cakes, wajik, babi cin, oranges, watermelon, apples, pears, pineapple, grapes, starfruit, sirkaya, and dragon fruit and kue keranjang. Layer cake meaning luck that layered views of its layers. Wajik have meaning that an ideals should be as sky-high represented by the cone shape. Babi cin has sufficient meaning. Orange, watermelon, apples, pears,, grapes, starfruit, sirkaya, and dragon fruit has a wealth of meaning represented by the number of seeds. Kue keranjang has a meaning that increasing success each year.

- Symbol of life

Types of offerings that have meaning associated with life such as wajik, sweets, sam sing and ngo sing, "ayam o", "Ca rebung", "tahu pong", "jay", oranges, and watermelon. Wajik have a meaning other than that contained elements of prosperity also contains the meaning given that humans came from one of the above. Sweets meaning that life is sweet. Sam sing and ngo sing is representative of the animals that live on land, water, and air. "ayam o" has the meaning of life on earth there are bad parts. "Ca rebung" have meaning set goodness in life. "tahu pong" meaning know that nature between the living and the dead is different. Jay has the meaning given ancient times when life was full of difficulties. Oranges and watermelon has a lot of water content which is a symbol of life.

4. The course of tradition

Regular offerings of snacks purchased in specialty stores that serve food orders used in tionghoa tradition while offerings of common processed foods made himself even though sometimes there is a buy. With the specialty stores showed that the existence of the tradition is still carried tionghoa hereditary and institutionalized in society.

CONCLUSION

From the research that has been done can be concluded that the Sam Po Kong temple is one of the places where the interaction between people from different religious and ethnic groups. The existence of young visitors shows that tradition is conveyed from generation to generation and maintained continuity.

Food offerings are used in every ritual has a good sense of the shape and namannya. The food offerings in the form of regular snacks available at specialty stores that sell foods that are used in tionghoa tradition. It shows

that this tradition has been institutionalized in society.

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EXTRACTION OF C-PHYCOCYANIN FROM MICROALGAE *Spirulina sp* AND ITS UTILIZATION FOR ANTIOXIDANT

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ABSTRACT

Diabetes Mellitus or DM is a disease caused by an increase amount of glucose in blood due to lack of insuline hormone. Usually, people consume drug to prevent it. A longterm drug consumtion will lead to kidney failure.. One of the available alternatives to cure disease by consuming natural ingredients like C- Phycocyanin. C- Phycocyanin had been proved to have a therapist pharmacologist function such anti oxidant, anti inflamation, hepatoprotective, and neuroprotective. The purpose of this research was to study the influence of temperature and solvent:biomass ratio (w/v) and to compare C- phycocyanin concentration obtained from vacuum and centrifuge separation. The method used for this research was by extraction Spirulina solved in methanol for 1 hour. The result shows that the optimum C- Phycocyanin quality obtained from extraction at temperature 25-40^{0}C and the optimum solvent : biomass ratio at 1:75.

Keywords : *Diabetes mellitus, Extraction, Phycocyanin, Spirulina, Temperature*

INTRODUCTION

Diabetes mellitus (DM), also known in Indonesia in terms of sugar diabetes is a metabolic disorder caused by many factors, one of which is a deficiency of insulin secretion/insulin activity, and both are glucose transporter deficiency (World Health Organization, 1999). Currently diabetes disease prevention efforts have not occupied the main priorities in health care, despite the known negative impacts caused considerable between other chronic complications of chronic heart disease, hypertension, brain, system nerves, heart, eyes and kidneys. One of microalgae that can be used to prevent diabetes is spirulina.

Microalgae have long been a source of high protein food for human consumption. Microalgae are autotrophs organisms that grow through the process of photosynthesis like plants in general. Microalgae can flourish and form a high density using only sunlight, carbon dioxide, water, and other inorganic compounds (John et al., 2011). Spirulina sp included in the class of blue-green algae that has been used as a source of protein, vitamin supplements and health drinks (Madhyastha, et al., 2006; Sarada, et al., 1999). Spirulina has a wealth of perfect nutrition, contains 25 kinds of vitamins and minerals for the health and longevity, body regulation, removal of toxins and strengthen the immune system.

Spirulina sp contains chemical compounds that can stimulate the formation of red blood cells and white blood plays an important role in the immune system. Chemical compounds are known to form dark blue pigments, namely C-Phycocyanin (Kozlenko and Henson, 1998). C-Phycocyanin can be used in foods and cosmetics as the dye, because the C-Phcocyanin are non-toxic and non-carcinogenic. C-Phycocyanin is also used for the prevention of diabetes because it contains high antioxidants.

Based on previous studies it is known that the cells of Spirulina platensis biomass will be much more soluble in polar solvents, such as water and buffer solution (buffer) compared to the less polar solvents such as acetone or chloroform. Changes in the amount of solvent used during C-Phycocyanin extract greatly affect the outcome of the extract obtained, the things that may be affected include the number of C-Phycocyanin obtained, as well as the stability of the extract.

Currently, the extraction of C-Phyocyanin of microalgae is not maximized, because the process of cultivation and extraction is not optimal, so research is required to optimize the acquisition of C-Phycocyanin in quantity and high purity. The purpose of this study is to examine the influence of the ratio of biomass: solvent (w / v), and analyzed the effect of extraction temperature on the purity of the resulting C-Phycocyanin.

MATERIALS AND METHODS

Material

Initial cultivation of Spirulina microalgae using seeds of sp C-Biore Bioproess Laboratory Chemical Engineering UNDIP. Cultivation done in batch and fed batch reactor. The best results are applied to the open ponds. The tools used are used in the form of glass beaker, erlenmeyer flask with different volume, extractor equipped with a stirrer stirrer, centrifuges, vacuum pumps, and spectrophotometry.

Variable

Variable fixed: Methanol solvents 0.1 M; extraction time of 1 hour. Variables change: temperature (25, 40.54) ^{0}C and biomass Ratio: solvent (w / v) ie (40,75,135) ^{0}C

Methods

Experimental procedure include microalgae cultivation, harvesting, extraction, and analysis Phycocyanin.

Analysis of C-Phycocyanin

Purity C-Phycocyanin

Analysis using spectrophotometry, the value of C-Phycocyanin purity is defined as the ratio of absorbance at a wavelength of 620 nm and 340 nm (A620/A340) nm.

RESULTS AND DISCUSSION

Effect of Biomass Ratio: Solve (w / v) of the Purity C-Phycocyanin

Biomass is dried Spirulina sp.Biomass used for Spirulina sp Phycocyanin extracted to obtain. Variable ratio used in this study are 1:40, 1: 75 and 1; 135. Absorbance indicates the amount of pure C-Phycocyanin. The higher the absorbance, the higher the purity of C-Phycocyanin contained in Spirulina sp.

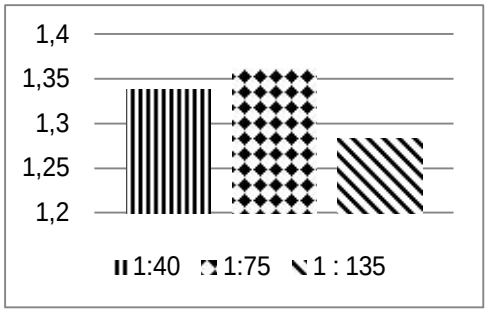

Figure 1. Purity C-Phycocyanin at a temperature of 40 Oc and Fed Batch Operation

From Figure 1 it can be seen that the optimum ratio of biomass to produce levels of C-Phycocyanin most temperature is 40o C 1:75. This is due to the high absorbance before experiencing a decline due to the ratio of 1:135 kejenuhan.Pada generated C-Phycocyanin low due to the amount of biomass is already happening saturation. Saturation causes a number of C-Phycocyanin extracted become inefficient. Saturation occurs because the amount of material extracted exceeds the ability of a given amount of solution. The ratio of the volume of extracting solution to the volume of extracted material is a factor affecting the extraction (Grima et al. 2004).

Effect of temperature on purity of C-Phycocyanin

Factors that affect the rate of extraction are: the type of sample preparation, extraction time, the quantity of solvent, solvent temperature, and type of solvent. Absorbance indicates the amount of pure C-Phycocyanin. Value of C-Phycocyanin purity is defined as the ratio of absorbance

at a wavelength of 620 nm and 340 nm (A620/A340) nm. The higher the absorbance, the higher the purity of C-Phycocyanin contained in Spirulina sp.

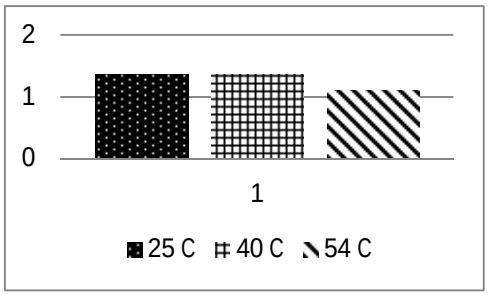

Figure 2. The relationship between the temperature of the purity C-Phycocyanin

From Figure 2 it can be seen that the levels of C-Phycocyanin are optimum at temperatures between 25-40 oC. . Phycocyanin levels will increase with increasing temperature, but once it reaches a certain point will decrease. This is because the reaction rate will increase with increasing reaction temperature, but if the reaction temperature is too high then the antioxidants contained in Phycocyanin be damaged. C-Phycocyanin antioxidant damage due to heat-sensitive nutrients, high temperatures (Berk 2009) At the time of extraction reaches an optimum point indicates that at the time of the Phycocyanin has been widely separated from spirulina cell structure, temperature changes in the extraction process has been optimized to be able to let go of Phycocyanin of the cell structure. As in the study Duangsee (2009) which showed a decrease in absorbance due to the temperature rise but not significantly until the temperature 68o C at pH 4-5. Phycocyanin which expands the molecular structure of the resulting protein (phycobiliprotein) the clot by increasing temperature.

CONCLUCION

.Extraction of Spirulina sp produce C-Phycocyanin. C-Phycocyanin Purity can be measured using the spectrophotometric absorbance 620/340 nm. On the substance of C-Phycocyanin extraction using methanol solvent with variable temperature and ratio shows:

1. The ratio of biomass to produce the most optimum levels of C-Phycocyanin most temperature is 40o C 1:75. This is due to the high absorbance before experiencing a decline due to saturation.
2. Levels of C-Phycocyanin are optimum at temperatures between 25-40 oC. . Phycocyanin levels will increase with increasing temperature, but once it reaches a certain point will decrease.

ACKNOWLEDGEMENTS

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EFFECTIVENESS INDIGENOUS COMPONENT LACTOPEROXIDASE SYSTEM IN MILK

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ABSTRACT

Lactoperoxidase is an enzyme that is available naturally in milk. Lactoperoxidase (LPO) can serve as an antimicrobial agent when combined with a compound of hydrogen peroxide (H_2O_2) and thiocyanate ion (SCN^-) establish a LPO system to produce compounds hypothiocyanite ion ($OSCN^-$). During long storage, LPO system in milk decreases so that the LPO system becomes unstable inhibiting the growth of microbes in the milk. The results showed from the beginning of milking up to the 3rd hour after the milking, the activity of three components decreased. The decrease of H_2O_2 compounds, SCN^- and LPO from the beginning to the 3rd hour after milking was due to the using of the three components to form the LPO system that produces compounds $OSCN^-$. At hour 3 to 6 after milking, H_2O_2 and SCN^- in the milk increased but LPO activity decreased. Therefore, it is necessary that the addition of LPO so lactoperoxidase system is formed and stable.

Keywords: *milk, hydrogen peroxide, thiocyanate, lactoperoxidase*

INTRODUCTION

Lactoperoxidase is enzyme in the milk. Lactoperoxidase is one of the most prominent enzyme in cow's milk. This enzyme catalyzes the peroxide and the thiocyanate (Kussendrager and Hooijdonk, 2000). Lactoperoxidase has the ability to catalyze specific molecules such as hydrogen peroxide. Lactoperoxidase inhibits microbial growth (Marshall, 2004, Kussendrager and Hooijdonk, 2000). Lactoperoxidase is an enzyme found the most in the dairy cow. The nature of this enzyme is stable in hot temperature and its activity is remained even after being pasteurized at a temperature of 63°C for 30 minutes but it can be broken at a temperature of 80°C for 2,5 seconds (Suleiman *et al*., 2009).

Thiocyanate ion is one of the components required to enable the lactoperoxidase system. Cow's milk naturally contains thiocyanate, but it has a low level of concentration so that it should be added more

thiocyanate to enable the LPO system (Firman *et al*., 2002, Legowo *et al*., 2009). Thiocyanate ion is on the glandular secretion. The concentration of SCN^- depends on feed. SCN^- concentration in cow's milk and blood serum levels reflect the amount various depending on the type of the species, the health condition and the type of feed (Kussendrager and Hooijdonk, 2000, Seifu *et al*., 2007, Suleiman *et al*., 2009).

Hydrogen peroxide is the third component of the lactoperoxidase system (FAO, 1999).. Lactobacillus, Lactococcus and Streptococcus under aerobic conditions can produce H_2O_2 to activate the LPO system. Hydrogen peroxide can also be provided exogenously by the addition of sodium perkarbonat and magnesium peroxide (Kussendrager and Hooijdonk, 2000).

LPO system is contained antimicrobial systems in milk and used to preserve milk, especially in conditions without refrigeration (Asaah *et al*., 2007, Defabachew, 2003, Seifu *et al*., 2005, Saad, 2008). LPO system consists of three components; LPO, thiocyanate and hydrogen peroxide. LPO system will be activated if all three components are available (Seifu *et al*., 2005).

During the long storage, the enzyme lactoperoxidase is not last longer so LPO system is unstable and can not produce $OSCN^-$ as an antimicrobial agent. Therefore, a research on the existence of the three components of the LPO system; LPO, SCN^- and H_2O_2, for 6 hours of storage is needed, so we know the effectiveness of the three components of the LPO system in maintaining the quality of milk by establishing a stable LPO system.

MATERIALS AND METHODS

Fresh milk was provided by the farm of Faculty of Animal Science and Agriculture UNDIP. Lactic acid and rennet was used to make whey. Ferric nitrate solution, ABTS, LPO and H_2O_2 acted as a reagent to determine the levels of SCN^-, H_2O_2 and LPO in the sample.

Sample Preparation of SCN^- and H_2O_2 analysis

As much as 15ml of fresh milk was poured into a sealed container and stored at 30°C. Storage was conducted for 6 hours and each hour was taken to be tested levels of SCN^- and H_2O_2 with acidified using lactic acid to pH 4.4 and then heated in a water bath at 80°C for 1 min. After 1 minute, remove the liquid by using a sediment filter cloth. Filtrate formed was ready for SCN^- and H_2O_2 analysis.

Sample Preparation of LPO analysis

As much as 15ml of fresh milk was poured into a sealed container and stored at 30 ° C. Storage was done for 6 hours and each hour milk was taken to be tested the LPO activity

with acidified using lactic acid to pH 5.9 and then heated in a water bath at 30 ° C for 40 min and added rennet 2% (w/w). After 40 minutes, remove the liquid by using a sediment filter cloth. Filtrate formed was ready for LPO activity analysis.

SCN^- Procedures

SCN^- procedures was based on the method Pruitt *et al.* (1990) in the Al-Baarri *et al.* (2010) with modifications. 10 grams Fe $(NO_3)_3.9H_2O$ was dissolved in 20 ml of HNO_3 in the glass beaker. The solution was put in a flask and added distilled water to 200 ml. 100 mL of sample was added 900µl ferric nitrate solution and then inserted into the cuvette and read absorbance. Absorbance was measured at a wavelength of 460nm using a spectrophotometer. SCN^- levels were determined by the ratio of the sample standard curve of solutions SCN^- levels that had been identified the concentrations.

H_2O_2 Procedure

H_2O_2 method was based Al-Baarri *et al.* (2010). 10µl LPO was poured into the cuvette added with 450µl of sample and 450µl of 1 mM ABTS solution. Enzymatic reaction was awaited for 20 seconds and then read absorbance. Absorbance was measured at a wavelength of 412nm. Levels of H_2O_2 sample was determined by comparison of the standard curve of identified solution of H_2O_2 levels.

LPO activity Procedure

LPO activity was based on the method of Al-Baarri *et al.* (2010) with slight modifications. 10µl of sample plus 0,55mM H_2O_2 450µl and 1 mM ABTS 450µl. The three solutions was placed into 1 ml cuvette. Enzymatic reaction was lasted for 20 seconds, after 20 seconds the absorbance was measured. Absorbance was measured at a wavelength of 412nm. LPO enzyme activity expressed the amount of enzyme required to oxidize 1µml ABTS/min. ABTS molar coefficient at 412nm was $32400M^{-1}cm^{-1}$.

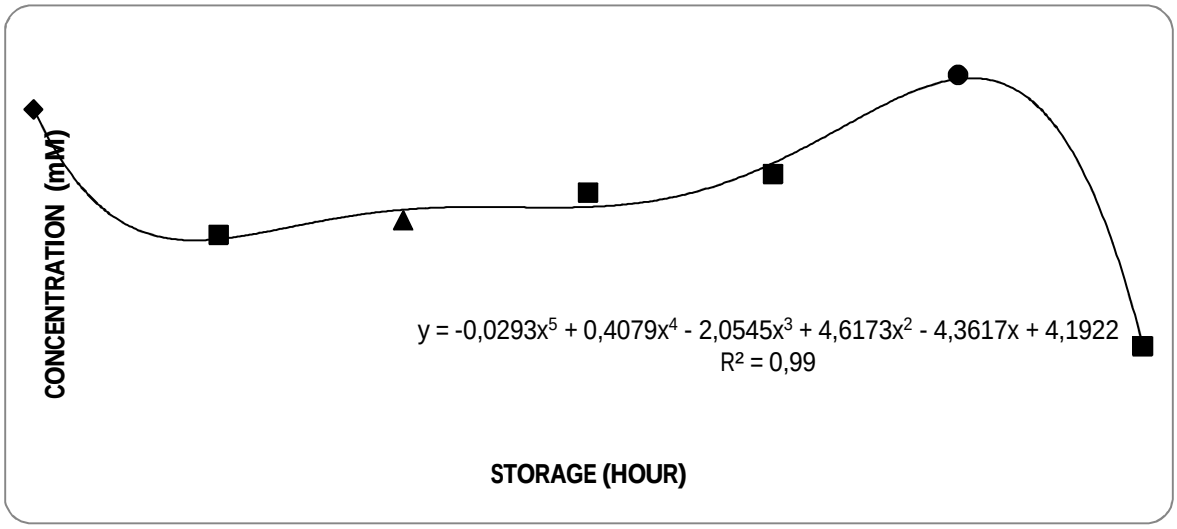
RESULTS AND DISCUSSION

The results of this study showed levels of SCN^-, H_2O_2 and LPO activities in milk stored for 6 hours.

The concentration of SCN^- in milk

Figure 1 shows the concentration of SCN^- in the milk.

Figure 1. The concentration of SCN^- in milk



Milk was stored for 6 hours and then measured the concentration of SCN^-. SCN^- concentration in milk at the 0, 1st , 2nd , 3rd , 4th , 5th and 6th hour were 4.18 mM; 2.82 mM; 2.97 mM; 3.28 mM; 3.48 mM; 4.56 mM and 1.60 mM. SCN^- is a chemical component in milk that has about 1 mM to 7mM of amount. The results showed levels of SCN^- in the milk was not too low, but at the 6th hour of storage levels in the SCN^- is the lowest in milk. SCN^- levels in milk are affected livestock feed eaten. SCN^- concentration in milk varies depending on the type of feed, type of species and state of health (Kussendrager and Hooijdonk, 2000, Seifu *et al*., 2007, Suleiman *et al*., 2009). SCN^- concentration in dairy cows ranges from 6.0 to 10.2µg/ml. Variations of SCN^- concentration in milk is influence by lactation process (Fonteh *et al*., 2002).

The data showed that the SCN^- in the milk stored for 6 hours did not significantly change although at the 0 to 3rd hour decreased. SCN^- decline in milk is likely to be used to establish the LPO system along with the LPO and H_2O_2, so at the initial milking up at the 3rd hour, SCN^- decreased. Thiocyanate ions is one of the components of the LPO system that produces OSCN. Supply SCN^- and H_2O_2 is required to activate the lactoperoxidase system to maintain the quality of fresh milk (Fonteh *et al*., 2002).

At 4th hour of storage, the SCN^- in the milk increased slightly up to the 5th hour and finally at the 6th hour, SCN^- decreased. SCN^- levels in milk increased from the 4th to 5th hour because the SCN^- was not used to establish LPO system so that the SCN^- starts

to increase although not dramatically increase.

The concentration of H_2O_2 in the Milk

Figure 2 shows the concentration of H_2O_2 in the milk

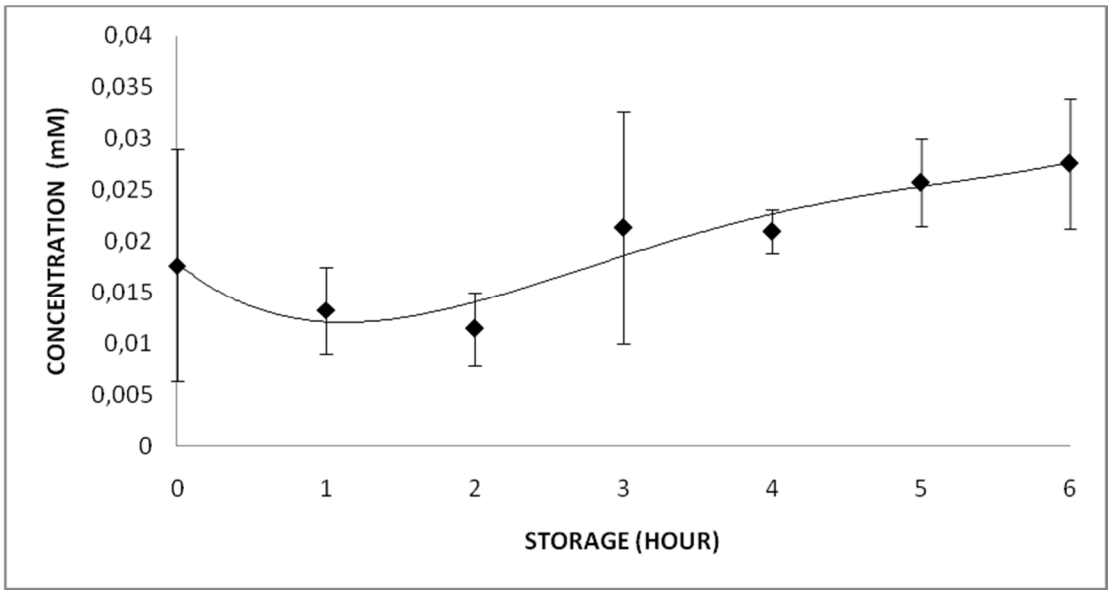


Figure 2. The concentration of H_2O_2 in the milk

H_2O_2 is a chemical compound present in the mammary gland. H_2O_2 in high quantities is toxic to mammalian cells, but when concentration is low and when LPO enzyme and SCN^- are available, the cells can be protected from toxic (Seifu *et al*., 2005).

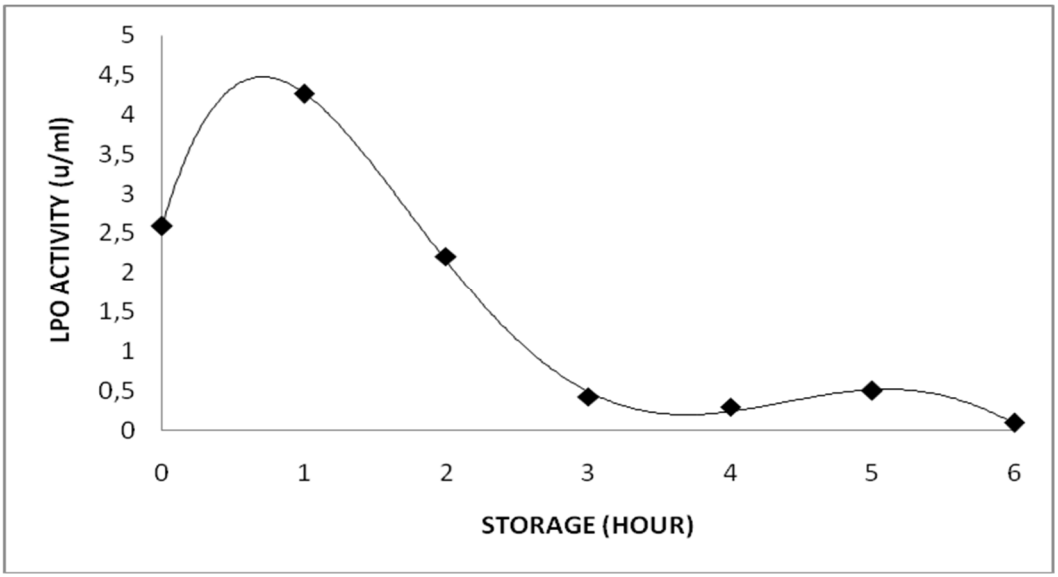
Graph 2 shows the levels of H_2O_2 in the milk from the 0 storage up to 3rd decreased. H_2O_2 at the 3rd to 6th hour of storage in milk increased. Decrease H_2O_2 at the 0 to 3rd hour in storage because SCN^- and H_2O_2 is used to form LPO systems that produce OSCN. Hydrogen peroxide is the third component of the lactoperoxidase system (FAO, 1999).

Compounds H_2O_2 will oxidize SCN^- with enzymes to decompose. After 3 hours of the storage period, H_2O_2 increased because H_2O_2 was not utilized to form the LPO system. This occured because the enzymes LPO activity in the milk began to decline at the 3rd to 6th hour so there was no separation of H_2O_2.

LPO activity in milk

Figure 3 shows that the LPO activity in milk from the 0 to 6th hour of the storage period has decreased drastically. LPO is known as enzyme when combines with SCN^- and H_2O_2 will form the LPO system.

Figure 3. LPO activity in milk



LPO activity in the 0 hour was as much as 2.7778 U / ml, in the 1st hour up to 4.4444 U / ml and then it gradually decreased to 0.4259 U / ml in the 5th hour of the activities. The decline in the activity occured because LPO was used as a catalyst for the establishment of the LPO. LPO system that is formed will produce OSCN as antimicrobials in the milk so that the milk has good quality. This enzyme catalyzes the peroxide and the LPO thiocyanat (Kussendrager and Hooijdonk, 2000). LPO system has the potential to control the growth of pathogenic microbes in the cow milk and goat milk (Seifu *et al*., 2004, Dajanta *et al*., 2008). LPO system is bactericidal against L. monocytogenes and Br. Melitensis besides, LPO also has the ability bacteriostatic against E. coli in goat milk (Seifu *et al*., 2004). Active LPO system can reduce microbial population in fresh milk. LPO system gives antimicrobial effect in fresh cow milk (Dajanta *et al*., 2008).

LPO activity may also decrease due to the components that inhibit the activity of LPO in the milk, one of which is lactose. According to Al-Baarri *et al*. (2011) lactose is acted as an inhibiting factor of LPO performance in whey. LPO activity decreases as concentrations of thiocyanate increases. LPO enzyme activity is absent when the concentration of thiocyanate increases to 6mM. Components in the milk that also affect the activity of LPO is casein. LPO will last in buffer solution (Fonteh *et al*., 2005).

CONCLUSION

Based on these results, it was concluded that the presence of the three components of the LPO system, SCN^-, H_2O_2 and LPO, is

effective in the milk from the beginning up to the 3rd hour after milking. However, from the 4th to 6th hour after milking, the three components of the system are not effective in milk because it can not form the LPO system that can produce $OSCN^-$ so that the quality of the milk will be dropped. Therefore, it is needed to add one component of the LPO system that is LPO enzyme at the beginning hour so that the three components of the system are able to form a stable LPO and produce $OSCN^-$ as antimicrobial agent that works to maintain the quality of milk so it can last for more than six hours after the milking.

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THE CHARACTERISTIC OF MOISTURE RETENTION OF TWO VARIETIES OF CHILI (Capsicum annuum L.) DURING DRYING WITH SOLAR TUNNEL DRYER

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ABSTRACT

In Indonesia, chili (Capsicum annuum L.) is always produced as mass production every year. In dry land, the planting begins in early rainy season, whereas irrigated land the planting begins in the late of rain season. This phenomenon brings peak season of chili production at certain months. When the maximum production happens, the prices of chili will extremely low. Therefore, it has to be found the practical way to stabilize the price. Drying method could be a way to solve this. Because, except fresh chili, the need of dried chili in Indonesia also high. Drying method with dehumidifier is commercially standard operation for industry. But it is relatively expensive. There is a traditional and relatively cheap method that is sun drying method that is modified with heat receptor and heat accumulator, which is called Solar Tunnel Dryer (STD). This research aimed to determine the characteristic of moisture retention in two varieties of chili by using STD with dehumidifier as the standard of drying. Two varieties of chili, i.e. red and green chili, with differ in their skin thickness, was dried in STD under hot summer day and dehumidifier as the control. To oversee the characteristics of these two varieties, mathematical modeling using 2 methods were applied. The first was differential technique, to determine critical time moisture retention of the two varieties of chili. The second one was integral technique, to describe the characteristic of moisture retention accumulation. Based on these two analyses, it can be found that the thickness of the chili fruit played critical time in moisture retention; the thicker the chili, the longer time is needed to reach its critical time, whereas in the accumulation of moisture retention, the thinner chili fruit, the smaller heat accumulation was needed than the thick one.

Key words: *chilli fruit, drying, Solar Tunnel Dryer, water retention, differential, integral, mathematical modelling*

INTRODUCTION

Chili (Capsicum annum L.) is a commodity of agribusiness that have huge influence of Indonesia economics. This commodity included in the ranks of the largest contributors to inflation that occurs every year. When harvest time comes, chili peppers will be abundant so prices are relatively very cheap but when the harvest season ends, the chili will be difficult to obtain, and if there is then are relatively

more expensive. This is partly due to A practical way to solve this problem is by drying. The principle of drying is evaporating the water content in the material. Dried chillies can be done with natural processes or by using the tool. Examples of tools used for drying include oven, dehumidifier, solar tunnel dryer, etc. Drying method with dehumidifier is commercially standard operation for industry. But, this method is relatively expensive. To mass usage, it is better to use other methods. There is a traditional and relatively cheap method can be used. The method is sun drying method that is modified with heat receptor and accumulator. This method is called Sollar Tunnel Dryer (STD).

This research focuses on the efficient use of dehumidifier and Solar Tunnel Dryer. The content measured every one hour.

difficult chillies kept in a fresh state. effectiveness of drying method depends on many factors, one factor that is affecting is the thickness of the skin on the pepper varieties. This study use two levels of skin thickness chilli from 2 different varieties.

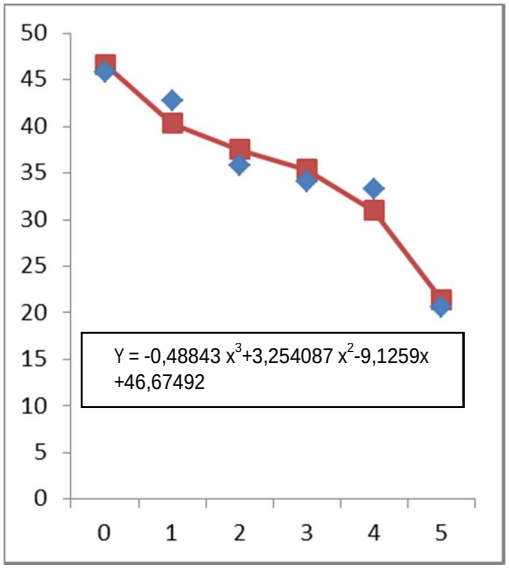
Materials and Method

The study was conducted at the UNIKA Soegijapranata laboratory in late of October. The chili pepper, *Capsicum annuum* and *Capsicum frutescens* obtained from traditional market in Karang Rejo, Semarang. The drying process carried out for 5 hours, from 9 am to 3 pm.

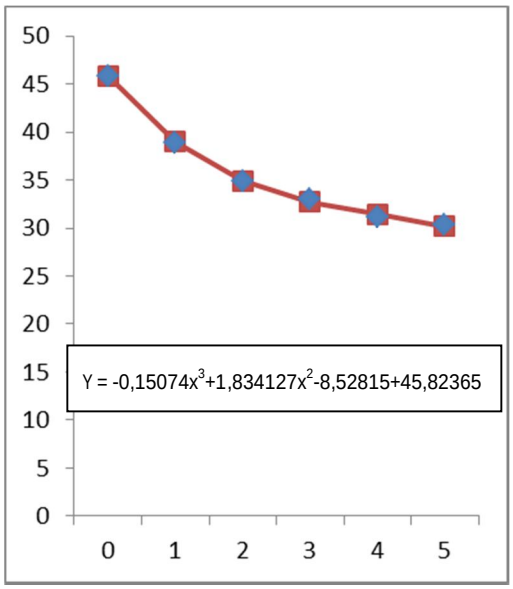
Measurement of water content

At first, the water content in fresh chili was measured by using moisture balance. The chili were place in Solar Tunnel Dryer and Dehumidifier for five hours and the water

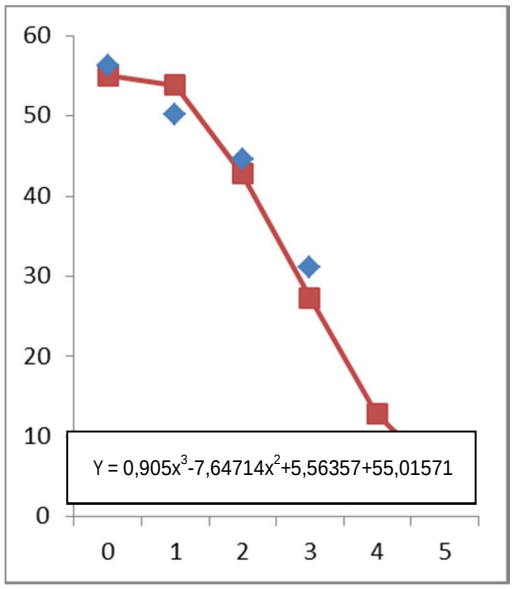
RESULT AND DISCUSSION



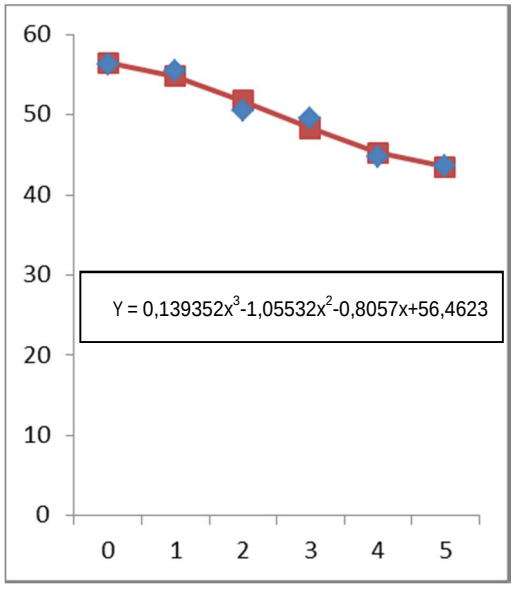
Graph 1. F(x) Red Chili in STD



Graph 2. F(x) Red Chili in Dehumidifier



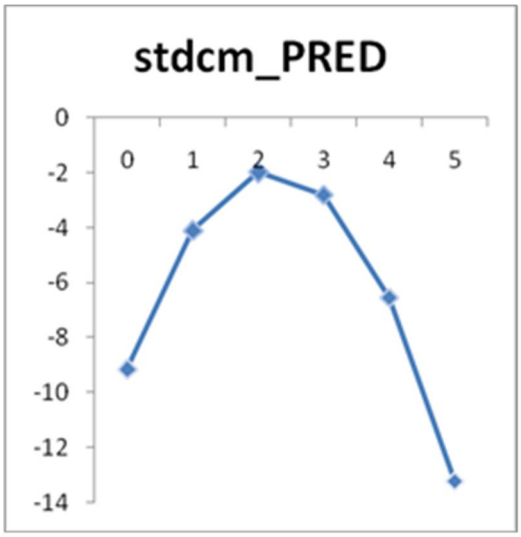
Graph 3. F(x) green chili in STD



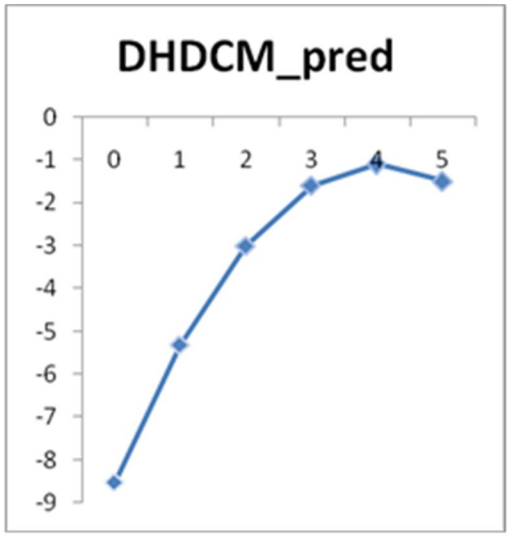
Graph 4. F(X) Green Chili in Dehumidifier

The charts above show us the water retention of green and red chili in Solar Tunnel Dryer (STD) and Dehumidifier for 5 hours, from 10 am – 3 pm. When STD is used, green chili is drier than the red one. But, when dehumidifier is used, red chili is drier than the green one. The retention of chili in STD is more significant than drying with dehumidifier. Drying with dehumidifier as a standard has an insignificant pattern in drying. Red chili has a significant retention from the 4th to 5th hour, whereas green chili has a significant retention from the 1st to 4th hour.

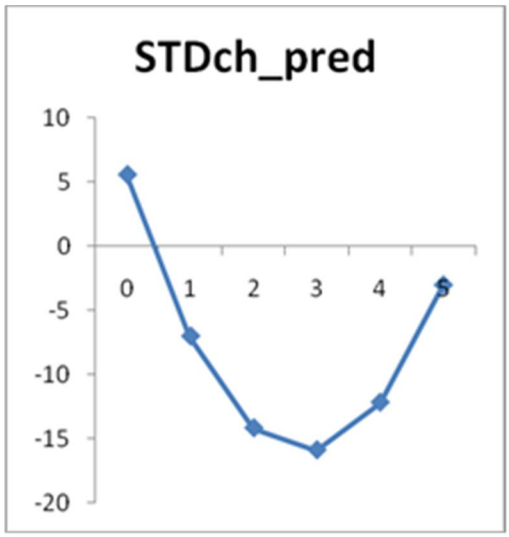
The charts tell that the water retention of STD is unpredictable and depend on the heat of the sun. STD can dry chili faster than dehumidifier. Dehumidifier is more controllable and can be a good standard drying for industry.



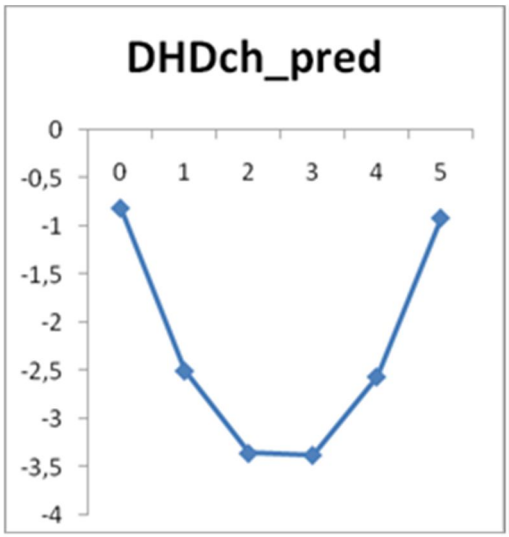
Graph 5. Dy/dx Red Chili STD



Graph 6. dy/dx Red Chili dehumidifier



Graph 7. Green Chili STD



Graph 8. Green Chili dehumidifier

The charts above show us the velocity of water retention of green and red chili, using STD and dehumidifier. Chart 5 shows that water retention velocity of red chili in STD is slower until the 2nd hour, and then starts to be faster. So do the chart 6, that tells the slower velocity of red chilidrying using dehumidifier until 4th hour. Whereas green chili has a faster velocity first, and then become slower. Green chili drying with STD has faster water retention velocity until the 3rd hour, whereas drying with dehumidifier has faster water retention velocityuntil the 4th hour. But overall, drying using STD is faster than dehumidifier.

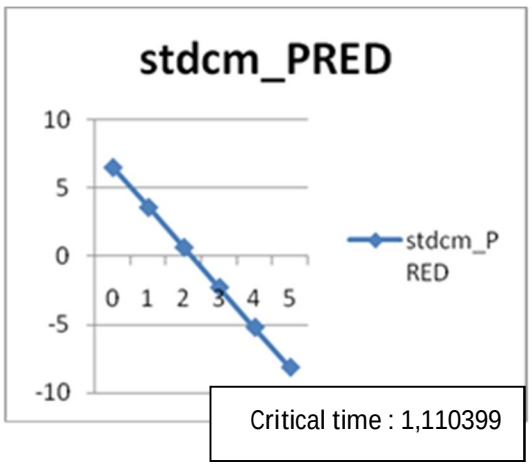


Chart 9. d^2y/dx^2 Red Chili in STD

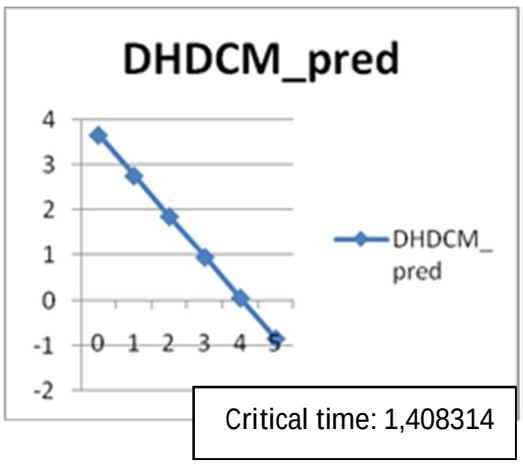


Chart 10. d^2y/dx^2 Red Chili in dehumidifier

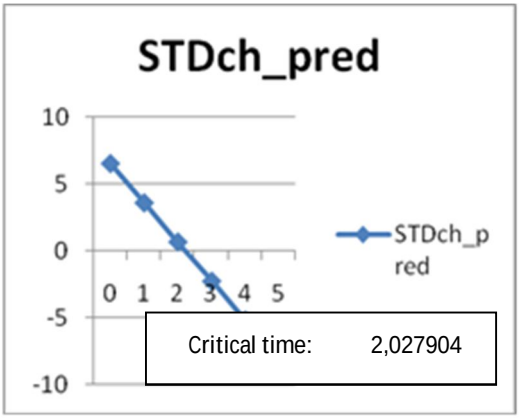


Chart 11. d^2y/dx^2 Green Chili in STD

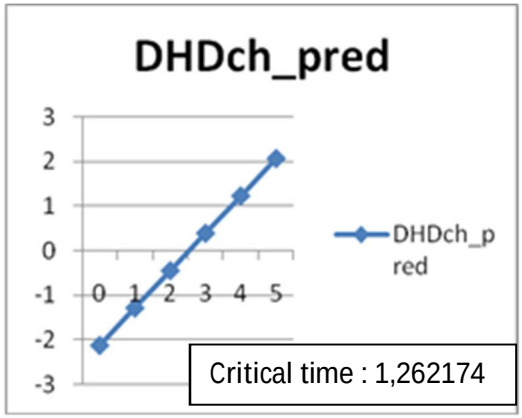
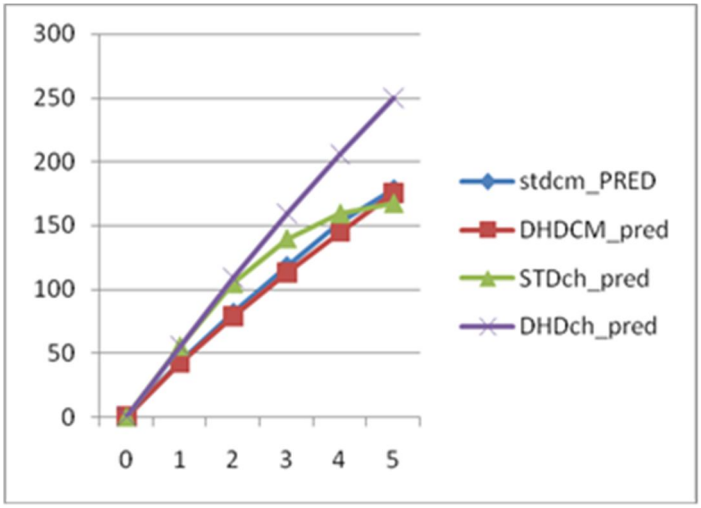


Chart 12. d^2y/dx^2 Green Chili in dehumidifier

From the charts above, we can get linear equation of this observation. Only green chili in dehumidifier that has positive linear equation, the others have the negative ones. From the equation, we can get the critical time of water retention. Critical time means the maximum point of the water retention of each method in each chili. Critical time of red chili in dehumidifier is higher than in STD, and critical time of green chili in STD is higher than in dehumidifier. The critical time depends not only on heat availability, but also on the physical characteristic of the chili. For example the thickness of the chili. The thicker the chili, the longer time needed to reach critical time. In this case, green chili is thicker than the red one. So, green chili spends longer time to reach its critical time.



Graph 13. Integral equation from 0 hour – 5th hour

From the integral chart above we can know the efficiency of moisture retention of each method in each chili. Red chili in STD is easier to release water than red chili in

dehumidifier. And green chili in STD is also easier to release water than green chili in dehumidifier, but it becomes more difficult to release water at the 5th hour. Water can be released when the heat accumulation is quite enough to dry the chili. This is also depending on the thickness of the chili. The thicker the chili, the more heat accumulation needed. Green chili is thicker than red chili, so it should need more heat accumulation in the beginning of the drying.Based on their critical time, red chili drying using STD is 2% more efficient than using dehumidifier, but green chili drying using STD is <1% less efficient than using dehumidifier. So, red chili can be dried efficiently by STD drying method, and green chili can be dried efficiently by dehumidifier.

CONCLUSION

There is difference of moisture retention rate during chili drying using Solar Tunnel Dryer (STD) and dehumidifier as standard. Dehumidifier has moisture retention model more controllable than drying using STD. The moisture retention of drying using STD depends on the heat or sunlight, also the characteristic of the chili. From the first differential method, can be shown that the rate of moisture retention in each method and sample have differences. Overall, the rate of moisture retention using STD is faster than dehumidifier. The second differential method can be shown the chili reach their critical time in each method. Green chili is thicker than the red one. So, green chili spends longer time to reach its critical time. The integral method show us about the heat accumulation needed in drying, that also told about the efficiency of method used in the experiment. From the experiment above, red chili drying using STD is 2% more efficient than using dehumidifier, but green chili drying using STD is <1% less efficient than using dehumidifier. So, red chili can be dried efficiently by STD drying method, and green chili can be dried efficiently by dehumidifier.The production of dried chili can be a practical way to stabilize the prices.

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UTILIZATION OF VIRGIN COCONUT OIL WASTEWATER AS THE MEDIUM FOR *Spirulina* sp. GROWTH

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ABSTRACT

Virgin coconut oil (VCO) is favourite derivated coconut product in Indonesia. Along with the production, a byproduct waste water 'skim" is also generated and could threat the environment.. It is predicted that skim of coconut contains high COD and BOD content, however it also contains several nutrient that predicted could be utilized for microalgae growth. The purpose of this research is to determine skim wastewater characterization and to utilize the wastewater as *Spirulina* sp. medium. Research was initiated by measuring COD, BOD, nitrogen, phosphorus, and potassium content. A first step was done to determine optimum diluted percentage by diluting skim wastewater to make up *Spirulina* sp medium supplemented by Bangladesh no.3 synthetic medium. A second step was continued to determine optimum synthetic nutrient reduction, by using a data from first step. *Spirulina* growth was measured using spectrophotometer in 620 nm wavelength optical density for 5 days each cultivation time. At the end of research, optimum result in second step was harvested using 10 mm cloth filter and determined protein content. The result indicate that 20% v/v waste water and 25% synthetic nutrient reduction gave optimum growth for *Spirulina* sp. Skim waste water was not yet suitable for *Spirulina* sp. growth due to white color and high contamination. Optimum biomass was produced in 0.206 gram dry weight and contains 39% of protein. COD and BOD content is lowered after utilized as *Spirulina* sp. growth, 225.8 ppm and 56.160 ppm, respectively.

Keyword: *VCO, Skim Wastewater, medium, Spirulina growth, waste characteristic.*

INTRODUCTION

According to data from Ministry of Agriculture of Indonesia in 2009, the amount of coconut oil production reached about 3,257,969 tons. Along with increasement of VCO (virgin coconut oil) production, the waste by-product are also increased.In VCO process, a coconut milk is separated from the skim to lower water content. However, these skim usually just thrown away because it did not produce more oil. This skim contains high amounts of COD, BOD, SS, Total Solids (TS), and Oil and Grease (Naksagul et al., 2006). In other hand, the waste water contain

severalmicronutrient that could be utilized for other organism.

One of the benefits that can be used to provide added value is by utilizing skimmed milk as medium of microorganism growth. Skim milk which contains mineralscould be the potential to serve as a medium for growth of bacteria such as *Acetobacter xylium* in the production of Nata de Coco (Setiaji, et al., 2002).

Table 1. Skim wastewater Characteristic

Parameter	Value
pH	4.0 to 5.5
COD (mg / l)	4000 to 15000
BOD5 at 200C (mg / l)	3000 to 8000
Turbidity (FAU)	400 to 4000
Total Solid (TS) (mg / l)	1700 to 5000
Suspended Solid (SS)(mg / l)	500 to 3500
NH3-N (mg / l)	10 to 200
Phosphorus (P) (mg / l)	50 to 160
Nitrogen(N) (mg / l)	200 to 800
C : N ratio	(20 to 30) : 1

(Jayamanne, 2004)

One leading microorganism product leading in industry is *Spirulina* sp. This microalgae contains 60-70% protein that can be used as a source of protein, carotenoid and several micronutrient for food or feed source (Hadiyanto, and Nur, 2012). In addition, weather conditions in Indonesia that the intensity of the sun light is available all year round with temperatures between 27-34^{0}C also supports the growth of *Spirulina* sp. However this miroalgae could also act as phycoremediator to lower COD, BOD, and toxic material in organi wastewater.

Purpose of this research is to determine skim wastewater characterization, to utilize the wastewater as *Spirulina* sp. medium, to measure the medium after used as microalgae growth and to analyse biomass formed from cultivation.

MATERIALS AND METHODS

Skim Wastewater

Skim wastewater was collected from small virgin coconut oil small bussines (UKM) in Yogyakarta. Wastewater was prepared by filtering to sparate cake and other contaminant by using 100mesh size. Wastewater then boiled in 100^{0}C to sterilize from other contaminant and cooled up to 30^{0}C before used as microalgae medium.

Spirulina sp culture

Spirulina sp culture was purchased from C-BIORE Bioproess laboratory chemical engineering UNDIP. Culture was ready to be used as inokulum if the optical density was reached up to 0.6 at 680 wavelength.

Preparation of Medium

Skim filtered using a vacuum pump and filter paper wheatman. The filtrate is then cooled to a temperature of 300C and put in 6 erlenmeyer appropriate experimental variables. Nutrients added to the filtrate

corresponding experimental variables that have been determined then stirred until homogeneous. medium pH was adjusted to 9, if too tart add but if too alkaline NaOH is added HCl.

Synthetic Nutrient

Laboratory grade Synthetic nutrient is used as addition, refer to synthetic nutrient Bangladesh 3 (Khatum et al, 1994), consisting of 1 gram / l $NaHCO_3$, 50 ppm Urea, TSP 10 ppm and 50 mcg / l Vitamin B12.

Cultivation

Spirulina sp was cultivated in different skim concentration and different synthetic nutrient in 2L flask glass, light source was generated from fluorescent lamp 4000lux, culture agitation source was generated from aquarium pump, and the culture operation was done in 5 days.pH was maintained in 9.

First experiment

In this first experiment, Spirulina was cultivated in medium 10%, 20%, 40%, 80%, and 100% (v/v) skim. Synthetic nutrient 100%w/v was added to medium, refer to synthetic nutrient Bangladesh 3.

Second experiment

A second experiment was done by cultivating spirulina in different additional synthetic medium (0,10,20,30,40,50% w/v) in optimum dilluted medium recorded from experiment I.

Measurement

Measurement start from day-0 up to 5th day using non UV VIS spectrophotometer with a wavelength of 680 nm. Biomass taken from the second experiment screened by using 10mm filter cloth. Biomass was dryed in 60^0C for 8 hour to reach 9% moisture content. Protein in optimum biomass product was analyzed using Kjedahl. COD and BOD content in the filtrate was analyzed using SNI (2005).

RESULTS AND DISCUSSION

Skim Wastewater Measurement

Table 2. Result Skim Analysis

Parameter	Unit	Result
COD	ppm	4916,67
BOD	ppm	983,33
P-Total	ppm	0,70
N-Total	ppm	104,16
Kalium	ppm	0,98
C-Organik	%	0,86

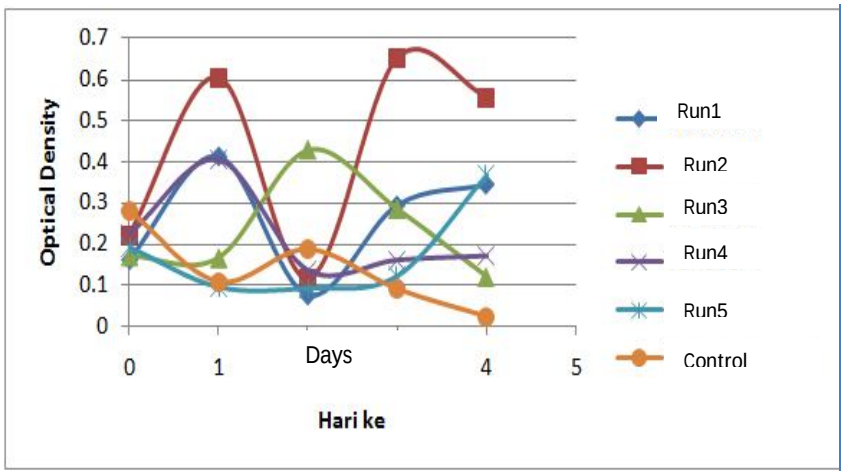
Measurement was done for skim wastewater. Result indicated that the waste contained high COD, and BOD content. However it also contained high nitrogen, and phosphorus. Several researcher reported that agroindustry wastewater could be used as microalgae medium. Habib, et

al., (2003) reported that *Chlorella vulgaris* could utilize nutrient from digested palm oil mill effluent that contains 468 ppm total nitrogen, and 68 ppm total phosphorus.

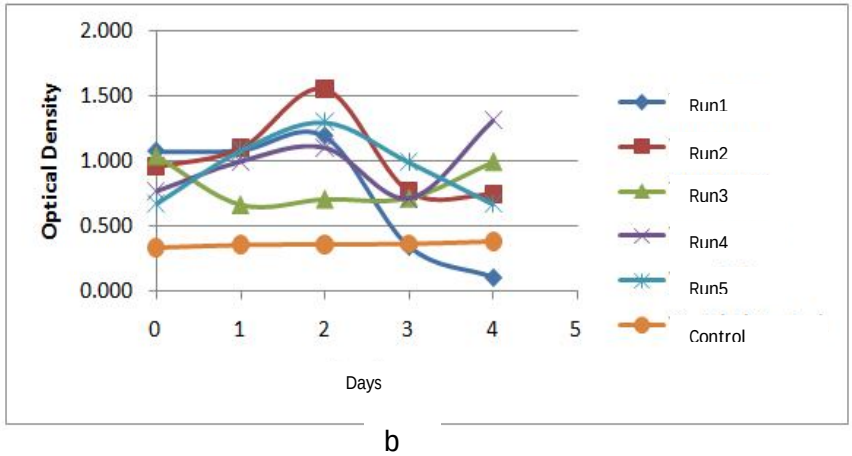
Thus, skim wastewater should be supplemented by synthetic nutrient to meets the optimum carbon, nitrogen, and phosphorus ratio for microalgae. A recommended weight ratio for microalgae is 56:9:1 of Carbon, nitrogen, and phosphorus, respecively (Edwards, et al., 1980).

Spirulina sp Growth in Different dilluted Skim Medium

Spirulina was done by cultivating in different dilluted skim, ie 10%, 20%, 40%, 80%, and 100%v/v. The results in Figure I indicates that medium containing 20% skim gave best spirulina growth, compared to the other variables.



a



b

Figure 1.Optical density vs days (a) first experiment. (b) second experiment

According to figure 1a.Growth of Spirulina sp 20% skim decrease in 2nd days, but it increase again till the 4th days. This phenomena indicates that microalgae utilize two different source from the medium.

Thus,organic source is more preferable for microalgae than anorganic source (Chojnacka, and Marquez-Rocha, 2004). Meanwhile Goldman, et al., (1971) explained that organic carbon source was generated from bacteria conteined in medium. In this research, it seems that organic source is utilized by microalgae.However, excess of nutrient could inhibit microalgae growth due to form toxic compounds.

Spirulina Sp Cultivated in Different Additional Synthetic Nutrient

An optimum diluted skim from experiment one (20%) was used as medium for microalgae. The addition of nutrient was 0,10,20,30,40,50% w/v. A result indicated that 20% dilluted skim and 20% gave highes optical density compared to first experiment, 0.67 and 1.5, respectively. However addition of 50% synthetic nutrient could be gave high optical density due to longer lag phase if the cultivation was done in longer time (figure 1.b).

Table 2. Wastewater parameter before and after treated using spirulina sp

Parameter*	Sample	After treated	Standard Discharge**
COD	4916,67	225.830	150
BOD	983,33	56.160	75
pH	4-5	8-9	6-9
TSS	NA	NA	100

*all in ppm except pH

**standard discharge ministry of environment number 13 year 2008.

Goldman et al., (1971) mentioned that microalgae can utileze organic and anorganic source. 20% skim and 20% synthetic nutrient could be the best composition for spirulina sp due to optimum recommended CNP ratio 56:9:1 (Edwards, et al., 1980).Meanwhile other additional nutrient was influence spirulina sp in a low growth rate since this composition was excess and form toxic compounds.

COD and BOD content after cultivation

COD and BOD of filtrate was analysed after used as spirulina sp growth. COD and BOD was reduced effectively by using

microalgae Spirulina sp. Goldman, et al., (1971) reported that microalgae could treat wastewater by promoting symbiotic bacteria to degrade organic compound in medium.

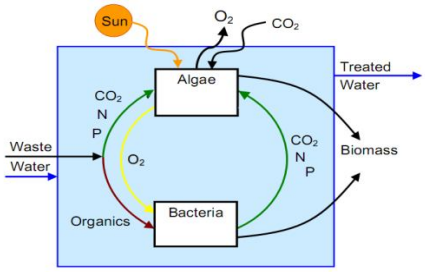


Figure 2. Symbiosis microalgae-bacteria. (source: http://www.researchalgae.com)

Bacteria contained in skim wastewater will degrade organic complex, meanwhile microalgae provide oxygen for bacteria growth. Organic degraded from bacteria will be utilized for microalgae growth. This life cycle will lower COD and BOD content. However a COD discharge did not satisfy the stadard regulation. This could be microalgae-bacteria still need more time to utilize wastewater more than 5 days.

Biomass Characterization

Spirulina sp was analysed to determine protein content. A result indicated that spirulina sp biomass was not satisfy standard protein content for spirulina sp.

Table 3. Biomass characteristic

Parameter	Sample	Standard
Protein	39%	>55%
Moisture Content	8.9%	<9%

It seems that oil content in the wastewater inhibits protein forming in biomass. However a phycocyanin and other high material product from this biomass was not measured.

CONCLUSSION

Research was done by cultivating microalgae Spirulina sp in different dilluted skim and different synthetic nutrient addition. Growth of Spirulina sp was limited by organic and anorganic carbon source. COD and BOD content in wastewater was lowered after used as medium. However protein content in biomass was not satisfied due to oil content.

ACKNOWLEDGEMENT

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PHYSICOCHEMICAL PROPERTIES OF FERMENTED CASSAVA ASSISTED BY LACTIC ACID BACTERIA

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ABSTRACT

Cassava is one of the best commodity with total production 21,593,053 tons/year in Indonesia. It can be modified its rheology and physicochemical properties in order to be wheat equivalents to improve better paste clarity, gel stability, increased resistance to retrogradation, increased solubility and swelling power, and increased baking expansion. One of methods to improve physicochemical properties of cassava is by using lactic acid fermentation. The objective of the research is to investigate physicochemical of fermented cassava assisted by lactic acid bacteria with 24 hours treatment of 0.1% (v/v), 0.2% (v/v), 0.3%(v/v), and 0.4% (v/v) respectively. The results of physicochemical properties were presented as swelling power of fermented cassava with lactic acid bacteria addition (0.1% (v/v), 0.2% (v/v), 0.3%(v/v), and 0.4% (v/v)) given data in the range 10.35 - 12.62, while the swelling power of unfermented cassava as control was 13.81. The viscosity of fermented cassava with lactic acid bacteria addition with concentration (0.1% (v/v), 0.2% (v/v), 0.3% (v/v), and 0.4% (v/v)) were given data in the range 796.55 cp - 1008.29 cp, while unfermented cassava was 783.20. The % solubility of fermented cassava was given data in the range 1.37 – 2.39.

Keywords: *Fermentation,Cassava, Lactic Acid bacteria, Phsycochemical Properties*

INTRODUCTION

Cassava is one of the best commodity with total production 21,593,053 tons/year in Indonesia. Because of the capability cassava to withstand in varying conditions such as extreme temperature , diverse pH, high shear rate and freeze-thaw variation (Daramola *et al*, 2006) native cassava are used for many application (Wang *et al*, 1993) in traditional food. Apart from the traditional foods in Indonesia, there is a great demand for cassava products which include raw materials like modified starches for the modern food, food industry, beverages, pharmaceutical and textile indutries (Uzomah, 2011).

Modified cassava have useful application as wheat flour substitute as main ingredient of bread and similiar products. Modified starch used lactic acid hydrolysis and UV photochemical reaction as catalyst shown that it improved swelling power and baking expansion of the muffin compared to initial tapioca (Pudjihastuti, 2010). Other outhor have also reported HCN content of cassava flour of fixed fermentation (the soaking water was not replaced) method was significantly lower than ($p < 0.05$) on unfixed fermentation (replacing soaking water every one a day) method (Rasulu *et al*, 2012).

Starch modification which is mean the change of molecular structures in starch can be broadly grouped into four classes namely: physical, chemical, enzymic and biological modifications (James and West, 1997).

Cassava can be modified its rheology and physicochemical properties in order to be wheat equivalents to improve better paste clarity, gel stability, increased resistance to retrogradation, increased solubility and swelling power, and increased baking expansion. One of methods to improve physicochemical properties of cassava is by using lactic acid fermentation.

Lactic acid bacteria which produce lactic acid have an amylolytic characteristic, it play an important role in the preparation of fermented cassava (Putri *et al*, 2010). The activity of lactic acid bacteria changed molecular structures during fermentative process in starches so it was cover up taste and aroma of native cassava. Some strains of *Lactobacillus* spp. such as *Lactobacillus plantarum, Lactobacillus amylophyllus* and *Lactobacillus casei* produce extracellular amylase and ferment starch directly to lactic acid (Marseno *et al*,2010). Consequently, the objectives of this investigation were: (1) preparation fermented cassava assisted by lactic acid bacteria (*Lactobacillus casei*). (2) Determination of phsycochemical properties of modified starch.

MATERIALS AND METHODS

Raw Materials

Microorganism

The mixture of glucose, KH_2PO_4, K_2HPO_4, $MgSO_4$. $7H_2O$, $FeSO_4$. $7H_2O$, $MnSO_4$. $5H_2O$, yeast extract, urea, gluten, biotin, thiamine, lysine, crysteine, HA-3000 and aquadest used as medium of microorganism. The mixture arranged in pH 6 and heated at temperature of 100°C for 5 min. The medium sterilized in autoclafe at 121°C,

1 atm, 15 min. The microorganism used were *Lactobacillus casei* isolated in

sterilize medium at temperature 30°C for 3 days.

Preparation Fermented Cassava Assisted by Lactic Acid Bacteria

Native cassava was purchased from local market in Semarang. The peeled cassava were cut into chips. Cassava chips were mixed with lactic acid bacteria solution and water in reactor during 24 h. The fermented cassava was dried for 3 days. The dry cassava were crushed using blender and screened in order to get flour with similiar size (Figure 1). Cassava chips were soaked (unfermented) into water for 24 h is needed as variable control in this research.

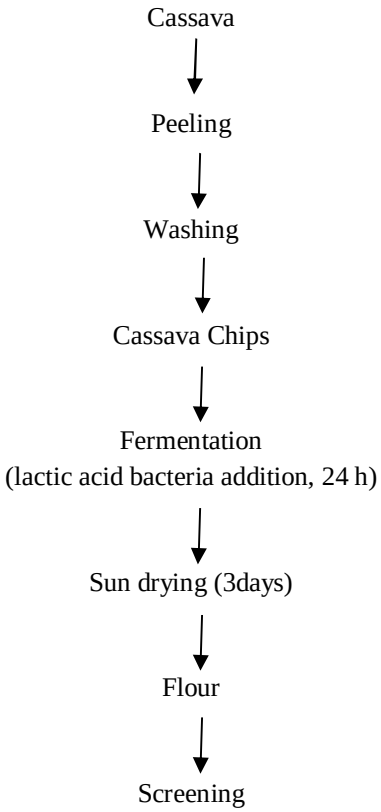


Figure 1. Flow chart for the preparation fermented cassava assisted by lactic acid bacteria

Methods of Analysis

Phsycochemical properties of modified cassava were determined using swelling power, solubility and viscosity analyses. All results were the average of triplicate analyses.

Determination of Swelling Power

The methods described by Leach et al. (1995). 0.1 g of flour were mixed with 10 ml water and heated at temperature of 60°C for 30 min. This was continually shaken during the heating period. The form of Supernat and paste was separated with centrifuge at 2500 rpm for 15 min. Supernatant was carefully decanted and the weight of the starch paste taken. Swelling power was calculated as follows:

$$\text{Swelling power} = \frac{\text{Weight of starch paste}}{\text{Weight of dry starch sample}}$$

Determination of solubility (%)

The methods of solubility was evaluated by Kainuma et al (1967) in earlier research. 1 g of starch were mixed with 20 ml of water and heated at a temperature of 60°C for 30 min. The form of Supernat and paste was separated with centrifuge at 3000 rpm for 20 min. Supernatant was decanted and dried in oven to constant weight. % solubility was calculated as follows :

$$\%\text{Solubility} = \frac{\text{Wieght of dry supernatant}}{\text{volume of supernatant}} \times 100\%$$

Viscosity Measurement

The 5% ($^{w}/_{v}$) mixture of fermented cassava flour and water were heated at 80-85°C for 10 min. After cooled at room temperature (25-27°C), the mixture was measured with Brookfield viscometer (Akesowan, 2002).

RESULTS AND DISCUSSION

Table 1. Phsycochemical properties of unfermented cassava and fermented cassava assisted by lactic acid bacteria with 24 hours treatment

Sample	Swelling Power (g/g)	% Solubility
1*	13.81 ± 0.365	1.7 ± 0.06
2	10.35 ± 0.11	1.37 ± 0.03
3	12.62 ± 0.115	2.25 ± 0.045
4	10.69 ± 0.16	1.43 ± 0.035
5	10.75 ± 0.105	2.39 ± 0.07

*unfermented cassava (1) and fermented cassava with 0.1% (v/v), 0.2% (v/v), 0.3%(v/v), and 0.4% (v/v) *Lactobacillus casei* addition (2,3,4 and 5).

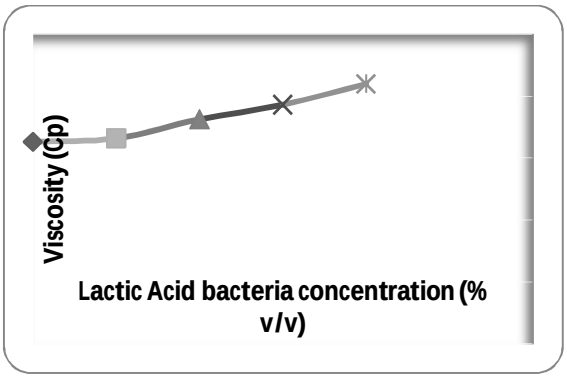


Figure 2. Viscosity measurement of fermented cassava

Swelling Power

Unfermented cassava as a control treatment have the highest values of swelling power (13.81 g/g) (Table 1). Whereas fermented cassava assisted by 0.2% (v/v) lactic acid bacteria gave the highest on swelling power (12.62). The value of swelling power in starch determines baking expansion of food products so products have softly texture (Pudjihastuti, 2010).

Table 2. Comparison of swelling power between fermented cassava and ginger modified cassava starch

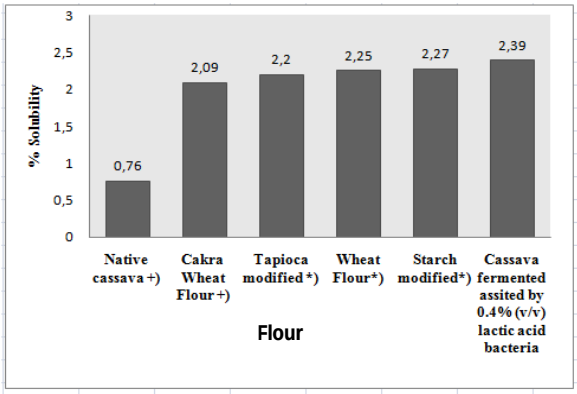
Methods of modified cassava starch	Range of Swelling Power (g/g)
Native cassava starch	8.9
Fermented Cassava assisted by lactic acid bacteria	12.62 – 10.35
Ginger-modified cassava starch (Daramola and Osanyinlusi, 2006)	12.9 – 9.5

From table 2, it can be seen that swelling power of modified cassava starch was higher than native cassava starch with 8.9 swelling power. Lactic acid bacteria fermentation by *Lactobacillus casei* effected the change of molecular structures in starches. Because of interaction lactic acid bacteria, molecular structure in starch is broken and the water molecules are bonded to the free hydroxyl groups of amylose and amylopectin by hydrogen bonds, which cause the change in the absorption and solubility (Abo-El-Fetoh,

2010). Swelling power showed that the capacity of starch molecules to hold the water molecules through hydrogen bonding (Marseno, 2011). Hydrolisis of starch granules will be produced organics acid so these compounds covered up taste and aroma of native cassava.

Solubility Index

Solubility of unfermented cassava and fermented cassava assisted by lactic acid bacteria is shown in Table 1. Fermented cassava by 0.4% (v/v) *Lactobacillus casei* having the highest solubility index (2.39 ± 0.07%). During fermentation and sun drying, the starch granules more vulnerable to the chemical agents and there is a relaxation of the crystalline structure in water (depolymerisation of the crystallin region) (Uzomah, 2011). The amorphous region in starch (the groups of amylose and amylopectin) associate with water molecules through hydrogen bonding. The availability of water binding sites among the starches may have contributed to improve digestibility.



The results reported by *)Pudjihastuti (2010) and +)Zulaidah (2011)

Figure 3. Solubility in varying flour

Figure 3 shown that solubility properties in modified cassava starch and native cassava significantly different. The solubility of modified cassava starch in the range 2.09 – 2.39% was higher than native cassava with 0.76 % solubility. This results in figure 3 displays the solubility in modified cassava starch approached the solubility of wheat flour. It was interesting to note that modified cassava starch can change its rheology and physicochemical properties so it can be equivalent with wheat flour.

Paste Properties

Paste properties of the starches determined by viscosity measurement. Correlations lactic acid bacteria addition to viscosity expressed line in figure 2.

During fermentation process, lactic acid bacteria produced enzymes and acid modification in the different stage of the process. The enzymes and organic acids

(lactic, acetic, butyric and propionic) which produced by the acid hydrolisis promoted starch granule damage and consequently affect the microstructure starch. A higher organic acid concentration in lactic acid fermentation caused the flour became viscous (Chinsamran et al, 2005) when heated and cooled.

CONCLUSIONS

Some physicochemical properties of the fermented cassava assisted by lactic acid bacteria which included swelling power, solubility and vicosity measurement were observed. The starches investigated in this study displayed unique characteristics in swelling power and solubility. The activity of *Lactobacillus casei* to produce organic acids during fermentation reduced viscosity of the starch compared with unfermented cassava.

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AN OVERVIEW OF *Spirulina platensis* AS FUNCTIONAL FOOD

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ABSTRACT

Up today, the function of food for human is not only considered as a requirement, but it changes as a need to keep their fitness and health. Consumption of nutrients, especially proteins, is lacking due to food availability and human diet irregularly. Protein is the important substance for humans, as well as the material forming enzymes and hormones in the body. Human requires approximately 1 g protein / kg body weight per day. To meet the need of protein, the alternative way to provide is to produce functional foods or supplements that contain protein such as from algae source: *Spirulina sp*. *Spirulina* is a spiral shaped cyanobacteria, has chlorophyll, and contains of protein about 50-70% d.w, several vitamins and minerals. *Spirulina platensis* can be cultivated on a freshwater, brackish water or seawater medium. For the needs of pharmaceuticals and human foods, *Spirulina platensis* cultivated in fresh water is better because it has a high protein content and low sodium content. *Spirulina platensis* cultivated in sea water medium have higher phycocyanins, carbohydrates, and has low production cost. However *Spirulina* cultivated using seawater medium is also tend to have a higher sodium content that is not good for the health. This paper describes the potential use of *Spirulina* as a protein source for functional food. In this paper the application of *Spirulina* biomass will be shown in the application of food and pharmaceutical.

Keywords : *Functinal food, Spirulina platensis, Protein, Human Food, Sodium*

INTRODUCTION

Nowadays customer needed for functional food is growing fast. Customer tent to make an opinion that those foods give good effect for health (Mollet and Rolwland, 2002; Young, 2000). In modern era, food is not only used as energy source, and nutrition, but also it gives immune system for body caused by nutrition depletion and also increase antibody system (Merad, 2003; Roberfroid, 2000b). This food is called as functional food.

Functional food is produced by using functional addition healty food in the product (Niva, 2007). Increasement of functional food describes that healty care of life is increase (Kotilainen, et al.2006; Robertford, 2000a, 2000b). Functional food concept is introduced by Japan scientist

who learnt correlation between nutrition, sensoric satisfaction, fortication, and physiological modular system.

Several example for functional foods are prebiotic, probiotic, functional cereal, bread, meats, egg, margarin low cholesterol, etc.

Fact that world is in food crysis is not neglacted. Almost people in development country are in hunger caused by source and access for mineral, protein, vitamin, and nutritional food. Protein depletion in the body causes kwasiorkor illnes. This crysis could be solved by giving functional food in which contains high protein for the people in development country. Several high protein food are eggs, meats, single cell protein, etc. One of unique high protein food is microagae kind of *Spirulina platensis*. This microalgae not only act as single cell protein, in fact, but also gives several benevit such carotenoid, pigmen, and micronutrient source.

Table 1. Protein source in several microalgae compared to other foods

Protein Source	content (% weight)
Bacteria	47-86
Fungi	13-61
Egg	49
Dunaliela salina	57
Spirulina platensis	46-70
Chlorella vulgaris	51-58
Meat	19-20
soybean	3,2

Panggabean, 1998.

SPIRULINA

Spirulina is kind of microalgae contain high protein, up to 55-70%, and micronutrient source (Phang, et al., 2000). In 1976, Spirulina platensis is choosed as future food source by International Association of Applied Microbiology. Several other microorganisme such fungi and bacteria only give protein content, called as single cell protein.

Spirulina is kind of cyanobacteria, a bacteria contains chlorophyl and could act as phytosynthetic reacting organism. Its shape is helix, contain high phycocyanin so the color tend to blue green. Spirulina can grow well in lake, fresh water, sea water, and soil medium (See Figure 1). Spirulina could also grow in high alkalinity medium, (pH: 8.5-11), so other microorganism could not grow well in this condition (Kebede and Ahlgren, 1996). A tolerance temperature for Spirulina platensis is 15^0C, and optimum growth is 35-40^oC.

KIND OF SPIRULINA AND NUTRITION CONTENT

Kind of spirulina

Spirulina, or also called as Arhospira, has a lot variety. Almost of 58 species Spirulina is recorded, but only several species is used for food source. Two fameous Spirulina in

the market is *Spirulina platensis* and *Spirulina maxima*. This two spirulina differs in shape and size. *Spirulina maxima* contains bigger size, although the helix shape is not as spiral as *Spirulina platensis*.

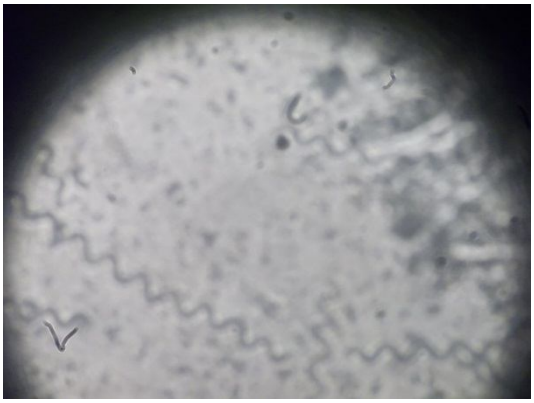

Figure 1. Spirulina seen from Microscope

Nutrition Content

Spirulina has several nutrition content and the characteristic is suitable as functional food. Protein, essential fatty acid, vitamin, mineral, and photosynthetic pigmen are component compossed by Spirulina. And it is believed that Spirulina could act as healer food product.

Table 2. Spirulina platensis content

Parameter	Content
Protein	56-62
Fats	4-6
Carbohidrat	17-25
Linoleic acid (gamma)	0.8
Chloropyl	0,8
Phycoocyanin	6,7-11,7
Carotein	0,43
Zeaxanthin	0,1
Water	3-6

Source: PT Luxor Inma.

Protein

Spirulina contains high protein 55-70%. This protein is a complex and rich in essential amino acid, methionine (1,3-2,75%), cystine (0.5-0.7%), tryptophan (1-1.95%), and lysine (2.6-4.63%). This rich amino acid is good for health.

Essential Amino Acid

Polly unsaturated fatty acid (PUFA) in Spirulina is about 1.3-15% from total fats (6-6.5%). Highest fats from Spirulina is Gamma linoleic acid (GLA) in about 25-60% from total of fats (Borowitzka, 1994; Li and Qi, 1997). Other compound in fats is palmic acid (44.6-54.1%), oleic acid (1-15.5%) and linoleic acid (10.8-30.7%). Cholesterol in Spirulina is about 32.5 mg/100gr.

Minerals

Almost of essential mineral contained in spirulina is about 3-7%. It is a bioacumulating from mineral contained in growth medium and also influenced by temperature, pH, salinity, etc. Sharma, and Azees (1988) reported that bioaccumulation of cobalt and zinc is influenced by different temperature medium. Meanwhile Gabbay, Tel and Gresshoff (1993) recorded that Spirulina in sea water accumulates sodium and chloride in high amount.

Toxic Mineral Neutralization

Spirulina has unique ability to neutralize toxic mineral (Maeda and Sakaguchi, 1990; Okamura and Aoyama, 1994). Spirulina could be used as arsenic neutralizer agent from water or wastewater, and other toxic material and heavy metal (Liu, et al., 1991).

Betacarotein and Vitamin

Spirulina contains high carotenoid content. A highest carotenoid found in Spirulina is betacarotein that could converted to A vitamin, and B vitamin. Thus, 4 mg nutrition in Spirulina is equal to 100 g fresh vegetable.

INFLUENCES OF SPIRULINA GROWTH MEDIUM IN BIOMASS CONTENT

Mineral content in Spirulina is different each other depend on kind of growth medium for cultivation. In general, Spirulina cultivation method use fresh water, sea water, and blend of fresh and sea water.

Sea Water Spirulina

Spirulina cultivated in sea water contains higher mineral than fresh or payau medium. Sea water contains high salt such NaCl, KCl, MgCl, etc. Spirulina also contains polysacharide, inositol, and higher phycocyanin. Although contains higher salt, a higher sodium content is not good for health. To lower this mineral, $NaHCO_3$ and NA_2CO_3 could be used through precipitating method (Faucher, et al., 1975). Spirulina sea water has lower growth rate than spirulina fresh water. This smell is more fishy like sea grass or squit, and several customer is not suitable with the smell. This smell is generated from mineral content in Spirulina.

Fresh Water Spirulina

This spirulina is usually used as food and pharmaeuthical. In fresh water medium, $NaHCO_3$ **,** phosphat, and urea is added to influence growth rate. A fresh water Spirulina has higher growth rate in about 0.1573/days, and generates 1.23-1.34 g/l dry biomass. Meanwhile sea water Spirulina has lower growth rate and generates biomass in about 10.3gr/m^2days (Costa, et al., 2003; Wu, et al., 1993). Since sodium content in fresh water Spirulina is lower than sea water, it is safe to be used as food and pharmautical source. A protein content generated from fresh water medium is about 60-70%, the smell is good because it has lower nutrient content.

SPIRULINA AS FUNCTIONAL FOOD

As higher content of protein, and micronutrient, Spirulina could act not only as single cell protein, but also it could used as functional food. FAO reported that Spirulina could be used as healthy food for

human (Becker, 1994). In general, Spirulina is produced in a juice, sprayed, capsule or tablet. Spirulina could also act as immune functional food source, and super oxide dismutase (SOD). Several hospital in modern country use spirulina to gain higher immunoglobin A (lgA) and immunoglobin B (lgM). Meanwhile phycocyanin content in Spirulina is a potential to inhibit leukimia cell growth in human (Liu, et al., 2000).

Dryed and sprayed Spirulina could be used as mixed paste source, sauce, soup, instant drink, and supplement food (See Figure 2). Spirulina could be mixed in noodles, bread, biscuit, etc. This adding Spirulina give a higher nutrient value to food. It is suggested that Spirulina could be consumed 10g/day to keep health body, not only for child but also for mature people (Henrikson, 1989).

Figure 2. Spirulina Tablets (Wikipedia, 2012)

In other hand, Spirulina contains a small toxic material called microcystin. A consumption of this material in high concentration is dangerous for human body. Microcystin is kind of peptide nonribosomal cyclic contained in all of cyanobacteria. Microcystin could attact liver and causes cancer. Spirulina contains 1 μg/g. So it is suggested that Spirulina consumption is about 0.5-3 gram each dessert.

FUTURE PROSPECT

Indonesia as tropical country could be leading in microalgae industry. A rich natural source and human consumption could also driving the industy to develop and design smart functional food. Spirulina as functional food is a potential source, not only as single cell protein but also it could act as healing food source. in future era, Spirulina could be used as additive source for biscuit, bread, and drinks, and it could be familiar for peoples in Indonesia.

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CHEMICAL AND PHYSICAL CHARACTER OF FERMENTED GANYONG (*Canna edulis*) FLOUR AND THE APPLICATION AS A RICE FLOUR ALTERNATIVE SUBSTITUTE FOR INSTANT VERMICELLI MANUFACTURING IN INDONESIA

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ABSTRACT

Flour that made from *ganyong* tuber can be use to substitute rice flour in a wide variety of food products including rice vermicelli so it can reduce Indonesian dependency on rice. But, *ganyong* flour has low nutrient content and poor physical properties. The purpose of this research is to determine the best ratio of microbes used in fermentation. *Ganyong* tubers fermented in aerobic condition for 3 days with mixture microbial between *Saccharomyces cereviceae* and *Rhizopus oryzae* on ratio 1:1, 1:2, and 2:1. After the fermentation was complete then continued with *ganyong* flour production. *Ganyong* flour analyzed chemically (water, ash, protein, lipid, carbohydrate, crude fiber, and pH) and physically (density, colour, odor, form, and fineness). While instant vermicelli analyzed physically (degree of wholeness, rehydration time, water absorption, and durability) and sensory (taste, texture, odor, colour, elasticity, and overall) that tested on 30 untrained panelist in Semarang. Chemical and physical results showed that the best *ganyong* flour was fermented *ganyong* flour using mixture mirobial ratio 1 : 2 by results water (8,07±0,15%), ash (1,06±0%), protein (14,91±0,29), crude fiber (4,50±0,26), bulk density (0,99±0,02 g /ml), fineness (99,53%). The best proportion between rice flour and fermented *ganyong* flour ratio 1 : 2 was 20% *ganyong* flour which then given 20% lime juices concentration treatment to removed brown colour on instant vermicelli. Based on the research, it can be concluded that fermented *ganyong* flour using mixture mirobial ratio 1 : 2 at concentration of 20% plus 20% lime juices concentration will produce the best instant vermicelli in terms from physical and sensory analysis.

Keywords : *ganyong flour, mixture microbial, instant vermicelli, rice, fermentation*

INTRODUCTION

Indonesian has high dependency on rice that is 139 kg rice per capita every year (Ardiyani, 2011). The increase in consumption is higher than the local rice production because there is a transition concumption of rice as a staple food and causing rice import to fulfill the need of rice (Darmawati, 1998 ; Tarigan, 2003). One of the solution is food diversification by exploiting tubers. The superiority from tubers is the high content of carbohydrate thereby potentially replacing rice and rice

derived products like rice flour (Slamet, 2010 ; Pangesthi, 2009). Ganyong is one of the potential tubers in Indonesia and can be processed into ganyong flour for replacing rice flour because have a high carbohydrate that is 86%-87% (Marzempi, 1995). Ganyong flour superiority include the high ability to absorb water, the starch is easily digested, good gelatinizattion, high content of phospor and calcium (Hidayat, 2008). Ganyong flour has a high content of amylose, wide temperature range of gelatinization, heat stable viscocity where support in vermicelli manufacture (Roisah, 2009).

However, ganyong flour has bad chemical and physical properties as low protein content also strong sense and odor of ganyong so it needs to be improved by fermentation. Fermentation improves nutrition content in foods, eliminate original ganyong taste, texture, and odor, increasing the self life of foods (Raimbault, 1998 ; Akindahunsi *et al*,1999). Fermentation using two microbial better than one microbial because it can complement one another's shortcomings so the result will be better in a short time compared with only using one single microbial (Thomson *et al*, 1984).

The purpose of this research is to determine the best ratio of microbes used in fermentation.

MATERIALS AND METHODS

Materials and Equipments

The materials were fresh ganyong tubers (*Canna edulis)* from Kulon Progo, Yogyakarta, *Rhizopus oryzae* and *Saccharomyces cereviceae*, Potato Dextrose Agar (PDA), Potato Dextrose Broth (PDB), Malt Extract Agar (MEA), Malt Extract Broth (MRB), K_2SO_4, HgO, H_2SO_4, aquadestilata, $Na_2S_2O_3$, NaOH, zink, HCl, methyl red blue indicator, hexan, Na_2SO_4, alcohol, sodium bisulfit, lime juices (*Citrus aurantifolia* Swingle.), NaCl, $NaCO_3$, KCO_3, and STPP

The equipments were *slicer*, measuring cylinder, erlenmeyer, pipette, volumetric pipette, pilleus pump, autoclave, dehumidifier, digital scales, food processor, sieves 80 mesh, modification vermicelli molds from Semarang, Central Java, steamer, porcelain, oven, desiccator, furnace, filter papers, soxhlet, distillation and destruction retorts, burette, volumetric flask, pH meter, chromameter, distillator, digester, spectrophotometer.

Metode

Ganyong flour production processes were consist of sorting fresh ganyong bulbs then peeled, washed, sliced, soaked in solution of sodium bisulfit 1000 ppm for 30 minutes. After ganyong slices ready, *Rhizopus oryzae* and *Saccharomyces cereviceae* was inoculated at concentration

ratio 1 : 1, 2 : 1, and 1 : 2 with basic concentration each microbial 10^{-6} CFU / ml every 3 kg ganyong slices in 4 litres water then incubated for 3 days in aerobic condition. Once the fermentation done, ganyong slices was dried, crushed, and screened then analyzed chemically (water, ash, lipid, protein, crude fiber, carbohydrate, pH) and physically (colour, density, fineness, form, odor).

Instant vermicelli production processes were binder makings with addition of lime juice, dough makings. After the dough was ready, dough was moulded, steamed, and dried. Instant vermicelli then analyzed physically (rehydration time, degree of wholeness, durability, water absorption) and sensory on 30 untrained panelist (colour, odor, elasticity, texture, taste, overall). The results then analyzed with SPSS 18.0 using one way annova on confidence level 95%.

RESULTS AND DISCUSSIONS

Results

Fermentation can improve chemical and physical properties of ganyong flour. This results can be seen in Table 1, 2, and Figure 1.

Table 1. Chemical Results of Fermented Ganyong Flours Various Treatments

Sample	Water (%)	Ash (%)	Lipid (%)	Protein (%)	Crude Fiber (%)	Carbo (%)	pH
TK	10,33±0,54^{b}	2,06±0^{c}	4,58±0,33^{c}	2,60±0,33^{a}	5,58±1,29^{a}	74,85±1,67^{b}	5,78 ± 0,05^{d}
TG 1	10,76±0,11^{c}	1,74±0^{b}	1,21±0,92^{a}	13,65±0,39^{c}	5,53±0,89^{a}	67,12±2,12^{a}	4,35 ± 0,04^{b}
TG 2	10,56±0,15^{bc}	1,67±0^{b}	2,32±0,93^{b}	11,34b±0,5^{b}	5,20±1,03^{a}	68,91±1,54^{a}	4,12 ± 0,01^{a}
TG 3	8,07±0,15^{a}	1,06±0^{a}	1,62±0,20^{ab}	14,91±0,29^{d}	4,50±0,26^{a}	69,85±0,64^{a}	4,45 ± 0,04^{c}

Note :
TK = Ganyong flour without fermentation
TG 1 = Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 1
TG 2 = Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 2 : 1
TG 3 = Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 2

Table 2. Physical Results of Fermented Ganyong Flours Various Treatments

Sample	Bulk Density (g / ml)	Fineness (%)	Form (skor)	Odor (skor)	Colour	
					L	^{0}Hue
TK	0,83±0,02^{a}	98,45	6,27 ± 3,27^{b}	12,40 ± 4,50^{a}	87,94±0,23^{c}	84,7±0,22^{c}
TG 1	0,82±0,01^{a}	98,97	12,53 ± 3,60^{a}	9,33 ± 4,37^{b}	83,40±0,28^{a}	78,51±0,30^{b}
TG 2	0,82±0,02^{a}	99,41	12,93 ± 3,60^{a}	8,93 ± 4,42^{b}	83,06±0,14^{a}	78,11±0,17^{a}
TG 3	0,99±0,02^{b}	99,53	8,00 ± 3,32^{a}	9,33 ± 3,98^{a}	84,56±0,85^{b}	77,96±0,31^{a}

Note :
TK = Ganyong flour without fermentation
TG 1 = Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 1
TG 2 = Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 2 : 1
TG 3 = Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 2

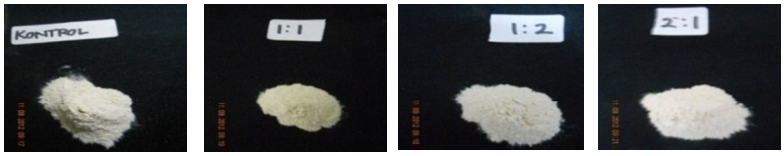


Figure 1. Ganyong Flour Various Treatments

Figure 2. Instant Vermicelli From Ganyong Flour Various Treatments

Next step was making instant vermicelli. The physically and sensory results of instant vermicelli can be seen in Table 3, 4, and Graph 1, Figure 2.

Table 3. Physical Results of Instant Vermicelli

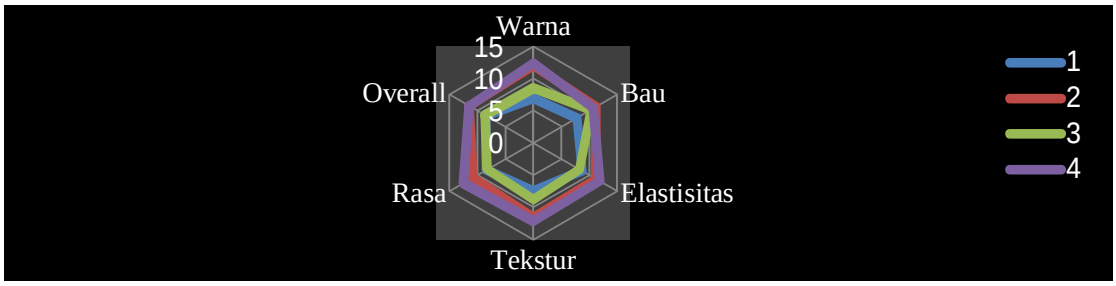
Sample	Degree of Wholeness (%)	Durability (%)	Water Absorption (%)	Rehydration Time (minutes)
BK	56,45	85,46 ± 4,46[a]	179,14±13,26[c]	3
BG 1	63,63	87,28 ± 4,55[a]	148,69±6,80[b]	3
BG 1	62,50	83,98 ± 4,62[a]	187,61±7,33[c]	3
BG 3	66,27	88,26 ± 4,92[a]	105,33±6,60[a]	3

Note :
BK = Instant vermicelli made from ganyong flour without fermentation
BG 1 = Instant vermicelli made from fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 1
BG 2 = Instant vermicelli made from Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 2 : 1
BG 3 = Instant vermicelli made from Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 2

Table 4. Sensory Results of Instant Vermicelli

Sample	Colour	Odor	Elasticity	Texture	Taste	Overall
BK	6,93±3,92[a]	7,73±4,32[a]	8,67±4,21[a]	7,47±3,75[a]	8,40±4,50[a]	8,53±4,17[a]
BG 1	12,00±4,46[b]	11,20±4,25[b]	11,20±4,38[b]	11,60±4,74[b]	10,80±3,95[b]	11,47±4,30[b]
BG 2	8,53±3,75[a]	10,27±4,54[b]	8,27±4,19[a]	8,80±3,55[a]	8,27±4,32[a]	8,67±4,59[a]
BG 3	12,40±3,21[b]	10,80±4,22[b]	11,87±4,26[b]	12,13±4,26[b]	12,53±3,89[b]	11,47±4,03[b]

Note :
BK = Instant vermicelli made from ganyong flour without fermentation
BG 1 = Instant vermicelli made from fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 1
BG 2 = Instant vermicelli made from Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 2 : 1
BG 3 = Instant vermicelli made from Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 2



Note :
1 = Instant vermicelli made from ganyong flour without fermentation
2 = Instant vermicelli made from fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 1
3 = Instant vermicelli made from Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 2 : 1
4 = Instant vermicelli made from Fermented ganyong flour using mixture microbial *S. cereviceae* : *R. oryzae* 1 : 2

Graph 1. Panelists Level of Preference in Instant Vermicelli Sensory Analysis

DISCUSSIONS

Water content in all ganyong flour various treatments are below 11% which can be seen in Table 1. This results are in accordance with the requirements in Indonesia National Standard that maximum water content in rice flour is 13% (SNI 3549-2009). Water content is more affected by drying, not by fermentation so this is the reason why there was no significant different results between fermented ganyong flour and ganyong flour without fermentation

Ash content from all ganyong flour various treatments decreased after fermentation (see Table 1.) Ganyong has high calcium, ferro, and phospor that has great dispersibility level in water and low affinity so a lot of them can be found as free ions (Muchtadi, 2001 ; Watson, 1987). This ions leaching in water soaking during fermentation whereas especially phospor available in large quantity so when the phospor leaching, there will be large decreasing in ash content. Fermentation not affected ash content (Sahlin, 1999).

Lipid content in all ganyong flour various treatments decreased after fermentation (see Table 1.) because the using of *R. oryzae*. This molds break down lipid in ganyong because produce lipase enzyme (Aunstrop, 1979). Lipid was breakdown into simple fatty acids that can be used by molds during fermentaion (Shurtleff *et al*, 1979). So the used of *R. oryzae* in large quantity will lowering the lipid content on ganyong flour.

Protein content in all ganyong flour various treatments increased after fermentation (see Table 1.) because the fermentation used *R. oryzae*. *Rhizopus* sp. is a dominant mold that produce enzyme which can breakdown complex compound into simple compound

like protease. This compound can degrades protein into aromatic amino acids (Oboh *et al*, 2007 ; Shurtleff *et al*, 1979). Other than that, *Rhizopus* can produce protein that better known as single cell protein (SCP) (Fennema, 1985 ; Oboh *et al*, 2007). Moreover, the high increasing in protein content is also because molds containing nucleic acids which contribute the additional of N (Kompiang *et al*, 1994) so the large quantity of *R. oryzae* in fermentation will increas the protein content in ganyong flour.

Crude fiber content from all ganyong flour various treatments decreased after fermentation (see Table 1.). This because of *R. oryzae* that using in fermentation has cellulase activity which is will degrades cellulose (Tamada, 2003) whereas ganyong has a high cellulose content (Fialkoff, 2012) so that the fiber will decrease. Therefore, the large number of *R. oryzae* in fermentation will decrease the crude fibre content.

Carbohydrate content in ganyong flour is decreased after fermentation (see Table 1.) because degraded by mold and yeast through amilase enzyme in the breakdown of starch substrate (McKee *et al.*, 2003).

After fermentation, the pH decrease due to the activity of mold and yeast. They use sugar substrate and produce large amounts of acid and carbondioxide from hexose through the heksosa monofosfat pathway (Onyango *et al*, 2003). In addition, since a by products of yeast metabolism excreted in fermentation solution (change sugar into etanol) is faster than the mold metabolism so the used of *S.cereviceae* in large quantity will lowering the pH values.

Ganyong flour without fermentation has the brighter colour than fermented ganyong flours. Moreover, using *R. oryzae* in high concentration will produce a better colour than *S. cereviceae* because *S. cereviceae* has higher carbohydrate breakdown activity that can produce more simple sugar. This simple sugars will browning rapidly when exposed to heat (Miller, 1993).

The biggest bulk density is fermented ganyong flour using microbial ratio 1 : 2 because this flour has the lowest water content that causes flour particles becoming light until the volume among particles cavities is small so the quantity of flour that can contained is considerable and the bulk density will increased (Prabowo, 2010).

The fineness of all ganyong flours various treatments are below 97%. This results are appropriate according to the Indonesia National Standard that quality criteria of good rice flour is having fineness at least 90% for an 80 mesh sieve (SNI 3549-2009).

Based on Indonesia National Standard 3549-2009, rice flour must have the form of a fine powder and normal odor. The results show that ganyong flour without fermentation has a lower fineness than fermented ganyong flour. However, all samples of ganyong flour has the form of a fine powder so it has according to the Indonesia National Standard (SNI 3549-2009).

Odor of ganyong flour is distinctive normal when the odor of the flour expressed ganyong. Ganyong flour without fermentation has the most characteristically odor of ganyong tubers, while the fermented ganyong flours tends not to smells ganyong. Fermentation will produce spesific taste and aroma that is aldehide and fermentation process will increase the degree of wholeness so that improves the physical properties for the better. But, this results is not appropriate with requirements of the Indonesia National Standar 01-3742-1995 that instant vermicelli must have degree of wholeness at least 90%

Rehydration time for all instant vermicelli from ganyong flour various treatments is the same that is 3 minutes. This results were appropriate with the Indonesia National Standard 01-3742-1995 that the instant vermicelli must be cooked again within a maximum time of 3 minutes.

ester which can affecting the flavour of ganyong flour (Fardiaz, 1992).

The addition of lime juices aims to reducing the brown colour in instant vermicelli. This brown colour caused by caramelization reaction and enzymatic browning (Miller, 1993). The control of enzymatic browning can be done by ascorbic acid (Fennema, 1985). When lime juices added, the pH of vermicelli binder suspension will decreased which makes the browning doesn't happen or be inhibited due to the browning reaction doesn't occur on acidic (pH<5) and base (pH>8) conditions (Hart, 2003).

The instant vermicelli from fermented ganyong flour using microbial ratio 1 : 2 has the highest degree of wholeness. The

Instant vermicelli from fermented ganyong flour using microbial ratio 2 : 1 has the highest water absorption. Instant vermicelli from ganyong flour can absorb water until more than 100% so it can swelling well. If the instant vermicelli has a lot of pores and the pores is big so it can absorb more water and the vermicelli becoming more swelling (Muhajir, 2007).

All instant vermicelli from ganyong flours various treatments has durability between 91% - 94%. This result is not appropriate with the Indonesia National Standard 01-2975-1992 that vermicelli should not be crushed. Although that, fermented ganyong

flours has higher durability than ganyong flour without fermentantion so this result proves that fermentation will improves the physical properties of the instant vermicelli that made from fermented ganyong flours.

From sensory test obtained that the most prefferred instant vermicelli is instant vermicelli that made from fermented ganyong flour using microbial ratio 1 : 2 in terms of the parameters colour, elasticity, texture, taste, and overall that have the highest score assessment of panelist.

CONCLUSIONS

- The best characteristic of ganyong flour is fermented ganyong flour using microbial ratio 1 : 2
- The best characteristics of instant vermicelli is instant vermicelli from fermented ganyong flour using microbial ratio 1 : 2 with the addition of 20% lime juices.

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CHEMICAL AND PHYSICAL CHARACTERISTICS OF FERMENTED *GARUT* (*Maranta arundinacea* L) FLOUR AND THE APPLICATION AS A WHEAT FLOUR ALTERNATIVE SUBSTITUTE FOR INSTANT PASTA MANUFACTURING IN INDONESIA

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ABSTRACT

Garut flour has a potency as a substitute for wheat flour in various kinds of food products including pasta spaghetti. But, the physical properties and the nutrient content of garut flour still poor. So we need tomodify the garut flour by fermentation process. Fermentation of garut tubersis done with *Rhizopus oryzae* and *Lactobacillus plantarum* combination ratio 1:1, 1:2, and 2:1 that fermented in aerob condition for 3 days.After the fermentation done completely, the next step is to make garut flour. The garut flour was analyzed in chemical parameters (water, ash, lipid, protein,crude fiber, and carbohydrate) and physical parameters (density, colour, dispersibility, wettability) to know the effects of fermentation toward garut flour quality.Based on the result, we know that the fermented garut flour mixed cultures *Rhizopus oryzae*:*Lactobacillus plantarum*1:1 has the best value, with water (10,73 ± 0,17 %), ash (5,64 ± 0,13 %), lipid (1,18 ± 0,54 %), protein (3,98 ± 0,12 %), crude fiber (3,28 ± 0,79 %), carbohydrate (75,18 ± 0,63 %), density(77,60 ± 7,99 g/ml), dispersibility(1,75 ± 0,12 %), wettability (123,33 ± 2,52 s),colour(L* 90,98 ± 0,28 a* -0,20 ± 0,01, and b* 4,73 ± 0,11).While analysis conducted on instan pasta is physical parameters (tensil strength, cooking loss, cooking time, and hardness) and sensory analysis (elasticity, odor, colour, flavor, and overall) to know the best characteristic of instan pasta based on fermented garut flour. From the result, we know that the instan pasta based on fermented garut flour mixed cultures *Rhizopus oryzae*:*Lactobacillus plantarum*1:2 has the best value, with tensil strength (7,19 x 10^{-2} ± 3,72 x 10^{-3}N/$mm^{2)}$,cooking loss(5,87 ± 0,30 %), cooking time (416,32 ± 7,95 s), hardness(213,32 ± 1,05 gf),colour(L* 66,55 ± 0,32, a* 0,87 ± 7,96, b* 13,82 ± 0,51), and sensoryoverallparameter (2,97 ± 1,19).

Keywords : *garut flour, mixed microbes, fermentation, instant pasta*

INTRODUCTION

During the period of 2008, the amount of imported wheat flour in Indonesia was increased to 5.3 – 5.5 millions tons. That data showed the huge dependency of Indonesian people with wheat flour commodity. This condition could weakened our national food defence. So food diversification based local commodity is needed, one of example is tubers. Tubers contain high carbohydrate and potentially

as a substitute of wheat and wheat flour (Harjadi, 2004).

One of the food product that potential to process into flour is Garut tuber (*Maranta arundinacea* L). Carbohydrate contain in garut tuber about 85.20 g, so it is potential to substitute wheat flour. Besides that garut tuber contain glisemic index about 14, if compared with glucose that the value is 100, the value of glisemic index in garut is better. So it can be concluded that garut tubers can used as a diet food, because it contain low calories (Marsono 2005).

About 15 – 20 % garut flour can be used as a mix component in noodle and pasta making process. But, chemical and physical characteristic in garut flour still poor enough. Also sensory characteristic like original flavor, taste, and texture of tuber still recognized. So it need to be modified by fermentation process (Karjono, 1998).

By fermentation, nutrition contain in garut tuber can be improved, reduce the original tuber flavor and taste (Sindhu *et al*, 2002). In this research, fermentation process was perfomed with mix microbial combination between *Rhizopus oryzae* : *Lactobacillus plantarum*. So those microbes can work together and complete each other, so the result would be better than single microbial use (Thomson and Yoon, 1984).

The purpose of this research is to modify garut flour through mix microbial fermentation to obtain the compotition of fermented wheat flour that close with wheat flour. These garut flour will applied into pasta product based local stuff that can be accepted in common, useful to developed through food diversification by home industry (small and medium industries), and also reduce the dependency of importing wheat flour.

MATERIALS AND METHODS

Materials

Fresh garut tubers (*Maranta arundinacea L)* from Kulon Progo, Yogyakarta, *Rhizopus oryzae* and *Lactobacillus plantarum*, Potato Dextrose Agar *(*PDA), Malt Extract Agar (MEA), Potato Dextrose Broth (PDB), Malt Extract Broth (MRB), K_2SO_4, HgO, H_2SO_4, $Na_2S_2O_3$ 4%, NaOH 50%, HCl, NaOH 0,1 N, H_2SO_4 0,25N, NaOH 0,25N, Na_2SO_4 10%, alcohol 96%, zink, NaCl, $NaCO_3$, KCO_3, Methyl red blue, Aqudest, Organic solvent, Natrium Tripolyphospate, Vegetable Oil, Eggs, and Salt.

High temperature oven, soxhlet, chromameter, spectrophotometer, incubator, laminar air flow, waterbath, autoclave, food processor, distillator, digester, dehumidifier, slicer, pilleus pump, volume pipette, boiling flask, destruction

flask, distillation flask, condensor, stirrer, 80 mesh siever, micro pipette, hotplate.

Methods

Fermented garut flour making process consist of sorting, peeling, washing, slicing, marinading in natrium metabisulfit 1000 ppm in 3 minutes, inoculation by *Rhizopus oryzae* dan *Saccharomyces cereviceae* (combination 1:1, 1:2, and 2:1) with base concentration each microbe 10^{-6} CFU / ml in every 3 kg garut tubers sliced in 4 lt of waters. Incubation process will be complete in 3 days, after that continue with drying in dehumidifier, flouring, and sieving. Chemical and physical analysis conducted after garut flour done completely. Chemical analysis consist of water, ash, protein, fat, crude fiber, and carbohydrate content. While the physical consist of density, dispersibility, wettability, and color test.

Instant pasta making process consist of pasta dough mixing, moulding, cooking, drying. Physical and sensory analysis conducted after instant pasta done completely. Physical analysis consist of tensil strength test, cooking loss, cooking time, hardness. And the sensory analysis consist of elasticity, texture, flavor, taste, color, and overall. The result will be analyzed with SPSS 18.0.

RESULT AND DISCUSSION

Result

Fermentation can improve the chemical and physical characteristic of garut flour. It shows in table 1 and 2. For physical and sensory characteristic shows in table 3., 4., and 5.

Table 1. Chemical Charactersistic of Fermented Garut Flour

Samples	Water (%)	Ash (%)	Fat (%)	Protein (%)	Crude Fiber (%)	Carbohydrate (%)
A	19,47 ± 0,31	2,30 ± 1,22	0,32 ± 0,16	3,29 ± 0,13	2,66 ± 1,07	71,96 ± 1,20
B	10,73 ± 0,17	5,64 ± 0,13	1,18 ± 0,54	3,98 ± 0,12	3,28 ± 0,79	75,18 ± 0,63
C	9,55 ± 0,11	5,46 ± 0,39	1,14 ± 0,47	3,35 ± 0,10	5,78 ± 1,26	74,71 ± 1,25
D	12,46 ± 0,26	5,42 ± 0,22	1,10 ± 0,72	4,07 ± 0,16	4,74 ± 1,95	72,21 ± 2,42

Notes :
A : Non Fermented Garut Flour
B : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:1
C : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:2
D : Fermented Garut Flour *L. plantarum* : *R. oryzae* 2:1
All value is mean ± deviation standard

Table 2. Physical Characteristic of Fermented Garut Flour

Samples	Density (g/ml)	Dispersibility (%)	Wettability (detik)	Color		
				L*	a*	b*
A	74,70 ± 5,38	1,72 ± 0,06	117,67 ± 9,07	91,31 ± 0,25	-0,22 ± 0,04	4,66 ± 0,17
B	77,60 ± 7,99	1,75 ± 0,12	123,33 ± 2,52	90,98 ± 0,28	-0,20 ± 0,01	4,73 ± 0,11
C	77,00 ± 6,51	1,80 ± 0,10	140,03 ± 3,46	92,08 ± 0,15	-0,24 ± 0,03	4,78 ± 0,21
D	76,20 ± 7,40	1,94 ± 0,07	121,63 ± 5,03	91,83 ± 0,11	-0,21 ± 0,07	4,82 ± 0,15

Notes :
A : Non Fermented Garut Flour
B : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:1
C : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:2
D : Fermented Garut Flour *L. plantarum* : *R. oryzae* 2:1
All value is mean ± deviation standard

Table 3. Physical Characteristic of Instant Pasta

Samples	*Cooking loss* (%)	Hardness (gf)	*Tensile strength* (N/mm^2)	*Cooking time* (detik)
A	6,72 ± 0,14	236,67 ± 1,03	$7,02 \times 10^{-2} \pm 2,03 \times 10^{-3}$	394,24 ± 2,86
B	6,23 ± 0,05	293,33 ± 1,04	$5,13 \times 10^{-2} \pm 1,06 \times 10^{-3}$	401,32 ± 2,37
C	6,10 ± 0,09	257,67 ± 1,25	$6,32 \times 10^{-2} \pm 1,17 \times 10^{-3}$	457,19 ± 1,15
D	5,87 ± 0,30	213,32 ± 1,05	$7,19 \times 10^{-2} \pm 3,72 \times 10^{-3}$	416,32 ± 7,95

Table 4. Color characteristic of Instant Pasta

Color		
L*	a*	b*
91,31 ± 0,25	-0,22 ± 0,04	4,66 ± 0,17
90,98 ± 0,28	-0,20 ± 0,01	4,73 ± 0,11
92,08 ± 0,15	-0,24 ± 0,03	4,78 ± 0,21
91,83 ± 0,11	-0,21 ± 0,07	4,82 ± 0,15

Notes :
A : Non Fermented Garut Flour
B : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:1
C : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:2
D : Fermented Garut Flour *L. plantarum* : *R. oryzae* 2:1
All value is mean ± deviation standard

Table 5. Sensory Characteristic of Instant Pasta

Samples	Parameters				
	Colour	**Flavor**	**Elasticity**	**Taste**	***Overall***
A	2,22 ± 1,16	2,27 ± 1,08	2,43 ± 1,14	2,77 ± 1,07	2,47 ± 1,14
B	2,77 ± 1,04	2,63 ± 0,96	2,13 ± 1,04	2,63 ± 1,10	2,73 ± 1,06
C	1,83 ± 0,87	2,43 ± 1,22	2,57 ± 1,25	2,07 ± 1,04	1,90 ± 0,88
D	3,20 ± 0,92	2,66 ± 1,21	2,93 ± 1,05	2,50 ± 1,20	2,97 ± 1,19

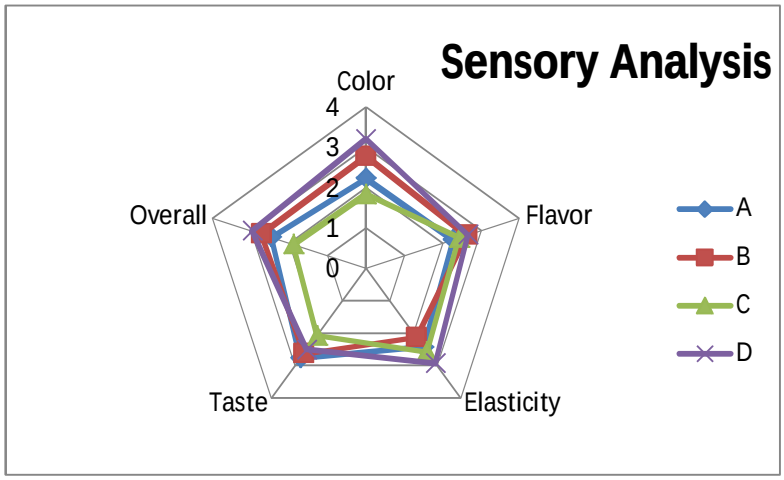

Figure 1. Level of Acceptance of Instant Pasta

Notes :
A : Non Fermented Garut Flour
B : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:1
C : Fermented Garut Flour *L. plantarum* : *R. oryzae* 1:2
D : Fermented Garut Flour *L. plantarum* : *R. oryzae* 2:1
All value is mean ± deviation standard

DISCUSSION

1. Chemical Characteristic of Garut Flour

From Table 1. shows that water contain in samples B to D is match with theory, that said the maximum water contain in flour about 14-15% (Fardiaz, 1989). But the water contain in sample A (see Table 1.) is higher than 14-15%, this condition will increasing the molds and bacterial contamination in flour (Frazier & Westhoff, 1988). For ash content from samples A to D (see Table 1.) was increased. Actually, fermentation had no significant effects with ash content, because ash content counted from minerals residue in food which soluble in water, and has low affinity which

easy to change into free ions. So it will decreasing the ash content in food (Muchtadi, 2011).

From Table 1. shows that fat content in samples B to D is increased. It happens because fat (trigliseride) was hydrolyzed to fatty acid and gliserols by lypase that produced by *Rhizopus oryzae* during fermentation (Septiani, 2004). Besides that, *Lactobacillus plantarum* that used in fermentation process had a secondary lypolytic activities that break fat into simple compounds (Bottazi, 1983). From Table 1. also shows that protein content in sample B to D was increase than sample A. This result is match with the theory that said fermentation process had an effect to protein content. The use of *Lactobacillus plantarum* that produce lypolytic enzymes can modify the protein content in tubers (Arief *et al*, 2006). Besides *L. plantarum*, the use of *Rhizopus oryzae* that belongs to khamir group, can breakdown complex fat compounds into trigliseride, amino acid, and protease (Fennema, 1985).

According to the Table 1. crude fiber content also increased because there is an enzymes that produce by Rhizopus oryzae that break the starch into simple compounds, so with similar weight unit the amount of crude fiber that analyzed was increased. Besides that, during fermentation almost compounds were break into simple part, except crude fiber. So the value of crude fiber increased (Birch, 1985). For carbohydrate contain, in fermented garut flour increase than non fermented garut flour. This result was not fit with theory that, organic compounds that decreased during fermentation process is carbohydrate because it was broke by yeast and khamir through amylase enzyme in amilum breakdown process, so the organic compound decreased (McKee *et al*, 2011).

2. Physical Characteristic of Garut Flour

In physical characteristic of garut flour, density, dispersibility, wettability, and color were tested. For density test, from Table 2. shows that all samples almost have same value. This result is match with theory that density value from powder food about 0,3-0,8 g/ml particles (Wirakartakusumah *et al.*, 1992). In dispersibility test, value of sample A is higher than others. Based on theory, dispersibility value has a relation with dough mouthfeel (Hartoyo & Sunandar, 2006).

For wettability test, the garut flour (fermented or not fermented) have lower value than wheat flour. Because garut flour has no gliadin as gluten's component, that only find in wheat flour. Beside that, the decreation happen because fermentation process that cause protein denaturation, agglomeration process, material's

absorbtion ability, non agglomerate partcicles, and particles size (Hartoyo & Sunandar, 2006; Canovas & Mercado, 1996). In color test, from Table 2. shows that the lightness value in fermented garut flour was decreased. It happen because in fermented garut flour have higher ash content, so the color was darker (deMan, 1997), browning enzymatic reaction that happen while peeling and slicing process. In that process, tubers was exposed by oxygen in huge amount, so oxygen transform into *orthoquinon* compounds that produce brown pigment or melamin (Fennema, 1985).

3. Physical Characteristic of Instantt Pasta

Physical analytic for instant pasta including cooking loss, hardness, tensile strength, cooking time, and color test. For cooking loss value in fermented based instant pasta is lower than instant pasta control, it happen because the high level of ash and fat content that dissolved in water when boiled, will decrease cooking loss value (Fennema, 1985). Based on that theory, this result was not match because in fermented based instant pasta, that contain high ash and fat content, the cooking value is low. Maybe this deviation happen because the increasement of protein content in wheat and garut flour mixture. In instant pasta from fermented garut flour, protein content from wheat flour increase by substitution of fermented garut flour, but in non fermented pasta just depend from protein content from wheat flour (Matz,1992).

There is gluten that consist of glutenin to build three dimensions system to bind the dough, so the dough will stay elastic, tough, and hard to solve (Beckett, 1995). For hardness test, instant pasta from fermented garut flour has higher value than instant pasta control, that contradictive with tensile strength value (Owens, 2001). Tensile strength test related with protein content. Because in wheat flour contains gluten that able to interfence the cohesifity, elasticity, and stretchness of instant pasta (Owens, 2001).

In cooking time, instant pasta from fermented garut flour has longer boiling time. The higher protein content can decreased cooking time value, because some heat in cooking process will used to denaturate protein (Bambang, 2011). For color test from Table 4., instant pasta is darker than the flour. It caused by mixing process between wheat flour, garut flour, and other additional matter, the higher ratio of garut flour mixed in will decreased the lightness and yellow color in instant pasta (Owens, 2001; Kruger *et al*, 1996).

4. Sensory Characteristic of Instantt Pasta

The sensory characteristic consist of color, flavor, elasticity, taste, and overall. Based on Table 5., for color, elasticity, and overall parameters, the samples D (instant pasta from fermented garut flour *L.plantarum* : *R. oryzae* 2:1) is most interested. Because according the panelis interest, color and flavor in sample D is most acceptable. This result match with the theory that said fermentation process can increased the flavor and taste from a product (Chabela, dkk., 2001). But for taste parameter, sample A (instant pasta control) is the most accepted by panelis, than the others. The unacceptable taste in instant pasta is not match woth theory that said During fermentation, starch granules will hydrolyzed into monosaccarides as the raw materials of organic acids, specially lactic acid. That acid compound mixed in flour, when this flour processed will produce unique flavor and taste that covered the original flavor of tubers that unaccepted by consumens (Sarpina *et al*., 2007).

CONCLUSION

Fermented garut flour mixture microbial *L. plantarum* : *R. oyzae* 2:1 is the best compotition to make instant pasta.

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ANTIOXIDANT ACTIVITY OF HOT AND COLD WATER EXTRACT FROM DURIAN SEED *ANGKAK*

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ABSTRACT

Angkak is a fermented rice product by *Monascus sp*. *Angkak* can be made from various substrates such as cassava, wheat bran, wheat meal, bread meal, corn meal,jackfruit seeds, adlay, and durian seeds. Durian seeds can be the fermentation media for *Monascus sp*. because they contain starch as a substrate. *Monascus sp*. produces some secondary metabolites such as pigments, isoflavones, dimerumic acid, dihydromonacolin-MV, dihydromonacolin-MV2, vanilic acid, (-) matairesinol, N-trans-ferloytyramine, and 3-hydroxl-4-methoxy-benzoic acid which have antioxidant activity. The scavenging antioxidant activity of hot (90^0C) and cold (30^0C) water extract of durian seed *angkak* can be analyzed with 1,1-diphenyl-2-picrylhydrazil (DPPH). The cold water extract can produce the lower yield than the hot water extract, otherwise the cold water extract shows higher scavenging ability on DPPH radicals than hot water extract.

Keywords: *Monascus sp., durian seed angkak, antioxidant activity*

INTRODUCTION

Angkak is fermented rice product by *Monascus sp*. *Angkak* has been used as food colorant and food preservatives. *Angkak* has been used in Chinese cuisine and medicinal food to promote blood circulation for centuries. The medicinal properties of *angkak* are that it favorably impacts lipid profiles of hypercholesterolemic patients. Nowdays *angkak* also used as a source of antioxidant (Chairote *et al.*, 2009).

Traditionally, *angkak* produced by solid state fermentation with rice as the substrate. Many studies showed that it grows in a wide variety of agro-industrial residues i.e. rice bran, wheat bran, cassava bagasse, jack fruit seed (Subhasree *et al.*, 2011), and durian seed (Srianta *et al.*, 2012). Durian (*Durio zibethinu Murr)* seed contain high carbohydrate (43,6%) that can be used as a substrate for fermentation.

Several secondary metabolites of rice *angkak* that can be used as antioxidant are yellow pigment, dimerumic acid, dimerumic acid, dihydromonacolin-M, dihydromonacolin-MV2, vanilic acid, (-) matairesinol, N-trans-ferloytyramine, and 3-hydroxl-4-methoxy-benzoic acid (Cheng

et al., 2010) and isoflavon compounds (Puttananjaiah *et al.*, 2011).

Water can be used as a solvent for antioxidant compounds in *angkak*. The water temperature determines antioxidant compounds that can be extracted (Lee *et al.*, 2007). The scavenging antioxidant activity of durian seed *angkak* can be analyzed with 1,1-diphenyl-2-picrylhydrazil (DPPH).

DISCUSSION

Antioxidant Potential of *Monascus sp.* Secondary Metabolites

The growth process of *Monascus sp*. utilizes source of nitrogen and carbon to produce succinate acid, citric acid, glukonic acid, oxalic acid, and ethanol as a primary metabolites (Kumari, 2009) and also few of useful secondary metabolites which are Monacolin K (Adjari *et al*., 2011), γ-aminobutiric acid (GABA), dimerumic acid (Aniya *et al*., 2000), and another bioactive compounds that haven't been proven medically yet. Those secondary metabolites are capable to be anticholesterol, anticarsinogenic, or antifatigue compound (Kumari, 2009).

The research of Aniya *et al*. (2000) and Taira *et al.* (2002) explained that dimerumic acid has a major role as a antioxidant compound but further research also showed that dihydromonacolin-MV and dehydromonacolin-MV2 which are monacolin derivatives are also able to be the antioxidant. Then the research of Kumari (2009) expressed that ankaflvin and isoflavones that contained in *Monascus purpureus extract* could be the antioxidant too. Another research held by Wu *et al*. (2010) achieved to isolate and identify *Monascus*pyrolle as the pyrolle derivatives compound from *Monascus pilosus* extract. Another antioxidant compounds are vanilic acid, (-) matairesinol, N-trans-ferloytyramine, and 3-hydroxl-4-methoxy-benzoic acid (Cheng *et al.*, 2010). Those secondary metabolites of *Monascus sp*. has shown their activity in scavenging 1,1-Diphenyl-2-Picrylhidrazyl (DPPH) radical.

Pigments of *Monascus* sp.

Monascus sp. produces at least six main pigments which are categorized to three groups depend on their colour. Ankaflavin and monascin are yellow pigment, rubropuktatin and monaskorubrin are orange pigments, rubropuktamin and monaskorubramin are red pigments (Timotius, 2004). The concentration of the pigment can be estimated with spectroscopy method at 392 nm, 470 nm, and 501 nm wave length for each yellow pigments, orange pigments, and red pigments (Puspitadewi, 2012). The chemical structure of *Monascus* pigments (Pattanagul *et al*., 2007) are on Fig 1.

Red and yellow pigments are the derivatives of orange pigments. Yellow pigments are formed by reduction reaction of orange pigments,while red pigments produced by Schiff Base reaction of amydase enzyme (Kumari, 2009). The research of Puspitadewi (2012) investigated a model of *Monascus* pigments production by *Monascus sp*. KJR 2 cultivated on Petruk durian seeds through solid state fermentation. The result is yellow pigments are the dominant pigments which are produced by *Monascus sp.* KJR 2 cultivated on Petruk durian seeds (Graph 1.).

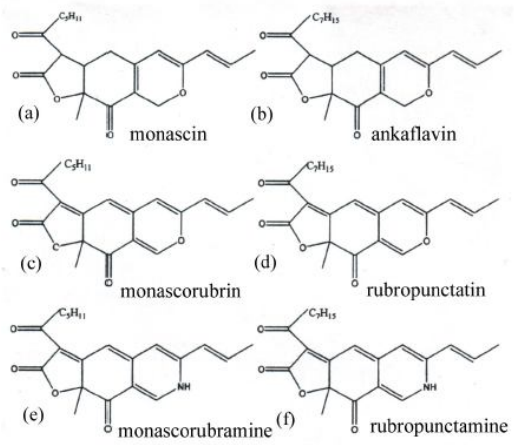
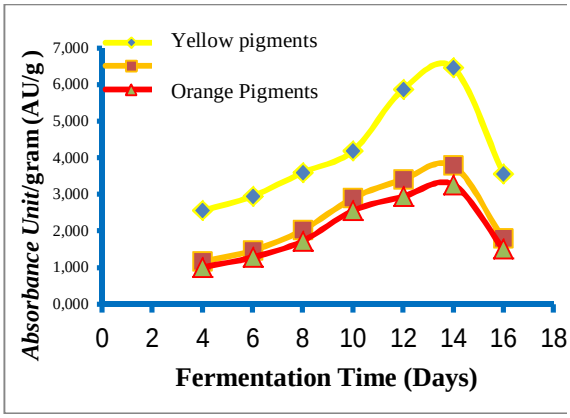


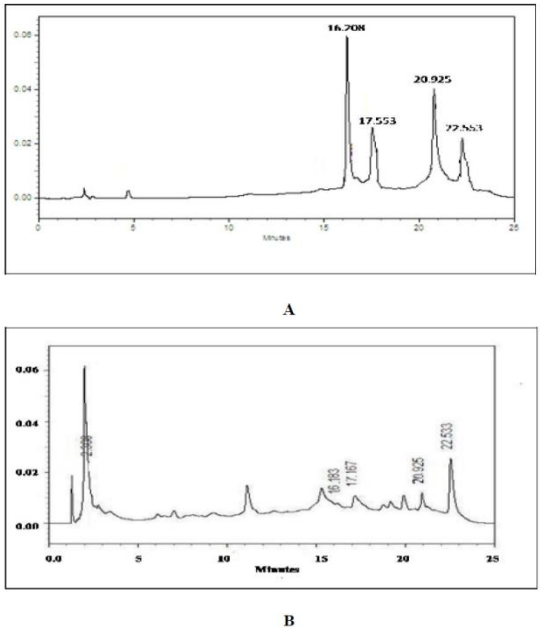
Figure 1. The Chemical Stucture of *Monascus* Pigments



Graph 1. A Model of *Monascus sp*. KJR 2 Water Extract Pigments Cultivated on Petruk Durian Seeds

Isoflavones of *Monascus sp.*

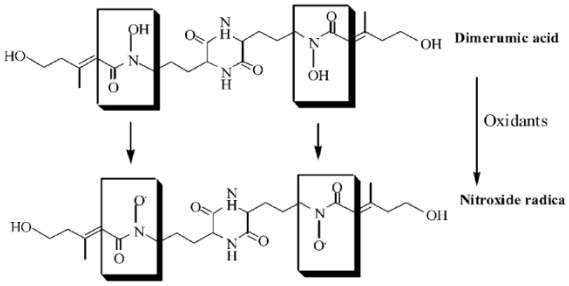
On his research, Kumari (2009) quantified the concentration of isoflavones which are contained in the *Monascus purpureus* extract by High Pressure Liquid Chromatography (HPLC) method with the isoflavone as a standard. The result showed that there were some glucosidic isoflavones (genistin and daidzin) and aglyconic isoflavones (genistein and daidzein) at concentration 20,39 mg/100mL and 0,37 mg/100mL (Graph 2.). The presence of sugar and hydroxyl groups on flavonoid derivatives will increase the solubility of that compound in water (Shahidi and Naczk, 1995). Many studies indicated that isoflavones has an antioxidant and anticarcinogenic characterisation. Based on that, Kumari (2009) continued the research by analyzing the antioxidant activity of *Monascus purpureus* extract by DPPH method. Antioxidant activity of *Monascus purpureus* extract was capable in scavenging the DPPH radical about 35,81%.



Graph 2. HPLC Profile of Isoflavone Standard (A) and *Monascus purpureus* Extract (B)

Dimerumic Acid of *Monascus* sp.

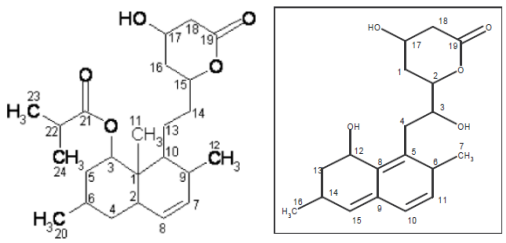
Aniya *et al.* (2002) isolated dimerumic acid from *Monascus*, the result of their research showed that dimerumic acid in low concentration was able to scavenge strongly towards DPPH radical, superoxide radical, and hydroxyl radical. Antioxidant properties of dimerumic acid is made up by the contribution of hydrogen atoms from hydroxamic acid groups to oxidants (Taira *et al.*, 2002) then in the end of the reaction nitroxide radical is formed (Graph 3).



Graph 3. Antioxidant Properties of Dimerumic Acid

Dihydromonacolin-MV and Dehydromonacolin-MV2 of *Monascus sp.*

Dihydromonacolin-MV and Dehydromonacoli-MV2 (Graph 4.) is the monacolin-K derivatives where the ester group is 2-methyl propionate. The research that conducted by Dhale *et al.* (2007) said that dihydromonacolin-MV and dehydromonacoli-MV2 have significant scavenging activity toward DPPH radical and superoxide radical. The double activity of dihydromonacolin-MV and dehydromonacolin-MV2 showed their capability as antioxidant in preventing atherosclerosis by avoiding the LDL (Low Density Lipoprotein) oxidation during oxidative stress.



Graph 4. The Chemical Structure of Dihydromonacolin-MV and dehydromonacolin-MV2

The Effect of Hot and Cold Water Extract to Antioxidant Activity of Durian Seed *Angkak*

Before analyze the antioxidant activity of durian seed *angkak*, it needs to be extracted first. Extraction is a method of separation several compounds from aqueous or solid substance physically or chemically. During the extraction process, solvent will comes

into the cell of substance and dissolves the compounds that possibly have the antioxidant activity especially the compounds with the similar polarity with water. The extraction method with heating can increase the rate of compound solubility because the difference of pressure within inside and outside the cell that cause the lysis of cell membrane and cell wall. Hot water extraction was also used by Wang *et al*. (2012) for *Monascus* micellia extraction. The research of Jenie *et al*. (1994) showed that the solubility of *Monascus purpureus* pigments cultivated on tapioca liquid and solid waste and tofu solid waste will increase with the higher water temperature (60°C, 80°C, and 100°C). The same result was showed in Lee *et al*. (2007) research, the higher water temperature for *Monascus*-Fermented Soybeans (MFS) extract produced the higher yield (Table 1.).

	Extraction yield[a] (g/100 g)	
	MFS-31499	MFS-31527
Cold water	a39.6 ± 0.45A[b]	b25.7 ± 1.78C
Hot water	a39.0 ± 0.92A	a30.2 ± 0.63C

Table 1. Extraction Yield of Cold and Hot Water Extracts from MFS (MFS-31499 and MFS-31527)

The higher temperature of water extract can produce the higher yield but affects the lower scavenging activity of DPPH radical (Lee *et al.*, 2007). The hot MFS extract (100°C) showed lower scavenging activity of DPPH radical than cold water MFS extract (25°C) (Table 2.).

Table 2. EC_{50} Values of Cold and Hot Water Extracs from MFS (MFS-31499 and MFS-31527) and soybeans

	EC_{50}value[a] (mg extract/mL)		
	MFS-31499	MFS-31527	Soybean
Cold Water	a8.76 ± 0.13A	a4.26 ± 0.06B	a1.79± 0.07C
Hot Water	b2.66 ± 0.04A	b1.66 ± 0.02B	b1.59± 0.04C

The decreasing of antioxidant activity might be caused by chemical changing, oxidation, and phenolic decomposition or forming complex phenol-protein so the phenolic compound loss their activity as antioxidant (Estiasih and Sofia, 2009). Otherwise, the *Monascus* pigments sensitives with heat, instable at various acidity (2-10), and lights (Timotius, 2004).

CONCLUSION

The cold water extract of durian seed *angkak* can produce the lower yield than the hot water extract. Otherwise, the cold water extract of durian seed *angkak* showed the higher scavenging activity of 1,1-diphenyl-2-picrylhydrazil (DPPH) radical than the hot water extract.

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STUDIES ON THE EFFECTIVENESS OF MINISTRY OF FINANCE REGULATION NO. 67/ 2010 ON THE INCREASE OF COCOA BEANS EXPORT

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ABSTRACT

Indonesia is the third largest country of cocoa producers with the production reached 430,000 tons per year, after the Ivory Coast to reach 1.3 million tones, and Ghana reached 750. 000 tons. Seiling value of Indonesian cocoa in the international market is very low because most of the beans produced were dried beans without fermentation. Only about 10% was sold as fermented beans. Meanwhile only three countries those were still willing to accept non-fermented cocoa beans, i.e. United States, Singapore and Malaysia. As the consequent the price is low. On the other hands, European countries such as Switzerland, Belgium and the UK would only accept cocoa bean fermentation. Therefore, the industries in these countries imported cocoa beans from Ivory Coast and Ghana because the beans from these two countries were fermented ones. To address these problems then the Government of Indonesia issued the Ministerial Policy through the Reguation of the Ministry of Finance No. 67/ 2010 regarding the duties on exports of cocoa beans to improve the standardization of the quality. The regulation aimed to boost Indonesian cocoa exports in the form of fermentation. The purpose of this paper was to examine the effectiveness of the policy. The studies were conducted through the development of import and export of cocoa beans, analysis of the governmental policies related to the cocoa production and marketing system and other literature review. From the study it was found that the policy is effectively increasing the selling price from Rp. 38.607/kg in 2009, to Rp. 34.326/kg in 2010, and 57.905/kg in 2011. However, the Ministerial Policy failed to increase the value and volume of exports of cocoa, because they actually declined since the policy was implemented. It was due to the fact that 89% of cocoa in Indonesia were owned by farmers and the rest 11% owned by a large companies. It can be assumed that the increase in export sales value per unit can only be enjoyed by large companies. If farmers were exporting, then the selling price will be lower, and the high export taxes. This was due to cocoa products sold were non-fermented cocoa which has a low selling price. Lack of knowledge, skills, equipment, and capital owned by peasant farmers to be a limiting factor of fermentation of cocoa. While large companies prefer to buy unfermented cocoa beans even willing to pay before harvest because it can lower prices by raising taxes. On withstanding on these facts, the ministerial policy should be accompanied with intensive guidance, increasing farmers skills and working capital, and the provision of equipment to farmers.

Keywords: *cocoa beans, fermentation, Ministry of Finance Regulation No No. 67/ 2010, export*

INTRODUCTION

Cocoa is one of the plantation commodity that holds an important role in Indonesia's economy, as a producer of foreign exchange, job field providers, encouraging the development of agribusiness and agro-industries (Direktorat Jendral Perkebunan, 2010). Up to now, Indonesia is the third largest producer of cocoa in the world after Ivory Coast and Ghana with a total area of 1,563,423 hectares and a production of 795,581 ton. Indonesia is known as the world's largest cocoa producing country, but the productivity and the quality is still very low.

Most of the cocoa that produced by Indonesia is exported to the other countries. This condition occurs due to the cocoa processing in Indonesia is still low in development. Cocoa farmers that mostly small holders also prefer to sell cocoa to the exporters for faster payment. Unfermented cocoa bean prices in the international market is much lower than the price of cocoa beans that are fermented. The price difference between them is about Rp. 2000.00 up to Rp. 2900.00 per kg. With this situation, the government and related institutions must find ways to improve the quality of Indonesian farmers, especially cocoa processing in Indonesia.

To overcome this problem the government issued a policy of imposing duties on exports of cocoa beans with PMK No. 67/PMK.011/2010 tentang apa. Peraturan ini mengatur apa. The aim is to ensure the supply of raw cocoa beans to cocoa processing industry in the country and to encourage the development of the cocoa processing in Indonesia.

The purpose of writing this paper is to analyze the production of cocoa in Indonesia, for criticizes the government in improving the education of farmers and export to the countries that produce the big amount of cocoa products, as well as the selling price of Indonesian cocoa exports.

METHODOLOGY

The method used in this paper was searching a variety of data on the searching engine of the popular media, the data of value and volume exports development of cocoa and rival countries, from the official reports of government agencies that is Directorate General of Plantation 2010, the desk study to the similar study, and comparative analysis of value / volume.

RESULTS AND DISCUSSION

The development of cocoa production in the country during the years 2006-2010 showed an inconsistent state. Decreasing and then

increasing from year to year. Productivity of the last 5 years have the condition up and down like cocoa production in Indonesia. However, the vast harvest has increased from year to year.

Table 1. Development of production, productivity, and harvested area in Indonesia

	2006	2007	2008	2009	2010
Production (tons)	769,386	740,006	803,593	809,583	837,916
Harvested area (acres)	1,190,000	1,379,279	1,473,259	1,592,982	1,651,539

Production is clearly below the Ivory Coast and Ghana reached 1,270,226 tons 830,790 tons in 2009. As shown in the following table.

Table 2. Cocoa Production of Ivory Coast and Ghana

	Ivory Coast	Ghana
2009	1,270,226 tons	830,790 tons

Compared with the Ivory Coast and Ghana, Indonesia cocoa exports under the two countries. Indonesia exported to the United States, Singapore and Malaysia. While Ivory Coast and Ghana exported to European countries such as Switzerland, Belgium and the UK would only accept cocoa bean fermentation. Only the Ivory Coast and Ghana were able to meet these needs. European countries do not want to accept the export of cocoa from Indonesia because low quality and not fermented.

Indonesia has a big opportunity to seize the world market because the producing countries such as Papua, Vietnam, Malaysia and the Philippines are far below Indonesia. To seize market opportunities, it needed to increase productivity, the use of high yielding varieties, fermentation treatment properly and handling nuisance pests (Plant Pest Organisms) in the on-farm sector. While in the off farm sector industries, it needs improvement in the international trade of Indonesia so it can be recognized and appreciated even able to obtain the price that should be.

Data export of cocoa beans and processed cocoa from 2009 to 2011 which can be seen in the table below.

Commodity	Export (ton)		
	2009	2010	2011(Jan-Nov)
Cocoa Bean	439,300	430,000	210,000
Processed Cocoa	82,539	103,055	156,450

Source : Kementerian Perdagangan dan BPS

In the table above it can be seen that Indonesia export more than cocoa beans that have been processed. However, from the above data it can be concluded that each year of Indonesian cocoa exports continued to decline. From the year 2009 the value of exports 439,300 tons, in 2010 to 430,000 tons, and in 2011 (Jan-Nov) dropped to 210,000 tons. While the value of exports actually rose from processed cocoa annually. In the year 2009 reached 82,539 tons in 2010 to 103,055 tons, and in 2011 (Jan-Nov) rose to 156,450 tons.

Commodity	Value (rupiah)		
	2009	2010	2011
Cocoa Beans (kg)	38,607	34,326	57,905

Source : The Ministry of Trade and Central Bureau of Statistics

In the table above it can be seen that the value of sales of cocoa beans reached Rp 38,607.00 in 2009. In the year 2010 reached Rp 34,326.00. Whereas in 2011 reached Rp 57,905.00.

In 2009 to 2011 decreasing occurs in the volume of exported cocoa. Sell value of Indonesian cocoa on the international market is very low because most of the beans produced in Indonesia is unfermented cocoa beans, that makes Indonesia does not fulfill the quality standards of the quality of the country will be exported because the country would only accept fermentated cocoa bean. Therefore, the industry imported cocoa beans from the Ivory Coast and Ghana because of the quality of cocoa beans from 2 countries are better than Indonesia. Only about 10 percent of that amount through the process of fermentation, and about 90% did not undergo the process of fermentation. This is why only the U.S., Malaysia and Singapore are willing to accept without the fermentation of cocoa beans from Indonesia but lower costs with higher taxes so that farmers suffered losses. Because of the difficult material from Indonesia, it led the domestic indrustry to imports from the Ivory Coast and Ghana cocoa beans that are fermented.

To overcome these problems, Indonesia make the Policy No. PMK. 67 of 2010 concerning the imposition of duties on exports of cocoa beans to improve the standardization of the quality and effectiveness so as to boost Indonesian cocoa exports in the form of fermentation. Policy No. PMK. 67 of 2010 is very strategic moment because of this policy should be able to force farmers to ferment

because farmers have a major impact for Indonesia. Since the enactment of Policy. No. PMK. 67 of 2010, production growth is decreasing. Whereas in previous years has increased. An increase in sales value of Rp 34,326.00 become Rp 57,905.00. But selling a small fraction showed cocoa exported. Though farmers hold 89% of their products, but it can be presumed that cocoa production could enjoy only private company that only holds 11%. It is also due to farmers due to lack of knowledge, skills, equipment, and capital owned by farmers who became an inhibiting factor for the fermentation of cocoa farmers. Due to lack of knowledge and skills, it makes farmer reluctant to fermentation of cocoa beans and the impact is they get difficulties at the time of going to sell the cocoa beans. And they prefer to sell to indrustry because it will provide a quick cash flow. Of the problem, the policy should be accompanied by coaching, skills, capital, and the provision of equipment to farmers. It can be resolved by increased the quality of product and controlled the disease.

CONCLUSION

- Cocoa is one of the plantation commodity that holds an important role in the Indonesian economy.
- Indonesia is the third largest producer of cocoa in the world after Ivory Coast and Ghana.
- The market share of Indonesia's biggest export cocoa are the European Union and the United States.
- In order to not to lose market, it needs a change of Indonesian farmers to improve the quality of cocoa.
- It needs an improvement in the sector on farm and off farm.
- The low quality of Indonesian cocoa fueled also by the post-harvest cultivation perfunctory.
- There was a decrease in the volume of cocoa exports in the year 2009 to 2011.
- PMK. No. 67/PMK.011/2010 contains policies imposing duties on exports of cocoa beans.

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REVIEW STUDY OF MICROBIOLOGY BIODIVERSITY FROM ASEAN FERMENTED FOOD

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ABSTRACT

Fermented foods are generally produced using plant or animal ingredients in combination with microorganisms which are either sourced from the environment, or carefully kept in cultures maintained by humans. In Asean, we easily find the fermented food products. This study was to previously preserve the fermented food products because of the conventional technology. There are many fermented food products such as tempoyak, peda, miso and etc. Each country has a traditional itself to produce fermented food. In Indonesia, soybean product can be processed as tempeh, but it can become nato in Japan. The objective of this study is to intoduce biodiversity fermented food in Asean. In addition we can get a local knowledge from the fermented food product in Asean. However, this is not separated from the role of specific microorganisms in each country.

Keywords: *fermented food, microorganisms, preservation, traditional, local knowledge*

INTRODUCTION

Fermented foods are generally produced using plant or animal ingredients in combination with microorganisms which are either sourced from the environtment, or carefully kept in cultures maintained by humans. Just as living organisms cover the surface of the earth, fermentation microbes cover the surface of the organisms. Microorganisms components in foodstuffs in the fermentation process can be converted into the desired product beacuse they play a role in the fermentation process among other yeast, fungi and bacteria (Volk & wheeler, 1984).

This study was to previously preserve the fermented food products but now it becomes a product that has a high economic value and functionality. Lactic acid bacteria (LAB) are examples of beneficial microorganisms and has an important role in the food industry (Rahayu & Margino,

1997). It can be found at traditional fermented food product and becomes microorganism which used as comercial product.

In Asean, there is a lot of fermented food product such as tempeh, peda, tempoyak, miso, kinema and so forth. The objective of this study is to intoduce biodiversity fermented food in Asean. In addition we can get a local knowledge from the fermented food product in Asean.

FERMENTED PRODUCT OF ASEAN

INDONESIA

Tempeh

Tempeh is a fermented product made from that have been soaked and cooked to soften them (Astuti, 2000). Tempeh is a widely consumed Indonesian traditional fermented food, which is principally made with soybeans, but can also be made from a variety of legumes and seeds. Historical evidence shows that soybean tempeh is a fermented product originally made by Central Javanese people and appeared in their food pattern around the 1700s.

There are four steps in the tempeh manufacturing process, soaking, boiling, inoculating with microbial and incubating at room temperature. Tempeh in Indonesia is fermented with *Rhizopus* sp. mould, especially *Rhizopus oligosporus*, *R. oryzae*, *R. arhizus*, *R. stolonifer* and *R. microspores*. Traditional inoculum is prepared in Hibiscus or teak leaf and inoculum powder is prepared from cooked rice. Tempeh producers in Indonesia do not use the pure culture of *R. oligosporus*, but they use a mixed culture of *Rhizopus* sp. There is no standard process for tempeh making, which is one of the reasons why there is a lot of variation in tempe making from one region and one producer to another (Astuti, 2000).

Tempoyak

Tempoyak is fermented durian (Durio zibethinus Murr.) which has a sense, a distinctive aroma and usually creamy yellow. The Fermentation of Tempoyak occurs naturally or without the addition of inoculum (Yuliana & Dizon, 2011). The main ingredient is the creation tempoyak ripe durian. The better quality of the durian is used then the resulting tempoyak quality will be better too. Rahayu (2003) showed BAL on tempoyak is *Lactobacillus plantarum* and *Streptococcus sp.*

Mandai jackfruit

Mandai jackfruit is a traditional food made from jackfruit dami which fermented using the high salinity is around 10-20% (w / w) for 1-2 weeks (Rahayu, 2003). Jackfruit dami is part of the jackfruit that can be processed and used as traditional food, even

when processed can be used as a substrate for the identification of lactic acid bacteria. According Rahayu (2003), she said that type of the lactic acid bacteria *Lactobacillus plantarum* and *Streptococcus thermophillus pentosus* influences in the fermentation process mandai jackfruit. The characteristic of completed fermentation of dami jackfruit is tender and flavorful texture dami alcohol that is not too sting.

Sourkrout

Sourkrout is a product that has a distinctive flavor, which is produced from the fermentation of lactic acid bacteria. In this fermentation process, lactic acid bacteria are left active *mesenteroide Leuconostoc, Lactobacillus grandson-Meris, L. plantarum and L. pentoaceticus*. At the beginning of fermentation, the bacteria are active in a large number of coliform bacteria such as *Aerobacter cloacer,* which produces gas and acid-volatile acids and the condition is also active bacteria *Rhenanus flavo-bacterium*, which produces flavor compounds forming of the combination acid and alcohols forming esters. Anaerobic fermentation of carried out in a state, but if there is air in fermentation container, will cause the decay process in sourkrouts (Anonim, 1981).

Peda

Peda usually made drom “kembung” fish, both male or female. The good peda has fresh red color, fat content for about 7-14% that brings delicious taste, and special taste because of fermentation (Astawan, 1997). Peda is fermented with high salt content spontaneously. That means the fermentation runs naturally by selected microbial because of salt added and bekept for a couple days. Salt added in the fermentation can increase the taste of fish, form the texture, and control the microorganisms, stimulate growth of microorganisms needed and inhibit the growth of rotting and pathogen microorganisms. Fermentation in peda can change the characteristic and form of fish, and also can prolong the shelf life of the fish (Ilminigtyas *et al.*, 2000).

The microorganism used in the fermentation come from the fish itself or from the salt added. Advanced identification is needed to know the appropriate bacteria. from many researches, can be found that the microbia can be from genus *Acinetobacter, Flavobacterium,Cytophaga, Halobacterium, Halococcus, Micrococcus*, *Staphylococcus* and *Corynebacterium*.

Ketchup

Ketchup can be made from fish, to be a transparent brown liquid, salty taste and

special aroma. This salty ketchup can be made from little fish, 'rucah' fish, and unused part of the fish. This product are rich of nitrogen and also important mineral to human body. The fermentation process of ketchup take time 2-12 months or more. In this process, the tissues hydrolyzed by enzymes (protease, lipase, and amylase) from microbial or the tissue itself. Fermentation on ketchup making also use high content of salt (Astawan, 1997).

The microorganisms found in fermentation process from this product are halophile bacteria and some kinds of mold, *Cladosporium herbarum, Aspergillus fumigatusPenicillium notatum*, and also yeast *Caudida clausenii*. At the beginning of fermentation, *Bacillus* sp, especially *B. coagulans*, *B. megaterium* dan *B. Subtilis* are found. During fermentation, can be found *Staphylococcus epidermis*, *B. lincheniformis*, and *Micrococcus calpogenes*. The end of the fermentation, can be found *M. variants* and *M.saprophyticusi*. The bacteria produce enzymes that can degrade certain compounds and form special compound in the product. Total microbial will decrease during fermentation because of acid producing.

Terasi

Terasi is paste fish fermented product. Terasi can be made from little fish, 'rebon' shrimp, and also little shrimp. The raw materials are then mixed with tapioca. The tapioca cause lactic acid fermentation through the fishes. In this fermentation, salt also be added to the dough to stimulate the growth of lactic acid bacteria (Astawan, 1997).

The bacteria that can be found from this process are mostly from genus Micrococci. Some are from *Flavobacterium, Achromobacter, Pseudomonas, Bacillus* and *Sarcina*. Beside that it can also be found *Aerococcus, Corynebacterium, Cytophaga, Halobacterium, Acinetobacter*, and some kinds of molds.

JAPAN

Miso

Miso is the name for the product used in Japan. Miso-like products, however, are also made in other countries throughout the Orient and their names mean literally bean paste because they are pastes and are made from soybeans. Miso is generally used as a flavoring agent with various foods including fish, meats, and vegetables. In Japan, miso is used primarily to make a soup with vegetables which takes tho place of our hot cereal for breakfast (Hesseltine, 1986).

Miso manufacture is essentially two successive fermentations. The first involves the preparation of koji under aerobic conditions from strains of *A. Oryzae* and *A. sojae*. The molded rice koji serves as source of enzymes and nutrients for the second fermentation. The second is an anaerobic fermentation involving yeasts and bacteria.

Natto

In the natural fermentation of soybeans, molds usually dominate, but natto is one of the few products in which bacteria predominate during fermentation. *Bacillus natto,* identified as *Bacillus subtilis*, is claimed to be the organism responsible for natto fermentation. Consequently, natto possesses the characteristic odor and persistent musty flavor of this organism, and is also covered with viscous, sticky polymers that this organism produces.

Many papers have been published concerning the microorganisms in natto fermentation; however, it is now well established that bacilli are the most important ones. Based on Muramatsu's account (1912), Sawamura was first to give the name of *B. natto* to 1 of the 2 bacilli that he isolated from natto. He identified the other one as a variety of *B. Mes. Vulgatus*. He also believed that both bacilli were required to make good natto. *B. natto* produced natto with good taste and aroma and *B. Mes. Vulgatus* provided the needed stickiness. But Muto (also cited by Muramatsu 1912) found that only one bacterium, which belonged to the B. subtilis group, was necessary for the preparation of natto.

INDIA

Kinema

Kinema is a soybean based fermented food. The soybean (*Glycine max*) is locally known as *bhatmas* and the varieties used are "yellow cultivar" and "dark brown cultivar". It is produced individually or on household level and sold in the local markets. It is extensively prepared by the *Nepalis* belonging to the *Limboo* and *Rai* castes of Sikkim. The produce is sticky in nature and has an ammonical flavour. The skill of production of this delicacy has been protected as a hereditary right and passed from one generation to another (Tamang *et al*., 2009). It is produced by the natural fermentation of bacterial species namely *Bacillus subtilis* and *Enterococcus faecium*. The fungal species *Candida parapsilosis* and *Geotrichum candidum* have also isolated from commercially available *kinema* (Sarkar *et al*., 1994).

CHINA

Sufu

Over the centuries, the Chinese have used microorganisms to convert agricultural commodities into fermented food (Chen,

1989). Sufu is the name for the product that first appeared in the literature (Wang and Hesseltine, 1970). Literally, sufu (*fu-ru*) means "moulded milk" and tosufu (*dou-fu-ru*) means "moulded soymilk". Most sufu products are produced by a similar principle, which involves four main steps: preparation of tofu; preparation of pehtze; salting; ripening.

The fungal genera involved (*Actinomucor*, *Mucor* and *Rhizopus*) all belong to the Mucoraceae. The mould used in fermentation of sufu is critical and has to possess certain characteristics. First of all, the mould must have enzyme systems with high proteolytic and lipolytic activities since it grows on tofu that is a protein and lipid-rich and carbohydrate-poor medium. Secondly, the mould must have white or, at most, slightly yellowish white mycelium to ensure that the sufu has an attractive appearance. Thirdly, the texture of the mycelial mat should be dense and tenacious so that a film formed on the surface of the pehtze will act as an over-casing to protect the final product of sufu from deformation. Finally, the mould growth should not develop any off-odor, astringent taste, or mycotoxins and the mould should resist undesired bacterial contamination during the fermentation.

Some *Mucor* spp., *Actinomucor* spp., and *Rhizopus* spp. fulfill all of these criteria and could be used for making high-quality sufu. Among them, *Actinomucor elegans* and *Actinomucor taiwanensis* seem to be the best moulds that are used for pehtze production commercially in Beijing and Taiwan, respectively. However, also other moulds such as *Mucor sufu* and *Mucor wutungkiao* have been mentioned as popular starter cultures.

FUTURE PRODUCT

The potential benefits from microbial diversity in fermented foods harnessed for many industrial application. One of the important developments is food enzymes production. The majority of the enzymes used in food processing such as amylases, proteinases, cellulases, pectinases, and others are produced by microorganisms that are important iin processing fermented foods like wine, dairy products, fruit and vegetable pickles, fishery products, etc.

Application of these enzymes are numerous, protease for examples, control viscosity, emulsifivation, develope flavor and specific application for tenderize meat and chili proofing in the brewing industry. The other enzymes like lactase is used to hydrolize lactose in ice cream to prevent crystallization and amylases important in

manufacturing glucose syrup in corn (Nga *et al.*, 1999).

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IMPLEMENTATION OF GOOD PRODUCTION PRACTICE TO IMPROVE *JAMU GENDONG* QUALITY AND SAFETY

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ABSTRACT

Jamu gendong is a traditional Indonesian beverage that can be considered as functional beverages because of its antioxidant content from its herbs. Although they are believed to help maintain good health, they are often considered low in quality and safety. The poor quality and safety is resulted from the fact that most *jamu gendong* are made manually with traditional equipments. Additionally, the process control and sanitation levels during processing are generally not implemented. Furthermore, the standard practice guidelines for good *jamu gendong* production practice has not yet been established. This study aims to assess the microbiological quality of *jamu gendong* from two *jamu gendong* producers in Bogor using parameters such as sanitation status of utensils, workers, processing and product, to be used in developing a good *jamu gendong* production practice guideline (GJGPP) for small scale industries and implement it to those *jamu gendong* producers. This study consist of evaluation of production steps through observation and interview, evaluation of the microbiological quality (Total Plate Count, *Salmonella sp.*and *Staphylococcus sp*.) of the product (*beras kencur* and *temulawak* extract) and utensils (bottles), develope good production practice guidelines based on the two assessments above and implement the GJGPP guideline to see the improvement of the product microbiological parameters. Data results show products before implementation have microbial load a range of 4.9×10^{6}- 1.9×10^{8} CFU/ml for beras kencur extract and 8.7×10^{5}- 2.5×10^{7}CFU/ml for temulawak extract, total plate count for bottles have microbial load a range of 1.6×10^{6} - 5.5×10^{8}CFU/ml and suspected to be positive *Salmonella sp*. and *Staphylococcus sp*. Whereas, data post implementation show a tremendous decrease of microbial load a range of 1.7×10^{3}- 2.5×10^{4} CFU/ml for both product samples, microbial load for bottles a range of 1.5×10^{4}- 4.6×10^{4}CFU/ml and negative *Salmonella sp.* and *Staphylococcus sp.* Moreover, results on air sanitation before and after implementation show a decrease from a range of 1.1×10^{4} - 1.7×10^{4} density/m^2/hr to be 3.0×10^{3} - 1.4×10^{4}density/m^2/hr.

Keywords :*jamu gendong, quality, safety, good jamu gendong production practices*

INTRODUCTION

Jamu gendong is an Indonesian home industry traditional herbal beverage. This productare sold from house to house in bottles that are placed in a basket strapped to the seller's back. In everyday life, jamu gendong is used to maintain good health and are also believed of curing certain diseases (Pratiwi, 2005). Because of its functional content from its herbs, this productcan be categorized as functional beverages. The Indonesian National Agency of Drug and Food Control (Badan POM, 2005) defines functional food as a food product that contains one or more functional components, based on scientific studies have specific physiological functions, health benefits and proved to be safe. Some varietyof jamu gendong sold today aresari asam, beras kencur, sari kunyit (turmeric juice), sari temulawak and sari jahe (ginger juice). Fardiaz (1997) stated that jamu gendong can be developed in a functional beverage industry.

Problems faced by this industry are its poor quality and safety. The poor quality and safety are related to the quality of raw materials, process control and sanitation in the processing that has not been properly supervised and controlled.

Apriyanthy (2000) explained that the microbiological quality of sari asam and sari kunyit can be considered as safe, this is evident from the total number of low microbial load ($<3 \times 10^1$ TPC / ml). On the other hand , sari beras kencur and sari temulawak has a high microbial load (2.4×10^7 TPC / ml and 2.5×10^6 TPC / ml) and some containing *Salmonella* and *E. coli*. Wiguna et al. (2001) also explained that temulawak extract has a high microbial load of 9.7×10^7/ml, and beras kencur extract of 1.4×10^8/ml. The microbial limit to be considered as safe for consumption according to The Indonesian National Agency of Drug and Food Control (BPOM, 2009) based on the standard microbiological contamination of fruit juice is $1x10^4$ CFU/ml, *Salmonella* sp. negatif/25 ml and *Staphylococcusaureus* negative/ml.

The results from those previous researches showed an inedequency in quality and safety. The high microbial load or presence of pathogens is closely related to the behavior of producers in the processing that pays less attention to or even notices hygienic factors such as personnel hygine. Assessment to maintain the quality and safety of jamu gendong should be established on the implementation of production practices on a small industrial household scale that is practical and easy to follow based on the capability of jamu gendong producers. In addition, the guidelines for a good jamu gendong

production practice has not yet been establised.

Furthermore, the application of thermal process is one way to improve quality and safety. Wahyuni (2000) explained that heating can reduce a number of microbial load in beras kencur extract. Based on the results of the study above, it can be explained that processing can affect the quality and safety of jamu gendong.

This study aims to assess the production process and the microbiological quality of jamu gendong from two jamu gndong producers in Bogor with the observed parameters that include utensils sanitation, personnel hygine, processing and products which are specifically aimed on formulating a good jamu gendong production practice guideslines for home industrial scale and implement.

MATERIAL(S) AND METHOD(S)

Materials

Buffer phosphate, jamu gendong temulawak and beras kencur extract, *Plate count agar* (PCA), Hektoen enterik agar (HEA), Bismut sulfit agar (BSA), Xylose lysine desoxycholate agar (XLDA), Triple Sugar Iron Agar (TSIA), Lysine Iron Agar (LIA), Baird-Parker Agar (BPA), *Trpticase soy broth* (TSB), Rappaport Vasidialis (RV), Tetrathionate Broth (TTB). Alkohol 75%, NaCl, Aquades.

Methods

I. Observation and evaluation of jamu gendong production process and product

Conducted by visiting the location of the production directly and identify the critical point in the processing through observation and interview on site. Product from the production was taken to lab for evaluation of microbiologicalquality(Total Plate Count, *Salmonella sp.* and *Staphylococcus sp*. analyzes(BAM, 2010)) and pH. Products that was evaluated are beras kencur and temulawak extract.

II. Developing guidelines for aGood Jamu Gendong Production Practice (GJGPP)

Guideline development is based on the observations and laboratory results that was previously conducted. Development is based on taking into considerations of Good Production Practice for home industry that was issued by The Indonesian National Agency of Drug and Food Control (2003). Desained based on the capasity and

capability of the jamu gendong produsers.

III. Implementation of Good Jamu Gendong Production Practice (GJGPP)

Implementing the guidelines on the producers that has participated since the beginning of the study.

IV. Evaluation of post-implementation

Samples from implemented processing was taken to lab for further evaluationto see the improvement of the product microbiological parameters.

RESULTS AND DISCUSSION

The results sampled from two jamu gendong producers in Bogor are as presented in Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7. Data obtained showed that products from those jamu gendong producers did not meet the acceptable limit of microbial contamination bioload. Several species were isolated from the products. The bacterial species isolated include *Salmonella*sp.and *Staphylococcus*sp.. Sanitation was also evaluated that includes Air and Bottle sanitation.

Data on the microbiological analyzes on Total Plate Count obtained from investigated products before and after implementation are as presented in Table 1 and Table 2.The bacterial counts of the investigated products from both producers before implementation (Table 1) obviously exceeded the maximum recommended standards in the range of 4.9×10^6- 1.9×10^8 CFU/ml for beras kencur extract and 8.7×10^5- 2.5×10^7 CFU/ml for temulawak extract. This is encouraged by the high pH of the product that helps promote microbial growth.Furthermore, both products are suspected to be positive in *Salmonella* sp. and *Staphylococcus* sp.

The microbial limit to be considered safe for consumption according to The Indonesian National Agency of Drug and Food Control (2009) for fruit juice should not exceed a maximum of $1x10^4$ CFU/ml, *Salmonella* sp. negatif/25 ml, and *Staphylococcusaureus* negative/ml.

Table 1. Total plate count product before implementation

Producer	TPC Product CFU/ ml		pH	
	Beras Kencur	Temulawak	Beras Kencur	Temulawak
Producer A1	1.9×10^{8}	2.4×10^{6}	6.93	7.32
Producer A2	2.6×10^{7}	1.1×10^{6}	6.87	7.31
Producer A3	4.9×10^{6}	8.7×10^{5}	6.88	7.32
Producer B1	1.8×10^{8}	2.5×10^{7}	5.81	6.37
Producer B2	2.2×10^{8}	1.9×10^{7}	5.81	6.38
Producer B3	1.8×10^{8}	2.3×10^{7}	6.68	7.29

Table 2. Total plate count product after implementation

Producer	TPC Product CFU/ml		pH	
	Beras Kencur	Temulawak	Beras Kencur	Temulawak
Producer A1	2.1×10^{4}	1.9×10^{4}	6.75	7.60
Producer A2	2.3×10^{4}	1.9×10^{4}	6.77	7.69
Producer A3	2.5×10^{4}	1.7×10^{4}	6.91	7.26
Producer B1	1.8×10^{4}	2.2×10^{4}	5.93	6.79
Producer B2	2.1×10^{4}	1.7×10^{4}	5.83	6.93
Producer B3	1.6×10^{4}	1.7×10^{3}	5.98	6.84

Data on the microbiological analyzes on *Salmonella*sp.and *Staphylococcus*sp. obtained from investigated products are presented on Table 3 and Table 4.

Table 3.*Salmonella*spp.and *Staphylococcus*spp. analyses before implementation

Producer	*Salmonella* sp. /ml		*Staphylococcus* sp. MPN/25 ml	
	Beras Kencur	Temulawak	Beras Kencur	Temulawak
Producer A1	+	−	2300	230
Producer A2	+	+	2300	430
Producer A3	−	−	2300	230
Producer B1	+	+	43000	2100
Producer B2	−	+	4300	92
Producer B3	+	−	9300	230

Table 4.*Salmonella*spp.and *Staphylococcus*spp. analyses after implementation

Producer	*Salmonella* sp. /ml		*Staphylococcus* sp. MPN/25 ml	
	Beras Kencur	Temulawak	Beras Kencur	Temulawak
Producer A1	−	−	< 3.0	< 3.0
Producer A2	−	−	< 3.0	< 3.0
Producer A3	−	−	< 3.0	< 3.0
Producer B1	−	−	< 3.0	< 3.0
Producer B2	−	−	< 3.0	< 3.0
Producer B3	−	−	< 3.0	< 3.0

Before implementation, producer's processing behavior was extremely unacceptable. Practices that contribute bacterial contamination was often seen during processing, namelylack of hand washing, cross contamination, improper tasking of cleaning and processing utensils such as, brushes that was used for cleaning the toilet was also used for cleaning bottles. Consequently, the product bioloads from these producers are high in view of the fact that this is a traditional home industry which lack in personel and environmental hygiene.

Table 5. Microbial air contamination plate count

Producer	Air sanitation density/m^2/hr	
	Before Implementation	**After Implementation**
Producer A1	1.7×10^4	9.8×10^3
Producer A2	1.3×10^4	7.2×10^3
Producer A3	1.3×10^4	9.9×10^3
Producer B1	1.5×10^4	1.4×10^4
Producer B2	1.4×10^4	3.0×10^3
Producer B3	1.1×10^4	4.8×10^3

Table 6. Bottle sanitation Total Plate Count before implementation

Producer	TPC Bottle CFU/ml	
	Beras Kencur	**Temulawak**
Producer A1	1.2×10^8	1.6×10^8
Producer A2	5.5×10^8	1.1×10^8
Producer A3	4.4×10^7	5.5×10^8
Producer B1	4.3×10^6	3.7×10^6
Producer B2	4.4×10^6	3.3×10^6
Producer B3	2.8×10^6	1.6×10^6

Table 7. Bottle sanitation Total Plate Count after implementation

Producer	TPC Bottle CFU/ml	
	Beras Kencur	**Temulawak**
Producer A1	3.0×10^4	3.2×10^4
Producer A2	3.2×10^4	1.6×10^4
Producer A3	3.2×10^4	1.6×10^4
Producer B1	4.6×10^4	1.5×10^4
Producer B2	4.1×10^4	1.5×10^4
Producer B3	3.1×10^4	2.3×10^4

Samples observed are very dependent on the level of personel and environmental hygine. There were strong positive correlations between product bioload and hygenic practices based of observation and lab results.

The total plate count for bottles have microbial load in the range of 1.6×10^6 - 5.5×10^8CFU/ml before implementation. This is considered high because these producers rarely clean their bottles properly before filling, they only rinse with water without the aplication of soap and proper cleaning utensils.

Result from post implementation shows tremendous microbial load decrease up to 5 log phase to be in the range of 1.7×10^3 - 2.5×10^4CFU/ml for both product samples, microbial load for bottles decreased to be in the range of 1.5×10^4 - 4.6×10^4CFU/ml and negative in *Salmonella* sp. and *Staphylococcus sp.* During implementation, attention to processing preperationprocedures that includes personel (nail, hair, hand and skin care) and environmental (clean working area, trash bin, floor, table, celling, pest) hygine, processing utensils and raw material handling were carefully implemented. During and after processing was also carefully implemented such as processing steps, cross contamination prevention, intensity of hand washing and after processing procedures were also applied based of the developed guidelines. Resuts on air sanitation before and after implementation show a decrease from a range of1.1×10^4–1.7×10^4 density/m^2/hr to be3.0×10^3 - 1.4×10^4 density/m^2/hr.This suggests that hygenic practices during processing may be a major factor in the microbial contamination of the investigated samples during the period of study.

The isolation of *Salmonella* which usually reside in animal or human intestines and is greatly suspected attributed from the presence of sewage and garbage (Ogugbue, 2011), and this is evident based of observation and lab report that producers often has their trash bins piled and placed near their production area. *Salmonella* causes food poisoning and typhoid fever (Ekperigin and Nagaraja, 1998) and are particularly effective at causing human infections because they can survive a series of harsh conditions which include strong acids in the stomach and the anaerobic and salty environment of the intestine that kill most bacteria. *Staphylococcus*is found in all individuals and usually expelled from the respiratory tract through the nose and mouth. The presence of *Staphylococcusaureus* in food is an indication of environmental and human contamination(Ogugbue, 2011). Although

there has not been any major reports related on jamu gendong outbreaks, nonetheless, their role in microbial contamination in ready-to-drink beverages cannot be ignored.

CONCLUSION(S)

In conclusion, results obtained from this study have shown that investigated products exceeded the maximum recommended standards according to The Indonesian National Agency of Drug and Food Control. This is exacerbated by the lack of personel and environmental hygine during processing, and are also encouraged by the high pH of the product.Subsequently, after implementation, samples show a decrease in microbial load. Product bioload succed to decrease near enough the maximum recommended standardsand are negative in *Salmonella* sp. and *Staphylococcus* sp.

The findings suggest that there should be a continuing research on the optimazation of the guideline practices and a focus on the serving of the product on fieldin order to ensure safety and consumerprotection. Microbial contamination during sale assafety is of particular concern with ready-to-drink baverange products that may pose potential risks for public health especially for vulnerable people.

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SAFETY ASPECTS ANALYSIS OF JAVANESE INDIGENOUS NON-FERMENTED KETCHUP MADE FROM KLUWAK

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ABSTRACT

Commonly ketchup is made in two stages of fermentation. The first fermentation is to increase the protein content using *Aspergillus sp.* or *Rhizopus sp.*, to making tempeh from soybean grains. The second stage is the use *Saccharomyces cereviceae* to degrade proteins into amino acids and bioconvert tempeh into ketchup. In Muria peninsula, in the northern part of Central Java, there is a indigenous technology, producing of ketchup without fermentation. The ketchup made by replacing the *Saccharomyces cereviceae* with traditional oily from kluwak (*Pangium edule* Reinw). The produced ketchup is believed very suitable for older people who are allergic to *Saccharomyces cereviceae* fermentation product. Kluwak contains coumarin which is a phenolic compound and present in kluwak as the secondary metabolites. Previous studies found that kluwak ketchup contained lower protein rate than the *Saccharomyces cereviceae* one. The colour of kluwak ketchup was also darker than the *Saccharomyces cereviceae* one. However the taste, aroma, and viscosity were not significantly different from those of *Saccharomyces cereviceae* one. Coumarin however is an anticoagulants, which is help to control our blood viscosity but at a certain dosage is harmful to health. This study explored the presence of coumarin levels both in kluwak and in the ketchup produced, analyze by TLC method and also analyze the save consumption levels for consumers to prevent the tocsicology effect.

Keywords: *Javanese indegenous technology, ketchup, kluwak ketchup, coumarin, safety*

INTRODUCTION

Ketchup is an additional side dish that we often add to our meal. Commonly ketchup is made in two stages of fermentation. Firstly is making tempeh from soybean grains using *Aspergillus sp.* or *Rhizopus sp*. This stage is to increase protein content, which was happen because of carbohydrate bioconvertion to protein by the microbes. Secondly is making ketchup from tempeh using *Saccharomyces cereviceae*. This stage would degradate protein of tempeh to become amino acid of ketchup.

In Muria peninsula, in the northern part of Central Java, there was an indigenous technology that producing ketchup without this second stage fermentation. The ketchup was made by adding kluwak (*Pangium edule* Reinw) to decompose protein into amino acid. Local people believe this ketchup is suitable for elderly people, who are allergic

to *Saccharomyces cereviceae* fermentation. Coumarin in the kluwak seeds replace the role *Saccharomyces cereviceae*, physically by decomposing protein polymers of tempeh into amino acids. Our previous research found that the levels of protein in the kluwak ketchup was lower than commercial ketchup, however consumer acceptance was not significantly different, and at the parameter of taste was even prefered by consumers than commercial ketchup (Sumardi, 2010).

Commonly kluwak ketchup is produced as home industry, and for generations has provided extra income for their makers. Nowadays however, the ketchup as well as the technology is already nearly extinct because of competition with commercial ketchup produced by modern industry.

Since this ketchup kluwak is a product of local technology, which shows a cultural wealth, the manufacturing technology of this ketchup making process need to be scientifically documented. While food technologists might documenting the production technology, this paper documented the food safety aspects of the ketchup, particularly in the use of coumarin compounds in the production process.

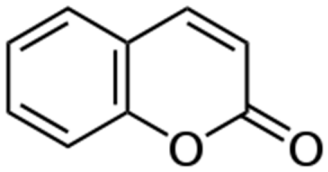

Figure 1. The chemical structure of coumarin (2-H-1-benzopyran-2-one)

Coumarin or scientifically called as 2-H-1-benzopyran-2-one, is actually an anticoagulant, which at a certain amount is needed, but in excessive amounts is harmful to the body. This study focusing on the content of coumarin in the kluwak, and simulating the average consumption level of ketchup per capita, to analyze the safety aspects of the ketchup.

MATERIALS AND METHODS

This research consisted of three series of studies. The first studies was evaluating the content of coumarin in kluwak ketchup, using TLC method. Kluwak ketchup was obtained from Village of Ngablak, District of Cluwak, Pati, Central Java. The kecthup was made in the early of November 2012. The determination of coumarine was run at the Laboratory of Industrial Research and Development, Provincial Government of Central Java, Semarang, and was made folowing procedures established by Murray et al (1982) as modified by Anonim (1987), Anonim (2000) and Celeghini (2001).

Some 50 ml samples of kluwak ketchup was extracted in back-cooling sochlete using methanol solvent, and was changed every 6 hours until the solution was no longer coloured. The obtained extract was concentrated by rotary evaporator until thickened, then dried in waterbath at 40-45^0 C until the solution come thick and then weighed.

The whole thick extract (28.63 ml) was dissolved in warm water (40-45^0 C) until all the extract dissolved. The dissolved extract then was put into 500 ml separating funnel, added with dichloromethan solvent to form two layers; ie dichloromethane fraction and methanol-water fraction. Dichloromethane fraction was then concentrated using a rotary evaporator from fractions of 500 ml to 100 ml.

TLC was prepared by oven the stationary-phase chamber of silica gel GF254 plate for 30 minutes, and the motion-phase using a mixture of n-hexana with a gradient of ethyl acetate and was saturated for 1 hour. Each fraction was analyzed in TLC by injecting samples with 10 uL syringe to the stationary phase silica gel GF254 plate. The plate is theb inserted into the chamber filled with n-Hexana: ethyl acetate (1:1) (Celeghini, 2001), wait until the elution sealed finish, the elucidation of the motion-phase well separated and the Rf value equal to the standard coumarine solution. The identification was conducted by comparing the Rf value of the sample with a standard solution Rf, and was recorded. The results of stationary phase TLC was detected using UV detector at the wavelength of 366 nm.

Standard solution was made by dissolving coumarin crystals in dichloromethane p.a. to the concentration of 2 µg/ml, 4 µg/ml, 6 µg/ml, 8 µg/ml, and 10 µg/ml. The TLC reading was then employed following the procedures as previously mentioned to sample.

Recovery was performed by adding methanol-water fraction with 1 ml of standard coumarin at concentrations of 4 ug, 5 ug and 6 ug / ml, read in TLC with three replicates. The results calculated using the following equation:

$$\textbf{Recovery} \quad \frac{\textbf{Read Concentration}}{\textbf{Added Concentration}} \quad \textbf{X 100\%}$$

The second studies were desk study to find out the consumption levels of ketchup per capita in the region of Pati and the surounding areas in Central Java and Indonesia. This stage was made by reviewing the government published data.

The third study was analyzing the safety aspect of kluwak ketchup consumption, in term of coumarine concentration. The stage was run by analyzing the level of consumption per capita with the

concentration of coumarine in kluwak ketchup.

RESULTS AND DISCUSSION

Laboratory results the content of coumarin in kluwak ketchup using TLC method, was began by standardizing Rf values of coumarin standard and the samples, which are presented in Table 1.

Table 1. Identification coumarin Rf using TLC at 366 nm UV light

Sample	RF	Colour	Shape
Coumarine Standard	0.32	Fluoresces bright blue	Round slightly oval
Kluwak Ketchup	0.32	Fluoresces bright blue	Round slightly oval

Further stage was determining the standard curve, that was made in 5 concentration levels of standard coumarin, i.e. 2 µg/ml, 4 µg/ml, 6 µg/ml, 8 µg/ml, and 10 µg/ml. The results were presented in Table 2.

Table 2. The read area on TLC at various levels of coumarine standard

Standard	Coumarine Standard (µg/ml)	Read Area
Standard 1	2	856.104
Standard 2	4	1,059.915
Standard 3	6	1,262.758
Standard 4	8	1,465.602
Standard 5	10	1,672.076

From Table 2, then can be drawn a data mapping and the from this mpping then can be drawn a curve, with various levels coumarin concentartion standard as Y axis and read area as X axis. The charracteristic of the drawn curve was linier. By using a linear regression procedure, the equation of the drawn curve was as follows:

Y = 0,00987 X - 6,45862

Where:
Y = coumarine concentration (µg/ml)
X was the read area.

From this equation then can be drawn the graph together with the observed data. Based on these two data of observed and predicted data using the equation, the R^2 of the equation was 0,986. The graph was shown on Figure 1.

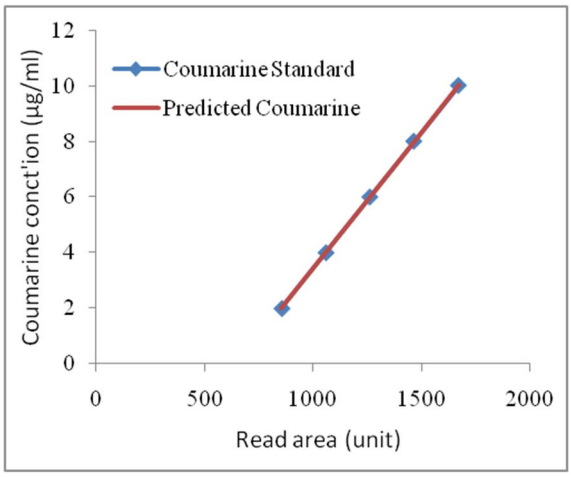

Figure 2. Standard curve of coumarine by read area on TLC

Finally, the coumarine contained in the kluwak ketchup was predicted based on the read area obtained from the TLC, and then

calculated to the mentioned established equation. The TLC evaluation was made in 6 replicates, and the result can be seen on Table 3.

Table 3. Predicted coumarin content in the kluwak ketchup, based on the standard curve on TLC readings

Sample	Observed Area	Predicted Conc'tion (µg/ml)
Sampel 1	1,171.571	5.105
Sampel 2	1,198.002	5.366
Sampel 3	1,203.751	5.422
Sampel 4	1,156.341	4.954
Sampel 5	1,168.546	5.075
Sampel 6	1,148.512	4.877
Average	1,174.454	5.133
St. dev'tion	22.168	0.219

Table 3. showed that the average of coumarin contained in the kluwak ketchup was 5.133 µg/ml, and the standard deviation was 0.219 µg/ml (4.27%). Since the standard deviation was below 5% of the average, it indicated that the data obtained was homogeneous. These figures of mean and standard deviation showed that at 95% degree of confidence, the coumarin contained in the kluwak ketchup was ranging from 4.914 µg/ml to 5.352 µg/ml.

In order to evaluate the validity of the TLC and the procedure applied in this evaluation, a TLC recovery evaluation was made at three levels of concentrations, i.e. 4 µg/ml, 5 µg/ml, and 6 µg/ml of coumarin standard. These levels were chosen to refflecting the range of obtained coumarin levels in the samples of kluwak ketchup. The results of this recovery evaluation was presented on Table 4.

Table 4. Results of TLC recovery evaluation at various levels of coumarin standard

Added Coumarine (µg/ml)	Read Area	Read Coumarine (µg/ml)	Recovery (%)
6	1,286.401	6.238	103.969
5	1,184.613	5.234	104.670
4	1,079.945	4.200	105.011

Table 4 showed that the results of recovery evaluation was ranging from 103.969% to 105.011%. This means that both the TLC and the procedures applied in this evaluation were valid, because the range of validity of the recovery evaluation was 95% – 105% (Yuningsih, 2010).

The results from this TLC evaluation was then compared with ketchup daily consumption level to get total coumarin of ketchup consumption. To simulate this consumption level, then a simulation was made with the consumption levels of total ketchup consumed by people in Pati regency, Greater Muria that covering of Pati, Kudus, and Jepara Regencies, Central Java and Indonesia. Based on the report provided by Central Java Food Security Council (2010) and Central Bureau of Statictics (2010), the levels of ketchup monthly consumption per

family in these areas were 110.473 ml, 108.218 ml, 107.091 ml, and 98.073 ml respectively. The dependent rate per family in these areas were 5.68 members, 5.39 members, 5.24 members, and 6.23 members respectively. Based on these figures, then the daily rate consumption of ketchup per capita can be calculated, and the results were presented on Table 5.

On the other hand, the level of tolerable intake of coumarin has not been established. Bruneton (1999) appointed a maximum limit of 2 mg/kg of food. While other researchers proposed of 4.1 mg/ day or 0.07 mg/kg body weight/day for 60 kg body weight (Ratanasavanh, 1996). Lake et al. (1999) recommended 0.2 mg/kg body weight, and Abraham (2007) proposed 0.1 mg coumarin/ kg body weight per day. Amongst these various recommendations, the maximum allowable daily intake of 0.1 mg/kg body weight sounds to be the safest measure. The European Food Safety Authority (EFSA, 2004) and The Institute for Risk Assessment (2006) also established this rate of 0.1 mg/kg for 60 kg body weight per person; or a maximum of 6 mg per capita per day.

Based on the mentioned levels of consumption of ketchup at various areas and the recommended maximum on allowable daily intake, then it can be analyzed the safety aspect of kluwak ketchup consumption, in term of coumarin content. The results of the comparison of consumption and limit daily consumption of coumarin safety was presented on Table 5.

Table 5. The average of daily ketchup consumption per capita and predicted coumarine consumption

Area	Ketchup Con'tion (ml)	Coumarine Contained (mg)	Levels of safe (mg)
Pati Regency [1)]	0.641	3.291	< 6
Greater Muria [1)]	0.662	3.398	< 6
Central Java [1)]	0.674	3.459	< 6
Indonesia [2)]	0.519	2.664	< 6

Note: [1)] Central Java Food Security Council, 2010 and [2)] Central Bureau of Statictics, 2010

From Table 5 it can be seen that when kluwak ketchup was consumed widely as a commercial ketchup under the consumption patterns at various levels of the region, the daily coumarin intake would range from 2.7 mg – 3.5 mg per capita, whereas the allowable intake was 6 mg per capita per day. This means that the level of coumarin intake was still safe for consumers.

Since the concentration of coumarin was only between 40-60% of the safe limit, the presence of coumarin in kluwak ketchup would be useful as an anticoagulant agent. Coumarin is used in human medicine as an anticoagulant, and is metabolized rapidly in the liver to form the hepatotoxin 7-hydroxycoumarin (Lake et al., 1999). Blood

clot was a serious problem in Indonesia, and as one of the main causes of death.

CONCLUSION

1. Kluwak ketchup was made from tempeh without *Saccharomyces cereviceae* fermentation. The decomposition of protein into amino acids was made by coumarin contained in kluwak.
2. Kluwak ketchup was an indigeneous ketchup in Muria peninsula, which nowadays started being pressured by ketcup produced by modern industry.
3. In order to preserve the technology, it was necessary scientific documentation, about the safety aspects, because of coumarin used in the production process.
4. The results of the evaluation conducted with TLC at 00:32 rf and UV light at a wavelength of 366 nm with a value of recovery 105% was found that the coumarin contained in the ketchup was 5.133 ± 0.219 µg/ml.
5. Since the level of daily ketchup consumption per capita was 0.519 – 0.674 ml, and if assumed that all ketchup consumed was kluwak ketchup, then coumarin daily intake was between 2.7 – 3.5 mg. This level was safe because the maximum allowable daily intake per capita was 6 mg.
6. As the concentration of coumarin was between 40-60% of the safe limit, the presence of coumarin in kluwak ketchup would be useful as an anticoagulant agent.

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HACCP IMPLEMENTATION TO IMPROVE FOOD SAFETY AT TRADITIONAL FOOD CENTER SALATIGA (LAPANGAN PANCASILA CASE STUDY)

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ABSTRACT

Lapangan Pancasila is a food center in Salatiga city that offers variety of traditional foods such as *Siomay, Batagor, Nasi Kucing, Gado-gado,* and et cetera. Today, people just eat to make their stomach full without considering the dangers from its food. There is a valuable local wisdom that says "food is medicine" so it is necessary to consider about food safety and healthy. The objective is to implement the concept of HACCP (Hazard Analyze Critical Control Point) at the Lapangan Pancasila food centre in order to improve the safety of traditional food. The methods used to collect data were interviews, observation and documentation.The collected data were analyzed by using descriptive analysis based on HACCP concept. Some problems that need to be improved in maintaining food security at traditional food center, are: (1) the non-conducive environment, (2) the layout of a waste dump near with the stand, (3) the system of using Lapangan Pancasila is not correct yet. There are several critical control points (CCPs) in the traditional food center, in the process of: raw materials supply, raw material processing, food display, washing equipment, cooking equipment use, and the storage. Role some stakeholders are needed to maintaining food security through ABG (Academician, Business Associations, and Government) synergy. The government needs to have cooperation with the academician and business association, both in make policies, training and regulations to improve food safety aspects at Lapangan Pancasila as traditional food center, so it can be the center of tourism in Salatiga.

Keyword: *food safety, local wisdom, traditional food center, HACCP concept, ABG synergy*

INTRODUCTION

Lapangan Pancasila is a food center at Salatiga that offers variety of traditional food such as Gado-gado, Nasi Kucing, Batagor, Siomay, Tahu Gimbal, and so on. Salatiga Government has a role in the operational of Lapangan Pancasila including cleanliness and orderliness management. The traders charged a contribution of IDR 10,000,00/month

for water and IDR 75.000,00/month for cleanliness and orderliness costs and submitted to the chairman of the trader. For the trader that do not require water and there is no waste in the process of selling only bear the cost of the ticket for IDR 3.000,00/day. The location of Lapangan Pancasila food center closes with road. The visitor who wants to enjoy some food will be able park their vehicle inside, and close with the stand. In addition, visitors also can play around at Lapangan Pancasila.

Today, people just eat to make their stomach full without considering the dangers from the food. There is a valuable local wisdom that says "food is medicine" so it is necessary to consider about food safety. Unsafe food will affect the spread of various diseases until to food poisoning. Based on BPOM (2012) data, in 2010 there are 592 food poisoning cases at national level.

Now, consumers demand on quality assurance and food safety are increasing. In the era of globalization, quality and food safety be a main priority to get competitive advantage in the global market (Febriana, 2009). Therefore, the implementation of HACCP concepts at Lapangan Pancasila needs to be done. Thus, the purpose of this study was to implement the concept of five principles of HACCP at Lapangan Pancasila to determine the potential hazards, in order to improve the safety of traditional food.

MATERIALS AND METHOD

This research was conducted in October 2011 at Lapangan Pancasila. Location selection is done purposely because Lapangan Pancasila is the only one traditional food center at Salatiga.

Types and Method of Research

The type of this research is descriptive qualitative. The method of research used is survey, because the data collection using the list of questions ranging from the procurement of raw material until food processing.

Sampling Method

The population in this study were all traders are at Lapangan Pancasila. From the population, sampel was taken purposively (purposive sampling), based on the consideration that the sample is representative of all types of food available at Lapangan Pancasila. Based

on these consideration, the sample taken is traders of Siomay, Batagor, Gado Gado, Fried Rice, Tahu Gayus, Tahu Gimbal, Leker, and Bakso Gimbal.

Data Collection Method

Data collected in the form of primary and secondary data. Primary data was collected through interviews and documentation, while the secondary data obtained from literatures which related with this study.

There are seven principles of the HACCP implementation, namely (Thaheer, 2005):

1. Implementation of hazard analysis. Preparation of a list of steps in the process where significant hazards are found and decryption prevention measures.
2. Identification of critical control points.
3. Determination of critical limits for preventive measures associated with each CCP identified.
4. Determination of CCP monitoring requirements.
5. Determination of corrective actions when monitoring identifies a deviation from a critical limit specified.
6. Establish the effective procedures for maintaining the records of HACCP system documents.
7. Establish procedures for verification that the HACCP system has worked well.

RESULTS

HACCP is a tool used to asses the level of hazard, risk estimates expect and establihsh the right measure in the control (Suklan in Sudarmaji, 2005).

In general, traders have been do a several same process, which can be seen in the figure below.

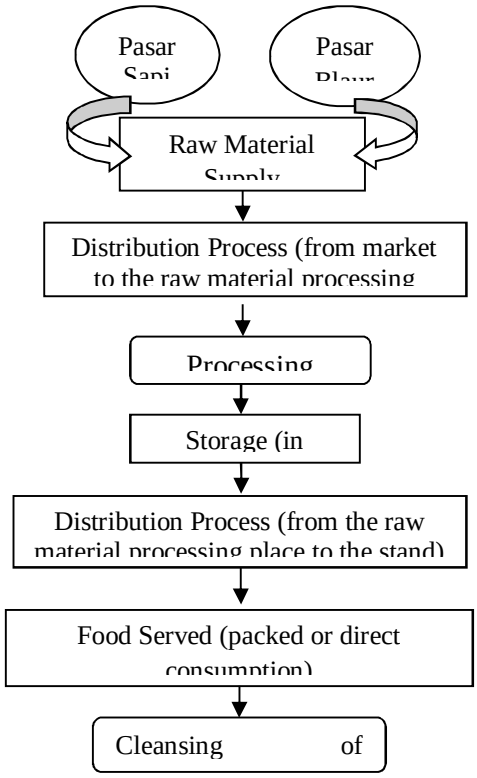


Figure 1. Stage of Process that conducted by traders at Lapangan Pancasila

DISCUSSION

1. **Raw Material Procurement Process**

   Mostly, the traders at Lapangan Pancasila buy raw materials on the Pasar Sapi and the Pasar Blauran, where the market environment has been polluted by industrial waste, fumes, and dust. Raw materials such as fish purchased at markets. Therefore, traders should buy the raw materials from guaranteed hygienic market. It is useful to minimize the risk, so it does not cause concern to consumers, such as food poisoning, disease and so forth.

2. **Processing Raw Materials**

   Most of the traders at Lapangan Pancasila make a semi-finished raw material processing in order for the product are available in warm. However, the authors observed some raw material processing is less well regardless of quality and hygienic products, such as: the storage of raw materials in the open-air so cause contamination caused by flies that attack foods (such as meat, eggs, potatoes, etc.). In addition, the equipment used such as knives, scissors, filter and so forth, just laid off without the neat layout enables occur the risk of product contamination by flies. Not only that, the use of a multifunctional tool reduces the taste of raw materials. Waste disposal location near with the selling stand strengthen contamination through flies. There is freedom of visitors to smoke, also have been a factor contamination of food harmful to consumers.

Figure 2. Several Condition That Affected Contamination

3. **Storage Process**

In the storage process, there is a different between each other foods. To maintain the processed products or semi-finished products that are not sold out, the traders store it in freezer. However, this storage technique will not durable and will eliminate the original taste, along with lead to losses incurred by traders. Therefore, it would be better if the procurement of processed products tailored to consumer demand, so no need to take a long time in the storage process.

4. **Distribution Process**

The distribution from Pasar Sapi and Pasar Blauran is done by using a motorcycle. Not only that, both processed products that have not been finished or semi-finished also done in the same way. Usually traders use the cart to carry raw materials from the market leading to the processing of raw materials (home). As for the refined products, traders pack into a boxes and then put in a large container to be transported from the home to the stand. Distribution process as this can result in a damaged vegetables that could reduce the quality and freshness.

5. **Serving Process**

The traders usually package their products in hot conditions using plastic for products like Siomay, Batagor and Bakso. While out Tahu Gimbal, Gado Gado, Tahu Gayus, and Leker use waxed paper. For food wrapped in plastic in hot conditions would harmful to consumers because it contains Dioktilfalat Plasticizer (DOP) which will cause cancer in humans (Joewono, 2009).

Figure 3. A Variety of Food Serving Techniques

6. Cleaning Equipment Process

In accordance with the authors observations, the traders cleaning tableware such as plates, spoons, forks, glasses, and other cookware with unfavorable process, which only use a few buckets of water to wash the equipment without replacing the water when the water is cloudy and filled with foam soap.

Figure 5. Cleansing Equipment Processing

Chart Decision/Determination of Critical Control Points (CCPs)

The questions posed to the raw material procurement

Question 1 :

Is it possible raw materials such as peanuts, potatoes, eggs, meatballs, tofu, and vegetables contain hazards at levels that are not acceptable?

YES → CCP (1)

Question 2 :

Is food processing can use to eliminate or reduce the hazard to an acceptable level?

NO → CCP (2)

Question 3 :

Is raw materials may contain a hazardous material (microbiology, chemistry, physics)

YES

Is the treatment can reduce or eliminate the hazard?

YES → not CCP

The questions posed for each processing stage of beans flavor (Siomay, Batagor)

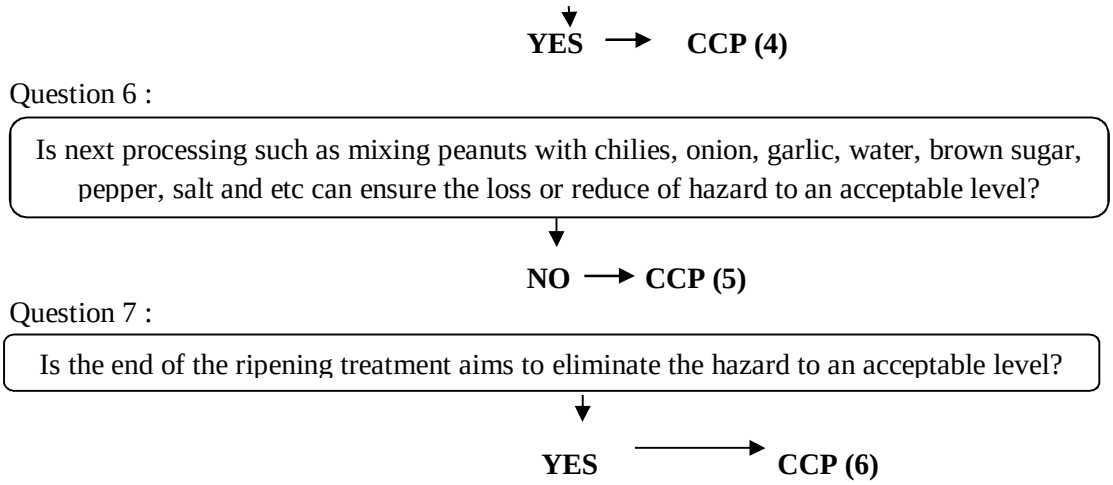
Question 4 :

Is the formulation or composition and the structure of the product it is important to prevent the escalation of danger to a level that is unacceptable?

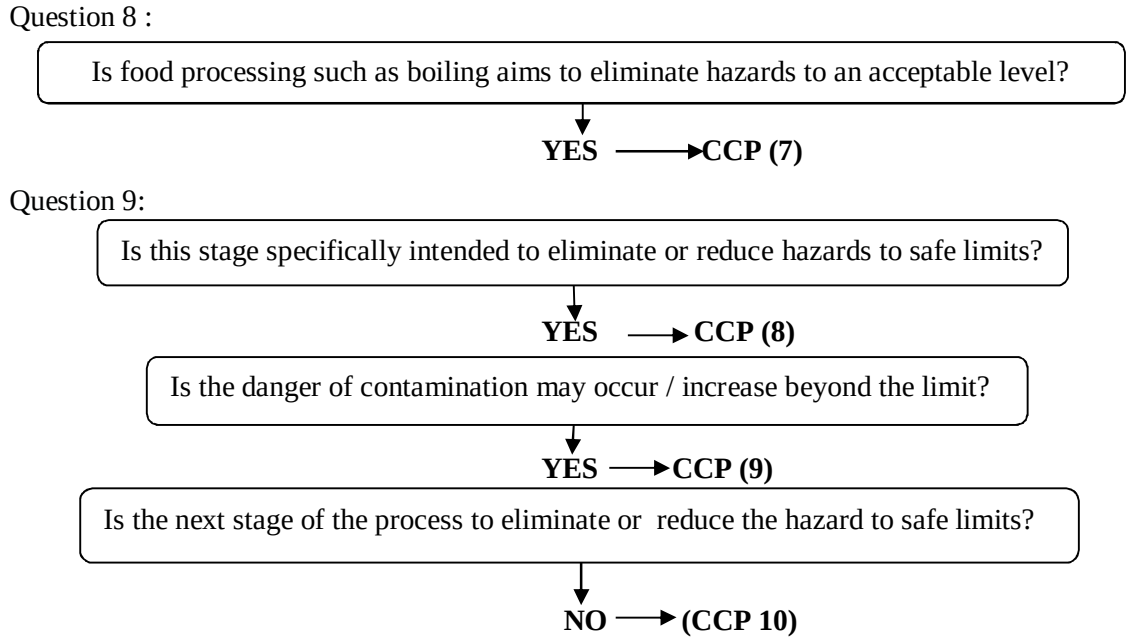
YES → CCP (3)

Question 5 :

Is the stage of the frying , grinding peanuts and stir fry other food ingredients (peppers, onions and garlic), the danger may increase to unacceptable levels?



The questions posed to each stage of processing of others food ingredients (Potatoes, Eggs, Tofu, Meatballs, Vegetables, etc)



Explanation about CCPs

a. CCP 1

Raw materials contain the hazards because the procurement of raw materials from the environment market that has been polluted by car exhaust, cigarette,

and others. In additions, vegetables that are used as raw materials also allowed to contain hazardous materials such as pesticides.

b. CCP 2

In the process of washing and cooking traders do not pay attention and not usethe right techniques in the process.

c. Bukan CCP

As for raw materials such as meat, milk, vegetables, allowing it contains hazardous materials such as bacteria (microbiology), while in the process of transporting the raw materials are also exposed to dust, fumes and cigarette (chemical). In the process of presenting to consumers occasional hair, pebbles and other foreign substances that are physical hazards. The traders prior to processing the raw materials usually do the washing, boiling, frying and so forth. This is one of the simplest ways of handling that can eliminate these types of hazards that exist in the raw material, such as bacteria, dirt dust, and so forth.

d. CCP 3

The composition of the products that will be presented should be considered as if it is neglected it will be able to damage the health of consumers. So in determining the composition of the products necessary for a great selection of raw materials and hygienic.

e. CCP 4

In the case of frying, boiling and milling may pose a greater danger at this stage if this is done with the wrong procedure, the boiling process does not use water as a hygienic it will increase the level of contamination in food, frying: used cooking oil that has been used 4 times when cooking oil would be better if used only once, whereas in the milling process: if not careful can be mixed with hair, pebbles or other foreign objects.

f. CCP 5

Subsequent processing is mixing peanuts, chilies, onion, garlic, water, brown sugar, pepper, seasoning, salt and others are not able to guarantee the loss or lack ofhazard to an acceptable level, it is only intended to give a good taste.

g. CCP 6

Cooking is done by the seller can reduce hazards contained in the raw material, because this boiling buffer deadly bacteria that may be contained in the raw material.

h. CCP 7

In the case of boiling it to reduce the dangers that exist in the raw material,

because the boiling can kill the bacteria present in the raw materials.

i. CCP 8

The purpose of boiling is to reduce or eliminate the hazards present in the raw materials, such as in meat, milk and vegetables contain bacteria that can be harmful to human health.

j. CCP 9

In boiling process can also pose a greater danger, this is due to the use of water that has been polluted or contaminated water or use repeatedly used for boiling.

k. CCP 10

If in boiling water the wrong way as the example above, the next process is also not able to reduce or eliminate the hazards.

Monitoring Critical Limits

Conditions/Consequences	Example
A danger to health	- The presence of flies that descend food and equipment used by traders. - Use of water was murky and filled with foam soap when washing process equipment and water is rarely replaced. - The use of equipment that is multifunctional and left just like that when finished use - The presence of mycotoxins (aflatoxin) in peanuts as a raw material in the manufacture of peanut flavor.
Possible hazards can increase	- The less heating. - Refrigeration temperature is less. - The process of product distribution with a motorcycle.
Products processed in do not ensure the health conditions	- Environmental contaminated with motorcycle fumes, dust, and cigarette smoke. - Landfills adjacent to the stand.
Quality of raw materials is not eligible	- Residues of pesticides on vegetables / fruits. - Metals contents in fish, - Formalin for chicken or noodle. - Borax for meatballs or noodles. - The existence of microbial pathogen - High acid numbers in petroleum & product - Gas NH3 and H2S in animal products, and natural toxins.

Corrective Actions

The Level of Risk	Corrective action / improvement
High-risk foods	a. Food should not be processed / processed before all irregularities corrected / repaired. b. Food detained / not distributed and tested for safety, and if the food does not meet the safety requirements, necessary corrective actions.
Food risk being	a. Food can be processed / processed, but the deviation should be corrected in a short time b. Specific monitoring is required until all irregularities corrected
Low risk foods	a. Food can be processed (forwarded), the deviation must be corrected / repaired if time allows. b. Routine surveillance should be carried out to ensure no risk status changed to medium or high risk.

Source: Susilo, 2010.

CONCLUSION

1. There are several critical control points (CCPs) in the traditional food center, in the process of: raw materials supply, raw material processing, food display, washing equipment, cooking equipment use, and the storage.
2. Role some stakeholders are needed to maintaining food security through ABG (Academia, Business Associations, and Government) synergy.
3. The government needs to have cooperation with the academia and business association, both in make policies, training and regulations to improve the food safety at Lapangan Pancasila as traditional food center , so

   it can become a center of tourism in Salatiga.

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POSSIBLE EFFECTS OF WASTES POLLUTION ON SHRIMP FARMING IN SEMARANG BARAT

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ABSTRACT

Shrimp aquaculture is an economic potential in Semarang Barat, due to the high demand of shrimp for Semarang city with a population of 1.5 million people. But one of the conditions required in order to produce shrimps commercially are having high quality water supply, clean, and free of industrial waste contamination. Reffering to a research report of Central Java's Research and Development Agency (BALITBANG) 2009, Central Java's northern waters, including coastal of Semarang, were still within in safe limits. The results of this study should be used as a reference in the development of fisheries and fishing pond on the north coast of Central Java, including in the coastal city of Semarang. This paper reviewed the feasibility of shrimp farming in Semarang Barat, based on the productivity and profitability of the shrimp. This paper was made based on a series of field surveys to shrimp growers in Semarang Barat, community leaders, academics, environmental researchers and review the related researches, including the research conducted by the mentioned BALITBANG 2009. Based on field observations it was found that since 2005, the productivity of shrimp ponds in Semarang Barat continues to decline. At the last harvest, the average of shrimp productivity was 500 kg / ha. One contributing factor is the high mortality of shrimp, which until the last harvest reached 70%. The decline in ponds productivity was also experienced by other fish pond, such as tilapia. But for the other fish, the problem was that fish do not grow large, while the mortality rate was relatively smaller. The farmers suggested that the reduced production of shrimp and other fish in their pond here was associated with the develompent of industries in the upstream region, the liquid waster thus contaminating their pond water. The BALITBANG research in 2009 it may be true that heavy metal contamination in the West Semarang is still within in safe limits, however the reality of the decline in farm production in Semarang Barat showed that there was still some contamination that endangers the lives of fish, especially shrimp. Therefore Balitbang expected soon doing research in these waters, in order to explore other contaminants and contaminant-source, which can interfere with the growth of the fish. If it is true that the contamination is from industrial waste, it has to recommending companies concerned to immediately implement the Waste Water Treatment Plant (WWTP) for their liquid waste. Moreover, the companies that dump waste into water bodies should also alocate their Corporate Social Responsibility funds to the farmers in the Semarang Barat, to improve their farming system.

Keywords: *Shrimp aquaculture, Semarang Barat, waste, contaminant, BALITBANG*

INTRODUCTION

Tiger shrimp is one of commodity in food source in Indonesia. One of the usual ways to breed tiger shrimp in Indonesia is aquaculture, which is a method of breeding in coastal area. Because its containment, tiger shrimp is not only as food resources but also become one of economic potential that actually interesting to develop. But in the other hand, aquacultures also need a good environment condition in order to produce shrimps with great quality.

Based on research report of Central Java's Research and Development Agency (BALITBANG) 2006, Central Java's northern waters, including coastal of Semarang, are contaminated with heavy metal (excess of safe limits regulation). In other hand, total production of shrimp tiger in Semarang Barat also decreased each year.

Deeper research is needed to find out how far the effect of contaminant, include heavy metals that pollute in Java coastal area to total production of tiger shrimps which water supplied from Java coastal area. This research conduct to ensure the quality of environment in order to stabilize a good condition of tiger shrimps breeding in aquaculture, so the product can reach the best quality before it sells.

MATERIALS AND METHODS

This research was conducted by survey at shrimp farming especially to know deeply on the productivity and profitability of the shrimp production, literature searching and aquatic laboratory data are needed to give more information. Academician and stakeholder information are needed in order to keep the objectivity of this research. Rules and regulations to build a new industry that relate to Bapedalda Semarang also need to collect. All of data that have been collected would compare to find the appropriate solution. In this analysis, aquaculture conditions have been contaminated with some waste product from industrial activities. Whereas Bapedalda has a standard about waste management and control the standard of waste for each industry in several period.

RESULTS AND DISCUSSION

Semarang is a strategic trading point of two cities, Jakarta and Surabaya. Along with the increasing intensity of trade, the industry began to appear in the city of Semarang. Semarang Mayor Decree No. 593.8/1285 in December 31, 1995 license in this area is headed by PT. IPU Semarang is the cause of environmental problem. Rapid economic growth in this area also give an impact on increasing the number of settlements in the surrounding area. Then the problem that must be concern is about the potential

contamination of the usual household waste flows into the nearby river. Based on the observation, all the rivers are located in the West Semarang is not disgorge streams from mountain springs so, if the contamination occurs, then the effect will be very dangerous. Moreover, industrial sewage that also flowed into the river, this will make the condition and quality of the river water and sediment in the river become worse.

Figure 1. Aquaculture before contaminated

From the data that has been collected, it is known that people around the pond (especially the farmers) are complaining about the decline of water quality in the waters of the Java Sea. One of the peculiarities observed is the change in water color became black, otherwise the arising smell that damage the health of local people. Conditions are expected because of some contaminants (including heavy metals) contained in the water so residents difficulty accessing clean water sources. Black color caused by the flow of the river can be polluted by sewage waste product that can trigger the river water had a pH fluctuations will affect the oxygen and chemical reactions in the water and waste zar can raise a significant amount of organic and inorganic turbidity produced by the decomposition process.

Black colored river that may also contain some heavy metals that exceed safe levels in the river water, the metal cover (Mercury (Hg), copper (Cu), Lead (Pb) and Cadmium (Cd). Heavy metal content contained on the ponds can be contaminated by waste from industrial such as soy processing industry soap and fish packing industries and etc.

Figure 2. Condition after contaminated

The farmers who complained about the deterioration of water quality also have their own reason, the results of their farms in the form of shrimp and nila fish declined in terms of both quality and quantity. In tilapia products, the year decreased yield obtained

was not optimal for the growth of fish. While the condition occurs in very poor results shrimp, because shrimp yields are declining because many shrimp are not resistant to water conditions in the pond so a lot of larva (seed shrimp) who die before the harvest as shown at figure 3. During the growth phase of harmful exposure is the turn of the shells where the commodity is directly exposed to pollutants that result in the accumulation of harmful substances in the body of the shrimp.

Figure 3. Shrimp condition because contaminantion

In conditions of sub lethal pollution levels (± 30ppm), it will cause changes in the structure of the organ which impact on the survival rate of decline in shrimp. These conditions cannot be addressed until this writing because the farmer just resigned to the situation.

Figure 4. Died shrimp condition because contamination

Based on the field conditions, it can be seen that the data of Balitbang 2006 that concern on the conditions of the Java Sea waters that have been contaminated by heavy metals considerable impact on the outcome of the pond which is in West Semarang. Observations were conducted also show that the possibility of other pollutants such as organic wastes that pollute the region. It can be observed from the changes in the color of the water in the pond. This is possible given that the rapid growth of housing in that area that each day stream of organic waste in water. Industries located in that region also contribute to contaminate water with organic waste did not waste properly. As a result of the pollution is the commodities of traditional farm became reduced. Hopefully with this invention, relevant government agencies would test the water quality in sea level of the Java aspects of organic waste, so it can be known for certain about the content of organic waste in the region and the

solution can be found so that the problem in this case can be resolved farmers perceived.

CONCLUSIONS

Waste pollution can be overcome by growing mutual responsibility in maintaining the cleanliness of the water. Using clean water is the right of every individual in this world. We cannot pollute the water for our personal interests at the expense of others. The water that is used, attempted reprocessed or recycled, so no water is wasted. Not only that socialization and publication were necessary to make people aware about the importance of water for the future. Socialization should be cross sectorial, by the government and all elements of society. Publications can be through print and electronic media. The more that is known about the function of the water, the more awake quality of water in our environment. Let's save our water for our future together. Further research is needed and socialization between the government and the fish farmers in the area. It is intended so that the fishery in the area increase and prosperity of the farmer farm assured.

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SYNTHETIC COLOR ADDITIVE: IGNORANCE OF SELLER ABOUT THE DANGERS OF SYNTHTETIC COLOR ADDITIVE

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ABSTRACT

The purpose of this study was to determine what percentage of traders who use color additive to the food which they sell, the dangers of food coloring and the factors why the trader using food additive in their food, to ignorance of the traders on the dye they use. The research was conducted in Semarang, with the object of the study is limited only to variable merchants drinks, the independent variable is the price of drinks sold and the dependent variable is the cause of ignorance of sellers about the dangers of synthetic color additive. Samples were taken at random and taken 30 merchants drinks in Semarang. The result showed that the variable rates are very influential on the use of synthetic color additive in beverages. Counseling, educational background, and description in the packaging of color additive variable is a variable that can explain the use of synthetic color additive by traders by 63% and 37% are other variables that are not included in this research method. It is recommended to the government to provide counseling to food vendors on the dangers of the use of synthetic color additive in beverages that consumers are not harmed ultimately

Keyword: *merchant, beverage, synthetic, color additive, counseling*

INTRODUCTION

Food for humans is the most basic requirement for life. Consumable food should contain a lot of nutrients and is safe if consumed. In modern times such as now, with the synthetic food color, will add to the attractiveness and make the price of the food higher. Sometimes the color - the color that causes a person's appetite to consume. Today, sellers are no longer using natural food color to give color to the food that they sell, but they use a synthetic food color that is artificial food coloring that gives a lot of convenience for food and beverage vendors.

Before discussing further any food color which is used in foods, there are 3 types of synthetic dyes commonly used by people in daily life. They are:

1. Food Grade
2. Food coloring ingredients that are not certified as a food coloring
3. And the last is a dye that is not to be used as a food coloring. An example is the textile dye and plastic colorants.

Synthetic coloring agents on the market provide a lot of convenience for food and beverage vendors. Synthetic dyes have a much cheaper price compared to natural dyes derived from plant extracts. The color produced by synthetic dyes are more stable, not easily fade, and durable.

Basically synthetic dyes that may be used exclusively for food but in very restricted and regulated by the government. However, the problem is the traders who use it to excess dye or food coloring may use materials that should not be used as a food coloring. Then the other problem is how are synthetic food safe? How can we guarantee a food contains ingredients that are not excessive food coloring. Who will oversee the distribution of synthetic dyes in the society.

In general, traders will be looking for the cheapest possible materials. Included also in the dye. Traders will be looking for a cheap dye in order to save costs, they use that gets the maximum benefit. Sometimes, the price of a cheap dye, traders actually use dyes that are harmful to human health, such as for example Rodamine B used to drink itinerant merchants for products framboze or strawberry flavor. They reasoned that the use of low-cost addition to Rodamine B also provides more color than natural food coloring derived from the fruit or leaves - leaves.

However, in addition to the price of cheap synthetic dyes, traders ignorance about the dangers posed by synthetic dyes are also one of the main factors behind the use of these harmful dyes. In general, vendors selling merchandise using hazardous synthetic dyes do not have a higher education background.

Educational background is also the reason why a trader would use harmful synthetic food color. With a low educational background so many traders do not know the dangers of synthetic food color which they use. In general, traders say that the goods they are selling are safe because they use the synthetic dyes are safe for human health. And many traders claimed that the government never pass up a survey or extension of the use of such materials. So as long as there was no protest from the buyer

to the seller, the seller always felt that their product is safe to consume.

Hazards that may arise from the use of synthetic dyes excessive and not in accordance with the standard are:
1. If it consumed in a long time, it will cause cancer cancer.
2. Renal impairment occurred in a long time.
3. Be a decline in human motion system.
4. In the short term will cause allergies like itching.

Because of the dangers posed by synthetic food colorings and the government attitudes toward this phenomenon, the authors are interested in discussing the topic of food coloring and the extent to which traders learn about the use of food coloring.

MATERIALS AND METHODS

In making this paper, the authors use 2 method. They are :

a. Literatury study

In literatury study, the authors make some study about synthetic food color from the definition, how to use, price, and also the harmness of synthetic color food

b. Environment Study (Interview)

In liteatury study, the authors make some interview toward 30 people who sell food and beverages in the street and they asked some question to the traders. These are some question who the authors aksed to the trader

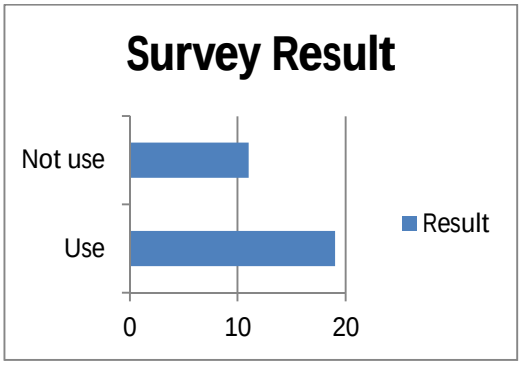
i. Do you used synthetic food color? What is the reason?
ii. Do you know the harmness of synthetic food color in more dosage?
iii. What is your last background of education?
iv. Do the government usually come to you and check your product?
v. After you know the harmness of synthetic food product, do you want to use again or change your substances in coloring food and beverages?

RESULTS AND DISCUSSION

1. Using or not using synthetic food color

Table 4 Result of the Survey

No	Seller	Amount	Percentation
1	Use	19	63,33%
2	Not Use	11	36,67%



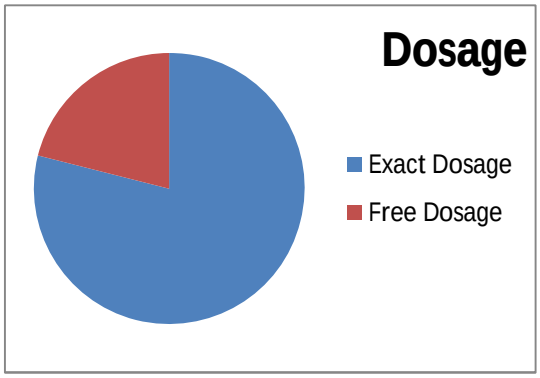
Graph 1. Result from the survey

From the graph, we can conclude that more than half seller which sell beverages using synthetic food color. In the graph 63,33% sellers using synthetic food color. And the rest, 36,67 don't use synthetic food color

2. Dosage

Table 5. *Dosage from the Seller*

Dosage	Amount	Percentage
Exact Dosage	15	86,67%
Free Dosage	4	13,33%



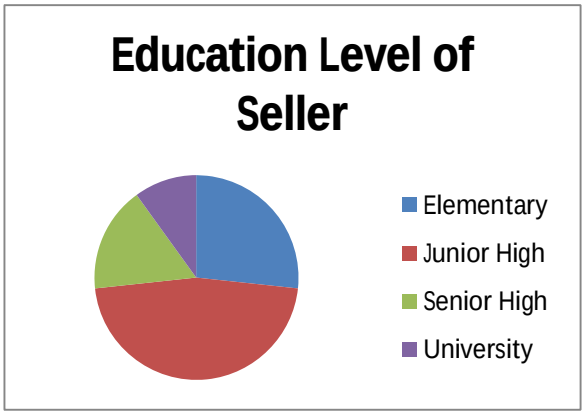
Graph 2 Dosage when the seller use synthetic food color

From the graph above, we can see that many sellers who used synthetic food color, gives synthentic food color to his beverage in random dosage and they don't the exact dosage for a food or beverage.

3. Education Level

Table 6 Educational Level of The Seller

No	Education Level	Amount	Percentation
1	Elementary	8	26,67%
2	JHS	14	46,67%
3	SHS	5	16,67%
4	University	3	10,00%



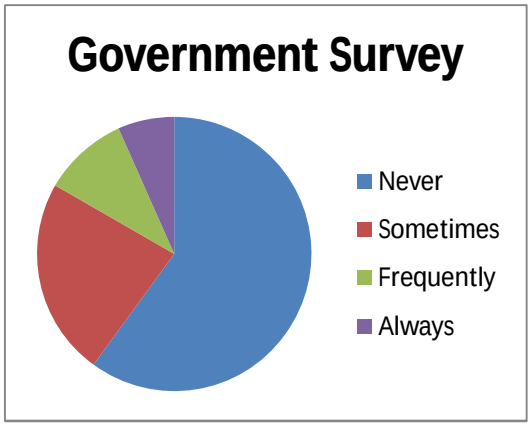
Graph 3 Educational Level of Seller

From the graph above we can conclude that education of the seller is very important. Many sellers are just graduated from elementary until junior high school. Because of that the risk if the seller don't know about the harmness of synthetic food color is very high.

4. Government Survey and Socialization

Table 7 Government Survey Socialization

No	Government Survey	Amount
1	Never	18
2	Sometimes	7
3	Frequently	3
4	Always	2



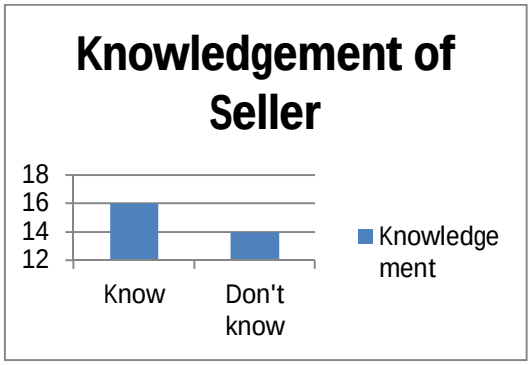
Graph 4 Government Survey for Seller Product

From the graph above we can know that participation from government is very low. In the average, government seldom to give attention to this aspect. Government forget if some people who sold food and beverages have low educational background, so they don't know about the risk of synthetic food color.

5. Knowledgement of The Seller

Table 8 ***Knowledgement of The Seller***

No	Knowledgement	Amount
1	Know	16
2	Don't know	14



Graph 5 Knowledgement of The Seller Toward Synthetic Food Color

From the chart above, we can conclude that a half of the seller don't know what is synthetic food color and the risk toward human body. A half is not a small amount, so that's the duty of the government to reduce them with socialization and make a survey regularly.

DISCUSSION

From some of the graphs presented above are clearly visible factors affecting a trader selling food and beverages by using excessive food coloring so harmful to the human body. Seen from the first chart 63.33% of the 30 people surveyed by the authors state that it adds excessive synthetic food color. And look at the second chart only 13,33% traders use avaiable dosage and the others is not. In the fact, even certificate synthetic food color for food and beverages must be in tolerant dosage for used. And although there are some synthetic food color that may be used, but the dose should be in accordance with the measure. If traders use excessive doses, it will give the effect of a danger to the human body. Many traders who claim that the mixing synthetic food dyes, they just look at the size of the color they taste pretty. If the colors are less bright, the merchant will add more number of food coloring in the food and drink they sell. In addition to its low cost and provide a color that is not easy to fade, many traders who

claim that they were unaware of the dangers contained in the food coloring. They assume that if no buyer of the protests, the food or beverage product that they are selling a product that is safe for consumption. With a background like this, the condition worsened again with the active role of the government significantly. Many traders who say that their products are not visited by the related department for review and investigation. As well, the government rarely provide counseling to the seller any material that is not feasible to put into the food. So, back to the assumption that traders feel the product is safe to eat as long as there are no reports of people who became ill after eating or drinking products that they sell. Therefore, the government should conduct periodic surveys and educating traders. If in this way can not be done after the various surveys and providing insight to the traders, the government should provide criminal penalties not only for vendors selling food and drinks that use dye but also a shop selling freely synthetic dyes are not suitable for consumption. So to combat the food and drinks are not safe to eat, the need for cooperation between traders, government, and society.

CONCLUSION(S)

After the research which have been done by the author, there are some conclusion from the data. They are :

- Some food and beverages' seller sell their goods with color food addition
- Synthetic food color gives more good than harm to seller but not for the buyer.
- The price of synthetic food color is cheap and has stable color, some seller used synthetic food color because they don't know the risk and effect toward human healthiness.
- Synthetic food color is available to use if:
  - Used in a correct level
  - Has food color certificate
- The advantages of synthetic food color are:
  - Give no additional spesific taste
  - High pigment stability
  - Have wide color spectrum
  - Easy to use
- The disadvantages of synthetic food color are :
  - Harmful for human healthiness
  - Make allergion for some people

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BEWARE OF LAUGHING MUSHROOM

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ABSTRACT

Laughing mushroom (*Psilocybe cubensis*) is a mushroom belongs to the genus Psilocybe which lives in cow dung. This mushroom is commonly called magic mushroom because of that effect that is given, which is the hallucinations are come from psilocybin or a substances similar with alkaloid that contained in this mushroom. However, with the effect that is similar to narcotics, this mushroom is easy to be found among community. The purpose of this study was to determine the effects from consuming laughing mushroom and also to review the national policies towards the availability of laughing mushroom in the market. Research on the response of the community was made by giving questionnaires to some respondents who had consumed magic mushroom. To review the government's policy towards the distribution of this mushroom, we interviewed the the divison of Inspection and Investigation, Food and Drug Monitoring Agency (Badan Pengawasan Obat dan Makanan, BPOM). Based on the survey, it was found that the motivation of the respondents for consuming laughing mushroom was the curiosity or eagerness to try and for boost up their mood. The effect of this mushroom were mostly the same for respondents, i.e. keep laughing for a few hours but not addicted. After the effect was gone, respondents felt so weak and asleep for a long time. Based on the results of interviewing the staff of BPOM, it was informed that laughing mushrooms that containing psilocybin was already categorized as class I of drug according to the National Law No.35/ 2009 about Narcotics. In articles 7 and 8 there were said that narcotics can only be used for the benefit of health care, science and technology. Mushrooms that containing psilocybin were not allowed to be consumed, but has to be processed in special treatment before released to the market under a certain controlling system.

Keywords: *laughing mushroom, drug, distribution, control*

INTRODUCTION

Laughing Mushroom is a mushroom that grows in a cow dung. Laughing mushroom or *Psilocybe cubensis* in the Latin contains active compounds psilocybin. Psilocybin is a substance that can give the effect of hallucination found in many species of mushroom that grows in the world. Psilocybin, like other hallucinogens or "psychedelics", induces a major sensory alterations, causing distortions of reality

and hallucinations. (Marsch &Bickel,2009). Psilocybin Mushroom or laughing mushroom has been known since hundreds of years ago and used for the purpose of religious or spiritual rituals. (Marsch &Bickel,2009). As seen from its Habitat, cow dung, this mushroom has a fairly high level of insecurity because of the processing which is not easy to do so it is difficult to be controlled in terms of hygiene, security and appropriateness of food, etc. But lately this laughing mushroom become a consumption and made in the form of fresh, fried, made into omelets, even there are also mixed with butter or juice. This mushroom is also still widely circulating in the big cities. Psilocybin that contained in this mushroom can cause a person to think, communicate or behave irrationally because of their perception of reality can be distorted significantly. People who consume them may see images, hear sounds or feel sensations that , while seeming quiet real, but in fact does not exist. The resulting behavior may be strange and even dangerous. Their mood may swing quiet widly,in part because they may be frightened by what they are experiencing (NIDA,2001). A Survey conducted by The Canadian Alcohol and Drug Use Monitoring in 2008 revealed the overall use of hallucinogens at 2.1% of the population, with men being more likely to have used it than women. Youth and young adults between the ages of 15 to 24 showed the highest rates of use at 10.2% (Health Canada,2008).

Review of Act No. 35 of 2009 regarding narcotics, psylocybin has been classified as narcotics group I, it is stated in the annex to law No. 35 of 2009 the number 47. This means the pcilocybin substances already on the same group with the other narcotics group I ike morphine, etc. But the difference is, psilocybin do not make the consumers addicted. As it has been known that the Narcotics I have been prohibited to be consumed freely, it is stated in article 7 of Act No. 35 of 2009. Whereas in article 8 it is said that Narcotics Group I may be used for the benefit of the development of science and technology and to diagnostic reagensia, as well as reagensia laboratories after getting the approval of the Minister on the recommendation of the head of Supervisory Board of Medicine and Food (BPOM). So should this mushroom did not circulate among communities moreover , to be consumed freely. But in reality, not many people know about the policy of psilocybin, they even didn't know what substance contains in the laughing mushroom itself, that is psilocybin, considering that psilocybin is not so familiar and laughing mushroom is also a wild product which only a few people who know.

The purpose of this research is to know the effects of consuming laughing mushrooms. This research is related to the condition of consumers before, during, and after they consume the mushroom, even the long-term effects. In addition, is to reviewing government policy regarding psilocybin mushrooms that have already consumed by people.

METHODOLOGY

To find out the effects of consuming mushrooms, quisioner handed out to some of the respondents who had consume that laughing mushrooms in Semarang city. Research includes a form of the mushroom that is ready to be consume, the doses, the motivation of consumers, the conditions before and after consumption, the duration of effect , personal response from consumers, side effects, first impressions on the product, last usage, source of information, and the spesific taste. After that, the data was tabulated from 10 respondents, because only a few people who knew and ever tried wild products. Tabulations were made with parameters that are taken based on the questions of the questionnaire which had been mentioned previously and then the data are calculated by means of the number of respondents who agree divided by the total number of respondents,that is 10, then multiplied by 100%. Then to review the government's policy on laughing mushroom, we interviewed members of the POM located in Semarang on the examination and investigation related to the Law on narcotics which regulates the response POM psilocybin and fungus on the product which has been circulating in the community. In addition, research is also supported with references to study about laughing mushrooms and the usefulness of the substances psilocybin contained in it and also the study of food policy, based on law No. 35 of 2009 regarding narcotics.

RESULT OF OBSERVATIONS

Table 1. Sources of Information and Basis Consumption

PARAMETER		PERCENTAGE (%)
Consuming reason	Curious	60
	Offered From Friends	20
	Relieving Stress	10
	Changing the Mood	10
Condition before consuming	Happy	60
	Sad	20
	Healthy	40
	Sick	0
Source of Information	From Friends	100
Last Usage	< 1 Week	10
	< 1 Month	10
	< 3 Months	70
	< 1 Year	10
Total Use	Once	10

Results from the study showed that the motivation or the biggest reason respondents consume mushrooms laughter is curiosity. Most of them consume in a state of happy and healthy. They get information from their friends and they are keen to try it. Most of them consume laughing mushrooms about 3 months ago and all the respondents have recently tried to eat the mushroom once.

Table 2. Form preparation and Perceptions of Taste and Texture Products

PARAMETER		PERCENTAGE (%)
Shape of the Mushroom	Omelete	30
	Fried	70
Dosage	>4	60
	>6	20
	>8	10
	>10	10
First Impression of Product	Interesting Shape	10
	Interesting Pack	0
	Nothing	60
	Not Convincing	30
Taste and Texture	Savory	50
	Delicious	50
	Soft	0
	Hard	0

Most respondents consume laughing mushrooms in the form of already fried and some are eating along with omelets. The dose to a person is about 4-6 mushrooms.

The first impression from respondents about the pack is plain / not good and not bad, but there are several of them who think that looks like a less convincing.

Respondents said that this mushroom tastes good and tasty, if it is fried ,the shape is similar to fried crispy mushroom ,the taste is also not much different.

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Table 3. Impression, Opinion and Response After Consuming

PARAMETER		PERCENTAGE (%)
Condition After Consuming	Happy (excessive laughing)	80
	Sad (excessive crying)	20
	Hallucinating	100
Duration of Effects	< 4 hours	70
	< 6 hours	20
	< 8 hours	10
Side Effects	Addiction	0
	No Effect	50
	Sleep For A Long Time	50
Response About Product	Agree	20
	Disagree	0
	Only One	80

After consumption, consumers began to hallucinate and see things that should not exist and all they see makes them laugh excessively. But there is also an excessive crying because their previous mood is not good / sad. The length of hallucinogenic effects last between 4-6 hours, but there is also a more than 8 hours depending on the dosage consumed. No evidence of the respondents feel addicted but after the effect is gone, some of them are feeling weak and tired. After knowing the effect the majority of respondents did not want to try anymore. But there is also a fraction of those who agree with the laughing mushroom because it can relieve stress although only for a moment.

Laughing Mushrooms or Psilocybe cubensis produced by many small societies, although not many people are familiar with this product because it is a product of the wild mushrooms with a kind of drug effects. In this fungus, it is difficult to control because it is easy produced but it is grow on cow dung, so the mushroom is quite vulnerable in the processing, production and consumption. The majority of producers do not know that these fungi contain hazardous substances that have been legally classified as a narcotic type I, which is officially written in the annex of Law No. 35 of 2009 on narcotics number 47. To review government policies conducted interviews with members of the POM in Semarang as a Supervisors and

Investigators. Respondents said that there has been no suggestion from the public about laughing or psilocybin mushrooms in POM Semarang, so they can not conduct an investigation and determine how safe the food. This might be because the fungus is not so familiar, and is also not a major food so it does not really affect people's food world. However, if it does contain psilocybin mushrooms that give mushrooms hallucinations, the fungus had been legally belongs to the type I parallel to the narcotics morphine and marijuana, it has been clearly stated in the Act 35 of 2009 on narcotics. Even according to the law of narcotics group I was not allowed to be consumed (chapters 7 and 8). Then the mushroom should not circulate among the public especially prevalent for consumption. In this regard, the government has not followed up immediately, whether by creating special rules for the distribution of this fungus or by creating quality standards of psilocybin had not previously existed.

Based on the results of a study of the daily reference “KOMPAS” on Wednesday, February 1, 2012 under the title "Overcome Depression with Psilocybin mushrooms", data showed that a study has found that psilocybin mushrooms have the potential to help treat depression and how it works is similar to antidepressants. This was later proved by Prefessor David Nutt, a researcher from Imperial College London neuropsychofarmacology, which concluded that psilocybin may be an effective supplement to psychotherapy. Psychedelics be able to expand the mind so it has been widely assumed to have the ability to increase brain activity. According to Nutt, psilocybin also has contributed in slowing the flow of blood to the hypothalamus of the brain, whereas it is known that the blood flow to the hypothalamus of the brain can trigger a cluster headaches (multilevel). This is evidenced by volunteers condition improved after taking psilocybin mushrooms on research conducted Nutt. But Nutt also advised against any attempt self-medication with this fungus. It can be concluded that the fungus has a laugh in health benefits. Namur because the fungus is not familiar nomenclatature so there is no medical treatment for the substance psilocybin.

There are no known death directly caused by psilocybin overdose, but drug-induced confusion has caused accidental deaths. (Health Canada, 2009). Individuals who use hallucinogens and also have major psychiatric illness will make their condition worse. (NIDA, 2001). Serious liver and kidney damage,as well as acidental poisoning deaths,may occur if individuals harvest wild mushrooms that do not contain

psilocybin, but instead are a similar looking poisonous species. (AFM,2005).

CONCLUSION

- Eating laughing mushrooms can give hallucination effect that causes excessive laughing or crying caused by psilocybin substances contained in them.
- The effects of hallucinations last for about 4-6 hours.
- If consumen was on a bad mood, after consuming this mushrooms consumers will crying excessively until the effects is gone.
- If consumen was on a good mood, after consuming this mushrooms consumers will laughing excessively until the effects is gone.
- The dose to one person is about 4-6 mushrooms, if it consumed more than that, then the effect will last longer.
- After the effect of the laughing mushroom disappears, the body will feels weak.
- Psilocybin has been classified as a group I drug according to the annex no. 47 of Law no 35 th 2009 on narcotics.
- According to the Act no 35 th 2009 psilocybin is unfit for consumption as a narcotics group I.
- According to research by Professor David Nutt, psilocybin has benefits on medical use that have a potential to depression treatment ,it works like an antidepressant.
- psilocybin are also able to increase the activity of the brain and make the flow of blood to the hypothalamus brain become slow thereby it could prevent the cluster headache.
- There are no knownndeaths directly caused by psilocybin overdose, but its effect can affect a person's mental causing accidental deaths.

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THE USING STYROFOAM AS FOOD PACKAGING: SOEGIJAPRANATA CATHOLIC UNIVERSITY STUDENTS' PERCEPTION

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ABSTRACT

Styrofoam or plastic foam is one of the types of plastic materials. Styrofoam commonly used as a protective barrier of fragile items from vibration, such as electronics. However, now the mater ial is also widely used as a food and beverage packaging materials. Based on health issues know n Styrofoam contains carcinogenic substances that can lead to cancer. Carcinogen is a substance causes cancer by changing the deoxyribonucleic acid (DNA) in the cells of body, and it is distur bing biological processes. The objectives of this study are to know Unika Soegijapranata Cathol ic University student's perceptionon the use of Styrofoam as food packing and to know the influ ence of given information to students' perception. The method used in this study is by literature study and surveying the Soegijapranata Catholic University students' perception on the use of St yrofoam related to health issues. According to data obtained through the survey, it indicates that the public concern about health issues on the dangers of Styrofoam, but they still use the Styrofo am. That is because consumers have already accustomed in using Styrofoam which is practical a nd still commonly used. Besides, only a few consumers who know that today some Styrofoam manufacturers have added Oxium substance in Styrofoam useful for improving the food safety s o that consumers don't need to be worried to use Styrofoam as food packaging.

Keywords: *Styrofoam, food safety, carcinogen, perception of Soegijapranata Catholic Universi ty student, food packaging* .

INTRODUCTION

Polystyrene or Styrofoam is a type of plasti c that is used for a variety of functions inclu ding in rigid items such as refrigerator crisp ers, coat hangers, DVD cases and printer ca rtridges. Polystyrene foam is a derivative of polystyrene known as Styrofoam or EPS. It is used in protective packaging for applianc es and in products such as insulated disposable cups, meat tray s and panel insulation (Clean up, 2010). Sty rofoam can be referring to foam. Since its w eight is light, reduce shipping costs and its e xcellent cushioning properties result in less breakage also is inexpensive. Another benef it of this material is that it is recyclable (DA RT corp, 2009).

Although Styrofoam is recyclable and very useful to people, the impact of Styrofoam is highly worse. In fact, in Styrofoam contains carcinogenic substances that can lead peopl e to cancer. Styrene is used to make polysty rene plastic and is a contaminant in all poly styrene foam packages. In 1998, there was a survey by the Foundation for Advancement s in Science and Education also found that i n human fatty tissue there was styrene with frequency of 100% at levels from 8 to 350 n anograms/grams (ng/g) (The Way To Go, 2 008).

Styrofoam potentially causes a health hazar d. Food packaging made from polystyrene r eleases styrene as potentially exposed to hig h temperatures, alcohol, oils and acids. Exp osure to styrene can cause hormonal disorde r that can cause thyroid disorders, irregular periods and even breast cancer and prostate gland. Styrene is also associated with increa sed levels of chromosome damage and abno rmal lung function in workers who work on a polystyrene plant. Benzene, which is part of the polystyrene foam is also known carci nogens that enter the body through the respi ratory tract. In July 2001, the Food Safety Division of the Government of Japan reveal ed that the residue can cause endocrine disr upter styrofoam (EDC), which is a disease c aused by a disturbance in the system and th e human reproductive endocrinology (Info POM, 2008).

Over100 US and Canadian, as well as some European and Asian cities have banned pol ystyrene food packaging as a result of the n egative impact to human and the environme nt (Polystyrene Fast Facts, 2008). However Indonesian Food and Drug Regulatory Age ncy (BPOM) state that so far, no country in the world has banned the use of 'Styrofoam' onthe basis of health considerations. Policy bans in several countries relating toenviron mental pollution problems. According to th e JECFA-FAO/WHO, styrene monomer do esn’t cause health problems if the residue d oes not exceed 5000 ppm.Nevertheless, inor der to carry out precautionary actions, the p ublic are encouragedto observe the
following:
b. Do not use Styrofoamin the microwave.
c. Do not use broken Styrofoam tofacilitate the oily / fatty foods especially in hot condit ions.

In this day, there are Styrofoam factory hav e added Oxium substances. Oxium substanc e is a substance which can help to decompo se plastic. This substance is already been us ed to many Styrofoam factories, although it is still questionable about that substance.

There are many different opinions or percep tion from each people. People perception m ay influence the way to live or consume in e ach daily life. The use of Styrofoam in peop le daily life as food packaging and its issue

may create someone perception. The objecti ves of this study are to know Unika Soegija pranata Catholic University student's perce ption on the use of Styrofoam as food packi ng and to know the influence of given infor mation to students' perception. Here in this thesis shows the result of students' percepti on.

METHOD

The method used in this study was by literat ure study. By searching much information f rom the journals and articles which discussi ng about the composition of Styrofoam and the health effect of using Styrofoam. The se cond method was by survey on the use of St yrofoam related to health issue to Soegijapr anata Catholic University students' percepti on. The questions given were asking people opinion about the use of Styrofoam related t o health issue. However the questioner was done in 2 steps. There first questioner witho ut information about Styrofoam and danger s substance within Styrofoam causing cance r. Then, the second questioner was the same question with information given. These two steps were done to know the influence of gi ven information to Soegijapranata Catholic University Students' perception. The questi oners were answered by fifty students aroun d Soegijapranata Catholic University.

RESULT AND DISCUSSION

In this study the questioners were answered by fifty students consist of fifty percent ma n and fifty percent women from many differ ent faculty of Soegijapranata Catholic Univ ersity such as Faculty of Economics and Bu siness, Faculty of Law, Faculty of Agricultu ral Technology, Faculty of Architecture and Design, Faculty of Psychology, etc. In this method, there are two types of questions. T he first type is without information and the second type with information about Styrofo am and its effect. The result is the sum of b oth man and woman. Here the question and the result of the answer for both, first type a nd the second type.

Question 1: Do you know about Styrofoam ?

Answe r	Without infor mation (%)	With informat ion (%)
Yes	98	98
No	2	2

There are the same answers within two step s. As we can know, people already known a bout Styrofoam because it's already in the s ociety and it's very flexible.

Question 2: What's your opinion about Styrofoam health issue?

Answer	Without information (%)	With information (%)
Don't care	2	2
Keep using it	18	22
Indifferent	32	24
Anticipate or use another product	48	52

From the data above, the answer with and without information about the Styrofoam show different result.In the first type, there are 48% of student answered that they will use another product or anticipate it. There is an increasing number within the first and the second method, in the second method there are 52% of students.. It means that Student already aware of it and start to use another product to replace Styrofoam. Unfortunately, the percentage of answer keep using it also increasing from 18% becomes 22%. The decreasing numbers happen in the third answer, "indifferent", from 32% to 24%.

Question 3: After hearing the health issue, do you still use Styrofoam as food packaging?

Answer	Without information (%)	With information (%)
Yes	58	50

From the data we can know that there is decreasing percentage of answer whose still use Styrofoam. At first there are 58% student still use the Styrofoam, but after the student know about the information, the percentage become 50%. The information given have changed some respondents' perception about Styrofoam. From the data above also known that at first there are more student answer still use it. Respondents who aware of every thing and change our mind about it, but the answer is different with our perception because people perception is different from one another.

Question 4: What is the reason for number 3, if it is "Yes"?

Answer	Without information (%)	With information (%)
It is practical	66	64
Because it looks interesting	3	0
Styrofoam is friendly to environment	7	12
Other opinion	24	36

From the data, we can conclude that most of their opinion is "it is practical". In fact the advantage of Styrofoam is practical. For other opinion, the student answers are almost the same like it is still commonly used by other people, there is no other choice and etc. Other advantage of Styrofoam is inexpensive, excellent mach inability, good impact resistance and so on. For the answer "Styrofoam is friendly to environment", the answers increase from 7% to 12%.

Question 5: What is the reason for number 3, if it is "No"?

Answer	Without information (%)	With information (%)
Harmful to health	85	88
Can't be recycled	10	4
Contain formalin	0	4
Other opinion	5	4

For the answer from number 5, we can conclude that student already know about the disadvantage of Styrofoam, which is the answer is "harmful to health". The result is increasing from before and after the given information, although it is only 3%. Some student, about 10%, also know that Styrofoam can't be recycled but after hearing the information about Styrofoam, it become 4% and most of them change their answer to "harmful to health" and "contain formalin". For student other opinion is the same from each other, it is "there is still another food packaging".

Question 6: Do you know about a substance that is added to Styrofoam which is can increase food safety**?**

Answer	Without information (%)	With information (%)
Yes	20	20
No	80	80

From the table above, we can see that student still don't know about the substance which is added in the Styrofoam. The result shows the same number from each type of question. Only few students know about the substance which is added in the Styrofoam, but some of them don't know about it.

This problem has already been notified by people. The reaction of people is different from each other. The reason people still using Styrofoam are already accustomed to using Styrofoam that is practical and is still commonly used by other people. Indeed Styrofoam is very useful to people because of it is inexpensive and recycling. Food packaging which is from Styrofoam or polystyrene become the most popular item in the food business. Styrofoam can be used to prevent the damage of food, can keep the food in any condition, for example hot food or cold food, keeps the quality of food, handy and inexpensive.

But in the other hand, Styrofoam is very harmful to human. The other negative impact of Styrofoam besides causing cancer is non-biodegradable, can cause air pollution, non-sustainable and the main problem is food contamination.

From all of the negative impact that has been known by society, society still continuously using the Styrofoam as food packaging. At first they are afraid of using Styrofoam, but later people began to use Styrofoam as food packaging again. The other reason is that because consumers are already accustomed to using Styrofoam that is practical and i

s still commonly used. People also prevent t he negative impact by putting dry and cool f ood inside the Styrofoam because the harmf ul remain from its reaction in high temperat ure causing cancer.

In these day, there are Styrofoam factory th at have added Oxium substances. Oxium su bstance is a substance which can help to dec ompose plastic. This substance is already be en used to many Styrofoam factories. The a ddition of Oxium is safe to be consumed.

CONCLUSION

- Soegijapranata Catholic University stu dents have known what is Styrofoam is and the health effect, but they still use i t as food packing.
- They keep using Styrofoam because it is practical and have no other choice.
- People haven't known what is Oxium a dded in Styrofoam.
- Given information about Styrofoam di dn't influence much the students' perc eption because most students have alre ady known about Styrofoam and the he alth effect.

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POTENTIAL OF TANNIN COATING TOWARD SALTED EGG QUALITY DURING STORAGE

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ABSTRACT

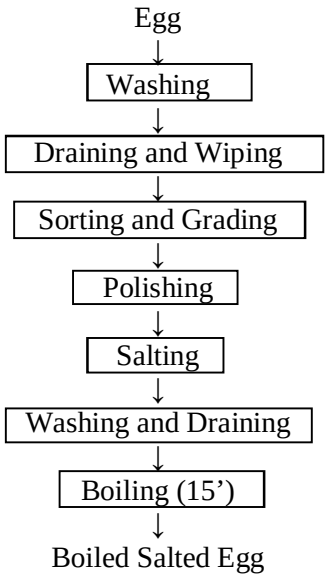
Egg is a food product comes from poultry that is easily perished so that egg should be preserved. Preservation of egg by salting process will produce salted egg which has longer shelf life and a typical flavor. The salting process still have a shortage in its product that can't prevent weight loss during storage time caused by evaporation of water and volatile compounds pass through eggshell pore. Salted egg-coating with tannin can minimize that disadvantages. Tannin compound is capable to bind protein contained on eggshell layer and form a solid complex which become sediments on eggshell layer and make it impermeable to be passed by gas, air and water. The research result about decrease of weight, Haugh Unit, and Yolk Index showed difference of tannin effectiveness at the different concentration and soaking time due to preserving egg quality during 4-week storage. The other function of tannin is to hamper microbes activity by its hidroxyphenolic groups as an antimicrobial agents. Tannin can obstruct the activity of *Staphylococcus aureus, Salmonella, and Pseudomonas* with difference of effectiveness in salted egg during storage. Obstruction of bacteria activity can prevent degradation of compounds inside salted egg become volatile compounds during storage.

Keywords: *antimicrobial, eggshell, protein, salted egg, tannin*

INTRODUCTION

Egg is one of poultry based-product which generally consumed by people as a high protein sources but has a short shelf-life time. Egg-preservation method which used commonly is salting method. Salted egg has a longer shelf-life time because its salt content can destroy microbe's cell by plasmolysis mechanism. Salt play role as a antimicrobial agent when in fact, protection of eggshell can't totally prevent egg from microbes contamination. *Salmonella enteritidis* is a main factor of microorganism contamination in reproduction tissues of egg by microbes penetration toward eggshell's pores (Reu, 2006). *Pseudomonas* sp. also has capability to contaminate egg which have low quality of eggshell. Addition of salt into egg can inhibit microorganism growth because saline environment has a high osmotic pressure so microbe's cell undergoes a

phenomenon called plasmolysis. Addition of salt also improve flavor of regular egg. Salted egg processing which commonly conducted consists of several steps. Kinds of steps that should be passed in this case is presented on Flowchart 2.1.



Flowchart 2.1 Procedure of Making Salted Egg's Process
Source: Zulaekah and Widyaningsih (2005)

Egg preservation method with salting can't prevent weight and quality decrease of egg during storage yet. The major factor that affects that phenomenon is presence of eggshell's pores which can be passed by microbes or volatile compounds as vapor. This problem can be solved by several methods such as dry storage, coverage of eggshell's pores with agar or soaking in certain liquid. One of effective methods is soaking treatment in tannin solution. Tannin is a compound which obtained by extraction from body parts of several kinds of plants such as tea, sorghum, guava, acacia and the other kinds of plants. Tannin is a polyphenol compound with molecule weight value between 500 to 3000 grams/mole and contains a number of hidroxyphenolic sides that can form cross-linking reaction with protein (Fahey and Berger, 1988 in Tanuwiria, 2007). The other compound that establish cross-link with tannin is polysaccharide, amino acid, fatty acid and nucleic acid (Nyachoti et al., 1997 in Tanuwiria, 2007). This potential become a base of addition of tannin's importance in case of improving salted egg quality during storage.

Egg tannery application in society trading business may improving economic benefit of seller. Raw salted-egg can be valued in a range from Rp1.600 to Rp2.200,- per grain. The average profit that obtained is Rp400,- for the seller. Coating of salted egg's shell with tannin certainly increase the production cost but that enhancement isn't too significant. Many simple way can be used to get tannin solution because the sources such as guava's leaf, acacia skin and tea's leaf can be found easily in this country. The extraction tools which needed just hot water and filter so that the addition of cost for this treatment relatively small in amount. For example, guava's leaf can be valued by Rp25.000,- per kg. Each kilogram of guava's leaf can be used for making 5 liters 20% tannin solution which

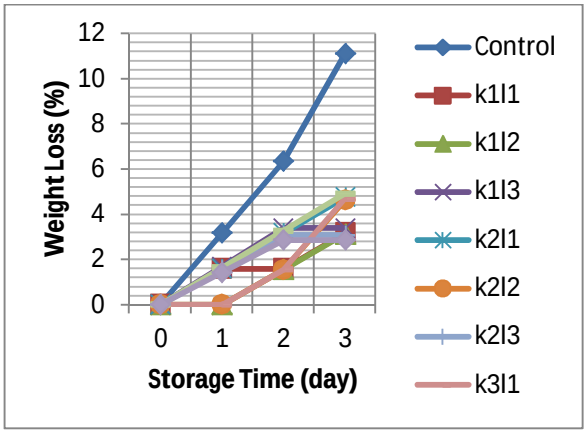
can be used for soaking several dozens of salted egg. The cost even can be minimized by having guava as the plant's own. The seller can get guava's fruit for their consumption and its leaves for obtain tannin extract. This way also can be applied for the other tannin sources.

DISCUSSION

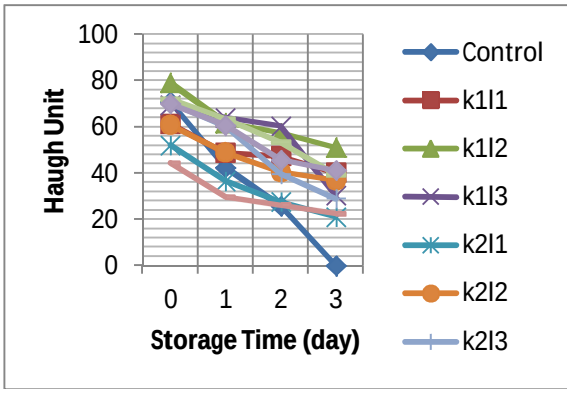
Tannin is a kind of polyphenolic compound which contains hydroxyl groups that have several pairs of free electron. Therefore, this compound can form complex with others compounds which provide empty orbital. Tannin has known in its capability to binding protein through hydroxyphenolic or hydrophobic groups that its have (Tharayil et al, 2010). The complex that formed will precipitated caused by its polarity level then its solubility become decreased drastic and deliver brown precipitate on eggshell's surface. This matter begotten hole of salted egg's pores is going closed because covered of precipitates of complex which formed by tannin-protein reaction.

Chemical quality of salted egg affected by respiration process which happens inside salted egg during storage. Internal respiration can be occurred because there is a contact between oxygen and substrate inside salted egg both oxygen naturally found inside salted egg and oxygen from environment that penetrate into salted egg. That process deliver water vapor and carbon dioxide as volatile compound. The evaporation process begotten weight loss and decrease of albumen and yolk's viscosity. A decrease of viscosity should decrease the quality of albumen and yolk too. Measurement of albumen and yolk's quality reduction can be explained by change of Haugh Unit and Yolk Index of salted egg during storage.

The effectivity of tannin while maintain egg quality didn't always improved along with increase of soaking time in tannin solution or concentration of tannin in solution. The influence of tannin addition (from skin wood of acacia extract) which contains tannin towards quality reduction of egg showed on Graphic 3.1. and Graphic 3.2.



Graphic 3.1.
Effect of Soaking Treatment with Tannin to Level of Egg's Weight Loss during Storage
Source: Agustin, S (2008)



Graphic 3.2.
Effect of Soaking Treatment with Tannin to Level of Egg's Haugh Unit during Storage
Source: Agustin, S (2008)

Both of two graphics that viewed before explain about reduction of quality during storage comparison between control egg (without any coating treatments) and egg with soaking into tannin solution (from acacia bark extract) treatment. Parameters which used to describe egg's quality are weight loss and Haugh Unit (HU). Tannin solution which used splits to three concentration types and three soaking times types which different each others. Haugh Unit explain about freshness and viscosity level of egg's albumen during storage. Albumen that lost their volatile compound such as carbon dioxide, ammonia and nitrogen will be decreased in viscosity. Evaporation of volatile compound also begotten weight loss.

Difference in Haugh Unit level at first week after soaking showed by both control egg and tannin solution-soaked egg. Low-concentration tannin solution perform more effectively in order to maintain Haugh Unit level than high-concentration tannin solution using for short soaking time. High concentration of tannin solution recently show their effectiveness in maintaining egg quality in long soaking time (72 hours). This phenomenon tend to appear clearer in several weeks later. Level of egg quality which soaking in high-concentration of tannin solution in short soaking time (24 hours) showing a drastic slope, but egg which soaked in high-concentration tannin solution for same soaking time showed lower decrease level of egg's quality. The effectiveness of medium and high-concentration tannin solution increased significantly as long as addition of soaking time, whereas low-concentration tannin solution didn't show the same progress.

Result of research on Graphic 3.1. and Graphic 3.2. show that soaking treatment with tannin could maintain egg quality during storage. Shelf-life of egg during storage improved when both salting and tannin-coating treatment have given before storage. Salting process of egg can improve egg resistance towards microbiology contamination significantly. This can be occur because most of microbes species can't stay alive at high-salt content environment. However, salting process still can't inhibit chemical process of

degradation. Internal respiration in salted egg as consequence of contact with oxygen from air begot degradation of chemical compounds and deliver volatile compounds which easily evaporated. This can reduce the quality of salted egg during storage. Coating treatment with tannin can minimize contact of egg's albumen and yolk with environment around the egg so that degradation reaction of chemical compound inside the egg that caused by oxygen and microbes penetration into the egg can be reduced.

Eggshell coating by tannins also can prevent the entry of microorganisms into the egg as well as to prevent the evaporation of volatile compounds in the eggs. Bacteria have a relatively small size of cell so it can penetrate through the pores of the shell of egg which is not preserved. Closure of pores due to the addition of tannins eggs will close the entrance to the decay-causing bacteria in the eggs including salt-resistant bacteria. This will cause the number of bacteria in the eggs become less than before tannery.

Tannin containing hydroxyphenolic groups located on the surface of tannin molecules (Lim *et al*, 2006). That groups gives a major role to the characteristics and biological activity of tannins, including the activities of tannins as an antiseptic and antimicrobial agents.

Mechanism of tannins action as an antimicrobial compound in the egg can be outlined as the effects of the toxicity properties of tannins and the ability of tannins to form complexes with other compounds. Tannins have a level of toxicity that can damage cell membranes by bacterial cell wall or cell membrane wrinkling so that disrupts membrane permeability of the bacterial cell itself. Resulted in impaired cell permeability is inhibited of cell growth even cell death. Enzyme protein precipitation and bacterial cell membranes that caused by the reaction of complex formation by tannins also inhibit bacterial growth. The ability of tannins to form complexes bond with metal ions may improve the toxicity of tannins against bacteria.

Activity of tannins obtained from S. Tribolatum against several species of microorganism contaminants in foodstuffs are presented in Table 3.2. Table 3.2 shows that the greater the concentration of tannin is added, the greater the inhibition strength of activity for against Staphylococcus aureus, Pseudomonas and Salmonella. All of that species mentioned are several kinds of bacteria that potentially live in a saline environment including salted egg..

Table 3.2 Antimicrobial Activity of Tannins which isolated from S. trilobatum

Con. (mg/ml)	Mean diameter of zone of inhibition (mm ± SD)		
	S. aureus	*P. vulgaris*	*S. typhi*
0.5	8.3 ± 0.28	NA	NA
1	8.6 ± 0.28	7.8 ± 0.280	8.5 ± 0.5
1.5	10.5 ± 0.5	7.83 ± 0.15	9.13 ± 0.32
2	11.5 ± 0.5	8.83 ± 0.28	10.5 ± 0.5
2.5	13.5 ± 0.5	9.66 ± 0.28	10.8 ± 0.28

Source: Doss *et al.*, (2009)

The research data in Table 3.2 shows the greater antimicrobial activity of tannin in Staphylococcus aureus inhibition compared to Pseudomonas or Salmonella inhibition. This is caused by the structure of the cell wall of Staphylococcus aureus as a gram-positive bacteria possessed different with the structure of the cell wall of Pseudomonas and Salmonella as a gram-negative bacteria. The cell walls of gram-positive bacteria have only a single membrane which mostly composed of peptidoglycan compounds, while the cell wall of gram-negative bacteria have a double membrane system that consist of peptidoglycan at inside layer and a permeable membrane composed of lipids, lipoproteins and lipopolysaccharide at outside layer.

CONCLUSION

The addition of tannins in salted eggs can inhibit the chemical degradation due to the evaporation of volatile compounds as a respiration results in salted eggs during storage. The addition of tannins on salted eggs also inhibit egg's quality degradation caused by the activity of microorganisms in salted eggs during storage.

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THE INFLUENCE OF FERMENTATION IN SWEET POTATO FLOUR (*Ipomoea batatas* L.) CHARACTERISTICS AND QUALITY OF INSTANT CREAM SOUP APPLICATION

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ABSTRACT

Yellow sweet potato flour was local flour that potential to used as a substitute for wheat flour because of its high fiber and high carbohydrate content, low fat, contained nutrients that are beneficial to health (probiotics, dietary fiber, and antioxidants) and it was cheaper. Sweet potato flour had a lower protein content, physical characteristics (included viscosity, power of rehydration and solubility) are less favorable than wheat flour and sweet potato flavor was still very pronounced, so we need fermentation. Sweet potato flour fermented with treatment used mixed culture of *Lactobacillus plantarum* and *Saccharomyces cereviceae* with ratio 1: 1, 2: 1 and 1: 2 performed in the preliminary research. From the results of preliminary research it was known that with fermentation, moisture, protein and crude fiber content increased; content of ash, fat and carbohydrate decreased; colors of sweet potato flour more bright; bulk density decreased and viscosity, dispersibility and wettability of sweet potato flour increased. In a major research conducted by making an instant cream soup using yellow sweet potato flour that has been fermented. The major research results revealed that instant cream soup that most preferred by consumers is instant cream soup of sweet potato flour fermented with a ratio of *Lactobacillus plantarum*: *Saccharomyces cereviceae* (1: 1). Based on the test results of instant cream soup of sweet potato flour fermented with commercial instant cream soup "Royco", it was known that instant cream soup of sweet potato flour fermented has moisture, fat and protein are higher than commercial instant cream soups, as well as viscosity and power of rehydration. From the results of sensory tests on 40 trained panelists noted that the used of yellow sweet potato flour fermented in an instant cream soup products acceptable to consumers even though such acceptance had not been able to approach the commercial instant cream soup "Royco".

Keywords: *yellow sweet potato flour, fermentation, instant cream soup*

INTRODUCTION

Indonesia is a net importer of wheat flour that is very large. The high price of wheat flour imported could threaten crisis raw materials for wheat flour-based industries. It can encourage the use of local flour. Indonesia has the potential of tubers as a source of carbohydrates as well as the raw materials of local flour that can be used as a substitute for wheat flour, one of them is sweet potato. As the country's second-largest producer of sweet potatoes in the world after the RRC, Indonesia has great

potential in the development of industry-based processing of sweet potato.

Sweet potato flour has several advantages than wheat flour, that are sweet potato flour high in fiber, low fat, higher carbohydrate and nutrients that are beneficial to health (probiotics, dietary fiber, and antioxidants), and the price is cheaper (Ambarsari *et al.*, 2009). Sweet potato flour has a lower protein content and physical characteristics (including viscosity, power of rehydration and solubility) are less favorable than wheat flour (Antarlina, 1994 in Zuraida, 2003). In addition, the sweet potato flavor is still very pronounced (Anggrahini & Supriyanto, 2011), so we need fermentation process.

Based on the above, researchers interest in applying fermented sweet potato flour in the manufacture of instant cream soup. Treatment in the form of cream soup was selected because public taste which began to come to life the very practical. In addition, the cream soup on the market still use wheat flour as the raw material of manufacture.

MATERIALS AND METHODS

Tools and Materials

The tools used in this study include dehumidifier, oven, furnace, sokhlet, equipment destruction of proteins, protein distillation apparatus, kromameter, viskotester, micropipette, test tubes, blue tip, incubators and stopwatch. While the main materials used in this study include yellow sweet potatoes, *Lactobacillus plantarum*, *Saccharomyces cereviceae* and materials for the manufacture of instant cream soups such as milk powder, beef broth, yellow sweet potato flour, and seasonings.

Preparation of Yellow Sweet Potato Flour

At first, yellow sweet potatoes peeled, washed, sliced to a thickness of 2 mm, soaked with a solution of sodium metabisulphite 1000 ppm for 30 minutes and washed. Then fermented with a mixed of culture *Lactobacillus plantarum* and *Saccharomyces cereviceae* with the ratio 1: 1, 2: 1 and 1: 2. For fermentation, 3 kg of yellow sweet potato sliced soaked in 4 liters of distilled water and added 10 ml of culture with a concentration of 10^6 cells/ml. Then, incubated at 30^0C and 90% RH for 3 days. After that, dried in a dehumidifier at a temperature of 60^0C for 8 hours, crushed and sieved (Sobowale *et al*, 2007 modified).

Preparation of Instant Cream Soup

At first, 202.5 grams of full cream milk powder mixed with 697.5 grams of beef broth and 8.46 grams of sugar. Then, heated to temperature of 86.7 to 90.6^0C, stirred

gently until homogeneous. Then, added 100 grams of yellow sweet potato flour that has been fermented, stirred gently. After that, added 27 grams of corn oil, 10.8 grams of salt, white pepper powder 0.27 grams, and 0.27 grams of garlic powder, stirred and allowed to clot. Dough is formed and cooled at a temperature of -20^{0}C for 5 hours. Furthermore, dried at a temperature of 60^{0}C with a dehumidifier to formed a thin sheet. Then, these sheets crushed in a blender and sieved into powder instant cream soup ready to eat (Modified Inglet and Inglett (1987) in Sunyoto *et al*., 2011).

RESULTS AND DISCUSSION

Preparation of Yellow Sweet Potato Flour

Product of yellow sweet potato flour fermented can be seen in Figure 1.

Figure 1 Yellow Sweet Potato Flour Fermented on Different Treatment

Note : (TK) Yellow Sweet Potato Flour Not Fermented (Control), (TA) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 1, (TB) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 2 : 1, (TC) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 2.

Fermentation increases the water content of sweet potato flour (Table 1). During the fermentation process will increase the moisture content in the substrate due to the decomposition of the total dry matter (Anggraeny & Umiyasih, 2009). Microbes will use carbohydrate as an energy source by breaking down it into simple sugars such as glucose, and then glucose is broken down into CO_2 and H_2O to produce energy (Fardiaz, 1988 in Rizal *et al*., 2006).

Table 1 Chemical Characteristics of Yellow Sweet Potato Flour Fermented

Parameter	Treaatment			
	TK	TA	TB	TC
Water (% wb)	5,46 ± 0,028^a	7,34 ± 0,045^b	7,64 ± 0,017^d	7,55 ± 0,036^c
Ash (% db)	3,28 ± 0,075^d	1,38 ± 0,141^c	1,08 ± 0,077^b	0,87 ± 0,076^a
Fat (% db)	1,18 ± 0,088^c	1,14 ± 0,164^c	0,69 ± 0,181^b	0,32 ± 0,076^a
Protein (% db)	3,06 ± 0,248^a	3,29 ± 0,169^a	3,87 ± 0,288^b	3,67 ± 0,216^b
Crude Fiber (% db)	3,30 ± 0,052^a	6,54 ± 0,186^b	7,77 ± 0,441^c	8,11 ± 0,780^c
Carbohydrate (% db)	83,40 ± 0,164^c	79,73 ± 0,128^b	78,31 ± 0,354^a	78,87 ± 0,778^a

Note :

- (TK) Yellow Sweet Potato Flour Not Fermented (Control), (TA) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 1, (TB) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 2 : 1, (TC) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 2.
- All values are expressed as mean ± standard deviation.
- Values with different superscript indicate a significant difference between treatments in a row, ($p < 0.05$) using one-way ANOVA test by Duncan multiple regions.

Fermentation lowers ash content of sweet potato flour (Table 1). The decrease is due to the activity of microbes using mineral

metabolism (Ojokoh, 2008). In addition, due to the dry ingredients and the volatiles were lost during the process of fermentation (Nnam & Obiakor, 2003 in Onweluzo & Nwabugwu, 2009).

Fermentation reduce fat content of yellow sweet potato flour (Table 1). The decrease is due to the activity of lipase enzyme produced by *Saccharomyces cerevisiae* working in the breakdown of fat for energy substrate for growth (Chopra & Khuller, 1987 in Anggraeny & Umiyasih, 2009). According Botazzi (1983) in Sunarlim & Sri (__), lactic acid bacteria have a secondary lipolytic activity.

Fermentation increases the protein content of yellow sweet potato flour (Table 1). The increase is due to microbes secrete several extracellular enzymes (proteins) (Ojokoh, 2008). *Saccharomyces cerevisiae* can secrete extracellular enzymes such as amylase, cellulase and linamarase (Oboh & Akindahunsi, 2003 in Boonnop *et al*., 2009). *Lactobacillus plantarum* produced enzyme proteinase during fermentation that can hydrolyze the protein substrate (Kurniadi *et al*., 2011). In addition, this increase is also due to the decrease in the content of other nutrients, especially carbohydrates (Anggraeny & Umiyasih, 2009). Highest protein content value indicated in the treatment of fermentation with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 2: 1. Bacteria containing high protein, based on the dry weight of about 60-70% (Fardiaz, 1992 in Sunarlim & Sri, __), whereas *Saccharomyces cerevisiae* containing protein by 31-51% (Anggraeny & Umiyasih, 2009).

Fermentation increases crude fiber content of yellow sweet potato flour (Table 1). During fermentation microbes produce pectinolytic and cellulolytic enzymes to break down the cell membrane (Mathew *et al*. 1995 in Aloys & Hui, 2005) and starch into simpler components, except for crude fiber (Sukardi et al., __). The increase in crude fiber content is also due to the growth and development of high microbial biomass could increase the content of crude fiber (Mildayani, 2007). *Lactobacillus plantarum* can produce exopolysaccharide (Tallon *et al*., 2006 in Zubaidah, 2008).

Fermentation causes a decrease in the carbohydrate content of yellow sweet potato flour (Table 1). Decomposition of organic matter due to the activity of the enzyme amylase and zimase that produce of microbes working in the breakdown of starch and other complex carbohydrates into simple sugars because it is used to fulfill the energy needs of a growing yeast so that the organic matter content during

fermentation decreased (Ardhana, 1982 in Anggraeny & Umiyasih, 2009).

The color of yellow sweet potato flour fermented tend brighter (Table 2). This color change can be caused by ash content contained in yellow sweet potato flour fermented is lower than non-fermented yellow sweet potato flour. According deMan (1997), the higher ash content of the flour, the color of flour will darken. Discoloration of sweet potato flour is also due to the degradation of pigments during the fermentation process (Rasulu *et al*., 2012). In addition, the color of flour is also influenced by the presence of enzymatic browning reaction because of phenol on sweet potatoes. This browning reaction can be inhibited by the addition of acid (Fennema, 1985) resulting from the activity of lactic acid bacteria and yeasts (Dziedzoave *et al*., 2000 in Aloys & Hui, 2005).

Table 2 Physical Characteristics of Yellow Sweet Potato Flour Fermented

Parameter	**Treatment**			
	TK	**TA**	**TB**	**TC**
Fineness (%)	93,07 ± 0,547[b]	96,62 ± 0,371[d]	92,36 ± 0,495[a]	94,27 ± 0,498[c]
Color				
L*	85,89 ± 0,363[a]	87,28 ± 0,120[b]	88,06 ± 0,349[c]	87,44 ± 0,250[b]
a*	12,26 ± 0,659[b]	8,14 ± 1,001[a]	8,65 ± 0,456[a]	8,79 ± 1,152[a]
b*	21,10 ± 0,504[c]	18,85 ± 0,674[b]	17,62 ± 0,767[a]	18,33 ± 0,867[ab]
Viscosity (dPas)	3,5	6	15	50
Bulk density (g/ml)	0,469 ± 0,001[d]	0,456 ± 0,004[c]	0,409 ± 0,008[b]	0,384 ± 0,008[a]
Dispersibility (%)	85,53 ± 0,555[a]	98,42 ± 0,058[c]	97,72 ± 0,197[b]	98,28 ± 0,021[c]
Wettability (minute: second)	2:00:02 ± 0,005[c]	1:27:56 ± 0,004[b]	1:14:16 ± 0,003[c]	1:11:55 ± 0,005[c]

Note :

- (TK) Yellow Sweet Potato Flour Not Fermented (Control), (TA) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 1, (TB) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 2 : 1, (TC) Yellow Sweet Potato Flour Fermented with a ratio *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 2.
- All values are expressed as mean ± standard deviation.
- Values with different superscript indicate a significant difference between treatments in a row, ($p < 0.05$) using one-way ANOVA test by Duncan multiple regions.

Fermentation lower bulk density of yellow sweet potato flour (Table 2). During the fermentation process, components that have a high molecular weight and particle size will most hydrolyzed by microbial enzymes produced into components that are simpler and have a smaller particle size (Gernah *et al*., 2011). The smaller the particle size of the flour, the bulk density of flour smaller. The smaller the particle size, the greater the surface area and the greater the volume so that the smaller the bulk density (Aini, 2009).

Solubility of sweet potato flour fermented was higher than unfermented sweet potato flour (Table 2). The increase is due to the during fermentation of carbohydrates and proteins with high molecular weight would be hydrolyzed to a more water-soluble components such as sugars, proteins and

other components (Amadi *et al*., 1999 in Onweluzo & Nwabugwu, 2009). Dispersibility of fermentation products is also associated with a reduction in particle size of the food (Kulkarni *et al*., 1991 in Aloys & Hui, 2005).

Wettability of sweet potato flour fermented shorter than sweet potato flour without fermentation (Table 2). With the fermentation, microbes will degrade the cell wall causing damage to the structure of starch granules, so the starch granules absorb water (Greenwood, 1979 in Kurniadi *et al*., 2011). During the fermentation process occurs breakdown protein into free amino acids which are polar so the ability to absorb water higher (deMan, 1997). Wettability properties are also highly dependent on the particle size of the flour. Small particle size reflects the large surface area makes it easy for water to moisten the flour faster than the flour particle size is relatively large (Hartoyo & Sunandar, 2006).

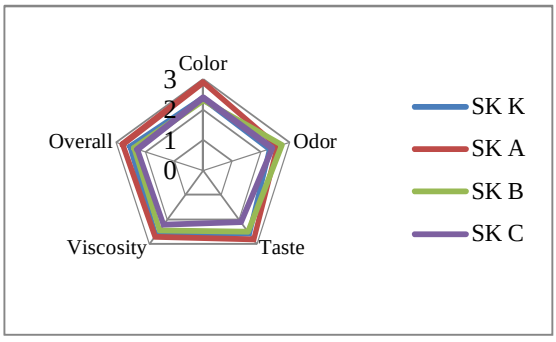
Fermentation increases the viscosity of the solution yellow sweet potato flour (Table 2). Viscosity is affected by the ability to absorb water. In addition, because of the fermentation and water as a result of fermentation media with water soluble fraction of amylose and amylopectin fractions are not water soluble. With the release of amylose fraction, the amylopectin fraction medium grew, so make starch more open structure so that the water will be easier to enter, penetrate into the starch granules and starch granules swell so that the value of the viscosity increase (Kurniadi *et al*., 2011).

Preparation of Instant Cream Soup

Products instant cream soup of yellow sweet potato flour fermented and commercial instant cream soup "Royco" can be seen in Figure 2.

Figure 2 Flour of Instant Cream Soup of Yellow Sweet Potato Flour Fermented on Different treatment (top) and Instant Cream Soup of Yellow Sweet Potato Flour Fermented on Different Treatment (below)

Graph 1 Sensory Test Results Instant Cream Soup of Yellow Sweet Potato Flour Fermented



Note : (SK K) Flour and Instant Cream Soup of Yellow Sweet Potato Flour Not Fermented, (SK A) Flour and Instant Cream Soup of Yellow Sweet Potato Flour Fermented with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 1, (SK B)

Flour and Instant Cream Soup of Yellow Sweet Potato Flour Fermented with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 2 : 1, (SK C) Flour and Instant Cream Soup of Yellow Sweet Potato Flour Fermented with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 2, (SK R) Flour and Commercial Instant Cream Soup "Royco".

Based on the results of sensory tests (Graph 1), instant cream soup most preferred by consumers is a instant cream soup with fermentation treatment with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1: 1. Then do the comparison between instant cream soup of yellow sweet potato flour fermented with commercial instant cream soup "Royco".

Table 3 Chemical Characteristics of Instant Cream Soup of Yellow Sweet Potato Flour Fermented and Commercial Instant Cream Soup "Royco"

Treatment	Parameter		
	Water (% wb)	Protein (% db)	Fat (% db)
SK K	5,97 ± 0,054[b]	10,88 ± 0,282[b]	17,53 ± 0,356[c]
SK A	5,84 ± 0,167[b]	11,34 ± 0,263[c]	16,99 ± 0,300[b]
SK R	1,63 ± 0,064[a]	10,36 ± 0,232[a]	9,78 ± 0,133[a]

Note :

- (SK K) Instant Cream Soup of Yellow Sweet Potato Flour Not Fermented, (SK A) Instant Cream Soup of Yellow Sweet Potato Flour Fermented with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1 : 1, (SK R) Commercial Instant Cream Soup "Royco".
- All values are expressed as mean ± standard deviation.
- Values with different superscript indicate a significant difference between treatments in a coloumn, ($p < 0.05$) using one-way ANOVA test by Duncan multiple regions.

Moisture content of instant cream soup product ranged from 1.63 to 5.97% (Table 3). The water content of instant cream soup is in compliance with the provisions of SNI 01-4967-1999 for instant cream soup that is a maximum of 8% (b). Fat content of instant cream soup product ranged from 9.62 to 16.48% (Table 3). Fat content of the instant cream soup product is in compliance with SNI 01-4967-1999 set in, which is at least 5%. High levels of these fats are used as raw materials containing high fat (Haryasyah *et al.*, __) such as milk (26-29%) (Bylund, 2003 in Purnama, 2007). The protein content of instant cream soup products ranged from 10.19 to 10.68% (Table 3). The protein content of instant cream soup product is in compliance with the SNI 01-4967-1999 set for instant cream soup that is at least 10%. High levels of protein instant cream soup is because the raw materials used are materials with a high protein content (Haryasyah *et al.*, __) like broth from beef (18.23%) (Susanti, 1991 in Triyantini *et al.*, 1997) and milk (25-27%) (Bylund, 2003 in Purnama, 2007).

Table 4 Physical Characteristics of Instant Cream Soup of Yellow Sweet Potato Flour Fermented and Commercial Instant Cream Soup "Royco"

Treatment	Parameter	
	Viscosity (dPas)	Rehydration (%)
SK K	30	632,44 ± 1,158[b]
SK A	400	651,41 ± 1,399[c]
SK R	45	574,99 ± 1,029[a]

Note :

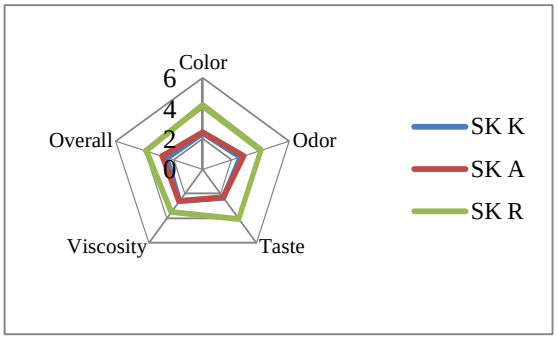
- (SK K) Instant Cream Soup of Yellow Sweet Potato Flour Not Fermented, (SK A) Instant Cream Soup of Yellow Sweet Potato Flour Fermented with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae*

1 : 1, (SK R) Commercial Instant Cream Soup "Royco".

- All values are expressed as mean ± standard deviation.
- Values with different superscript indicate a significant difference between treatments in a coloumn, ($p < 0.05$) using one-way ANOVA test by Duncan multiple regions.

Instant cream soup of yellow sweet potato flour fermented has its highest rehydration (Table 4). Yellow sweet potato flour fermented as raw material for instant cream soup has great water absorption ability and solubility and porosity flour is also greater due to the fermentation process as described previously. Materials with large porosity will cause the material to absorb water faster (Sunyoto *et al*., 2011).

Instant cream soup of sweet potato flour fermented at high viscosity (Table 4). The high viscosity instant cream soup is influenced by the materials used such as yellow sweet potato flour fermented has a high viscosity as described previously. Kuswanto & Sudarmadji (1989) in Sunarlim *et al*., (2007) says that the viscosity is also derived from milk casein clot due to the low acidity of work-related microbes.



Graph 2 Sensory Test Results Instant Cream Soup of Yellow Sweet Potato Flour Fermented and Commercial Instant Cream Soup "Royco"

Panelists preferred commercial instant cream soups such as cream soup with yellow-white is lighter than the instant cream soup of sweet potato with a darker yellow color (Graph 2). The yellow color is due to the proteins and lactose in milk. In the manufacture of instant cream soup, lactose cause a Mailard reaction between reducing sugar with proteins, peptides, and amino acids that resulted in a darker yellow color (Sunyoto *et al*., 2011). In addition, because of differences in the color of flour used for making instant cream soup.

There is a decrease in the level of consumer preferences for instant cream soup of sweet potato flour fermented compared to commercial instant cream soup "Royco" (Graph 2). This may be mainly due to the formulation ingredients in the manufacture of instant cream soup is milk that dominated in terms of flavor is dominant creamy flavor. This creamy flavor

possibilities may cause a decrease in the level of consumer preferences.

The test results also showed decreased sensory panelists at the attribute level of preference consistency in the instant cream soup of sweet potato flour fermented (Graph 2). It is thought to be caused by the viscosity of instant cream soup sweet potato flour fermented very high (400 dPas) (Table 2), so it allows the use of flour in smaller amounts to achieve a certain viscosity and ultimately reduce the cost of production.

CONCLUSIONS

Fermentation can increased the nutritional value and improved the physical characteristics of yellow sweet potato flour. The used of yellow sweet potato flour fermented with a ratio of *Lactobacillus plantarum* : *Saccharomyces cereviceae* 1: 1 in the manufacture of instant cream soups most preferred by panelists among other treatments. Instant cream soup of sweet potato flour fermented had moisture, fat and protein were higher than commercial instant cream soups, as well as viscosity and higher power of rehydration.

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MATHEMATICAL MODELING OF CHILI PEPPERS QUALITY AFTER HARVESTED UNDER VARIOUS PICKING TREATMENT

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ABSTRACT

In Indonesia, the fruit chili pepper (*Capsicum annuum*) usually is marketed in fresh condition, soon after harvested. Therefore there is a need to operate the right harvesting technique and the post harvest handling, in order to keep the freshness of the fruit. After harvested the fisiological process is still progressing, and some environmental factors like temperature and humidity strongly influence on the fruit freshness. Our goal in this research was to find out whether a simple treatment in harvesting like picking the fruit at the stem node could affect the quality of the chili pepper after harvested. To these ends, chili pepper fruit were picked on the same day, in three different treatments. The first treatment was cutting on the stem node, second one was on the middle of the stem, and the last one was the bottom of the fruit. The parameters of the fruit quality here was the changing of the fruit weight and size, which included the fruit height and width, over 10 days display at room temperature, after harvested. The observation on these three parameters was made every two days, and the temperature and relative humidity were recorded. The changing in these three parameters was then analyzed mathematically. The differentiation and integration technique were employed to construct the mathematical models. The models showed that the decreasing of weight and size were different on each treatment. On the first treatment, the weight reduction was increasing over the displaying period, whereas on the second treatment the biggest weight loss happened on the second day. The last treatment showed that the highest weight loss happened on the third day. Based on the models it can be concluded that the simple treatment of cutting the stem right part, i.e. at the stem node, resulted in the strong differences in quality of the chili pepper fruit over 10 days after harvested.

Keywords : *chili pepper, treatment, quality, mathematical method*

INTRODUCTION

Chili pepper (*Capsicum annuum*) is one of the fruit that highly produced in Indonesia. It has high economic value because of unique taste, i.e. hot because of capsaicin (8-methyl-N-vanillyl-6-nonenamide) and other capscicinoids. It also rich in vitamin C, provitamin A, Vitamin B such as vitamin B6, potassium, magnesium, and iron (Berke et al., 2004). Nowadays, besides eaten raw, chili pepper also added to processed product such as dried fruit, powder, paste, and cooked dishes to provide the desired spicy taste.

However, this fruit usually consumed in fresh condition, so the right pre-harvest and post-harvest treatment may increase the quality and leads to minimalize the losses like weight and size. Mechanical harvesting is not advisable for chili because the machinery may injure the fruit, so the fruit was picked by hand. The fruit was picked by removing it from the branch and ensuring the stem remains intact and attached to the fruit (at the stem node). But usually, there are pickers picked the chili in the middle of the stem or bottom of the fruit. The right picking treatment will keep the quality and prolong shelf life against the environmental factor, macroorganism and microorganism. As a result, there are comparison between the impact of three picking treatment to find out whether picking the fruit at the stem node or the other parts such as bottom of the fruit and middle of the stem could affect the quality of the chili pepper after harvested.

MATERIAL AND METHODS

In this research, 30 chilis pepper was picked on the same day in three different treatment. First treatment, 10 chilis was cutting at the stem node, then at the second treatment 10 chilis was picking at the middle of the stem. At the third treatment, 10 chilis was picked at the bottom of the fruit. The parameters of the fruit quality here was the changing of the fruit weight and size, which included the fruit height and width. The observation on these three parameters was made every two days over 10 days display at room temperature after harvested. The temperature and relative humidity were recorded. The changing in these three parameters was then analyzed mathematically with differentiation and integration technique to construct the mathematical models. On the figure below, we can see the changes of chilli paper in several treatment.

Figure 1. Observation day 2 on full stem chilli peppers

Figure 2. Observation day 10 on full stem chilli peppers

Figure 3. Observation day 2 on half stem chilli peppers

Figure 4. Observation day 10 on half stem chilli peppers

Figure 5. Observation day 2 on no stem chilli peppers

Figure 6. Observation day 10 on no stem chilli peppers

RESULTS AND DISCUSSION

Analytical result from our research that related with our all treatment on weight parameters of the chili pepper is presented on Table 1.

Table 1. The changing of chili paper weight during 10 days exposure in the conditions of Full Stem (FS), Half Stem (HS) and Without Stem (or No Stem, NS)

Days	FS (g)	HS (g)	WS (g)
0	3,689	3,562	3,564
2	2,845	2,693	2,728
4	2,17	1,974	1,927
6	1,559	1,416	1,272
8	1,134	1,071	0,938
10	0,9584	0,926	0,845

Table 1. show the average of weight on three treatment for ten days of research that in chilli peppers. The result shown that the weight of chilli peppers is decreased for ten days treatment because the water content on the chilli peppers was dried. The declining of the weight in these three treatments, was following these equations:

$$\mathbf{Y_{FS} = 0{,}00022\ X^4 - 0{,}00237\ X^3 + 0{,}01038\ X^2 - 0{,}35368\ X + 3{,}57587}$$

$$\mathbf{Y_{HS} = - 0{,}00039\ X^4 + 0{,}00901\ X^3 - 0{,}04340\ X^2 - 0{,}34116\ X + 3{,}56585}$$

$$\mathbf{Y_{NS} = - 0{,}00025\ X^4 + 0{,}00680\ X^3 - 0{,}03279\ X^2 - 0{,}37473\ X + 3{,}56254}$$

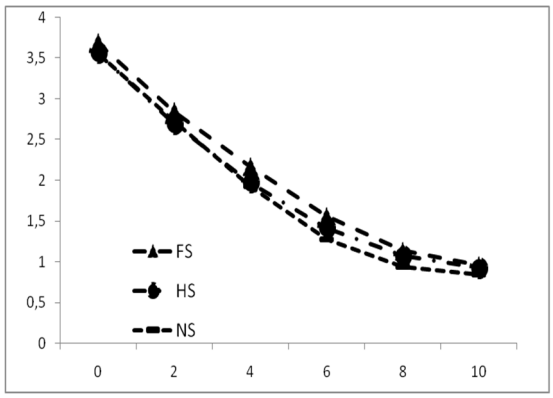

Figure 1. The loosing of chilli papers fruit weight treated under three treatments of stem during 10 days of exposure

The differentiation of these equation will show the the rate of drying of the three treatments. The mathematical equation of the differentiation is as follows:

$$dY_{FS}/dX = 0.00090\,X^3 - 0.0712\,X^2 - 0.02076\,X - 0.35368$$

$$dY_{HS}/dX = -0.00156\,X^3 + 0.02703\,X^2 - 0.08681\,X - 0.34116$$

$$dY_{NS}/dX = -0.00099\,X^3 + 0.02039\,X^2 - 0.06557\,X - 0.37473$$

When these differential equation is drawn in a graph, then we will find the following curves, as shown on Figure 2.

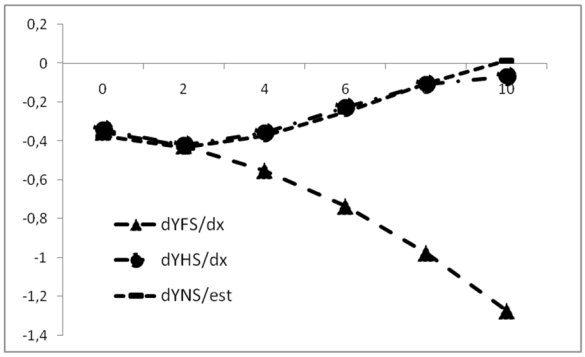

Figure 2. Drying rate of chilli papers under three treatments of stem as predicted based on the first differentiation of the weight changing during 10 days of exposure

Figure 2 showed that the chili peppers with full stem had increasing drying rate each day. The highest drying rate happen on the tenth day. Graphic on figure 1 showed that

the drying rate on chili peppers with half was decreasing from the second day until tenth day. On the first day the drying rate was increased. Figure 1 showed that chili peppers without stem had the drying rate increasing on zero day to second day. But on the second day until the tenth day the drying rate was decreased each day.

As the result, the weight of chili peppers in each treatment show the difference drying rate. On the first treatment, the drying rate increase each day, but in the second and third treatment, the drying rate was decreasing on zero day to second day before increasing each day.

Further differentiation will be found the critical time of the weight declining. The equation resulted from this second differentiation of the three treatments were as follows:

$$d2Y_{FS}/dX^2 = 0.00269\ X^2 - 0.01424\ X\ - 0.02076$$

$$d2Y_{HS}/dX^2 = 0.00468\ X^2 + 0.05406\ X\ - 0.08681$$

$$d2Y_{NS}/dX^2 = -0.00298\ X^2 + 0.04078\ X\ - 0.06557$$

These equations can be drawn in graph, and by putting the X from 0 to 10, the grapths are as follows:

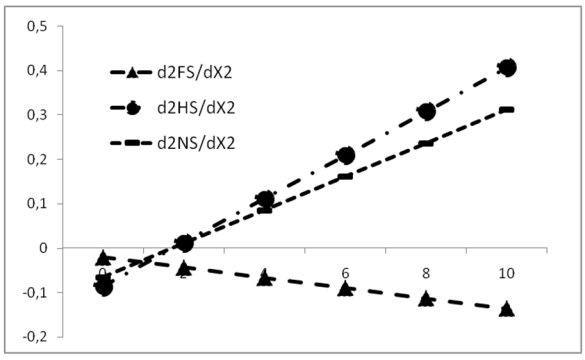

Figure 3. Critical points of loosing weigth of chilli papers under three treatments of stem as predicted based on the second differentiation of the weight changing during 10 days of exposure

In order to find out the figure of X when the graph is at Y = 0, the so called ABC equation is employed, and the results were:

	FS	HS	NS
X_1	6,487996	1,927447	1,861501
X_2	-1,19083	9,624027	11,80342

Based on these figures, then we can define that the critical time of loosing chilli papers weight under the three stem treatments were as follows:

FS = 6,487996 days

HS = 1,927447 days

NS = 1,861501 days

These figures indicated that FS treatmets were taking the longer time in keeping the fruit weight, i.e. 6,487996 days, followed with HS, i,e, 1,927447 days, and the treatment that fastest loosing the weight was NS, i.e. 1,861501 days

$$\int_0^n f_{FS}(x) = 0.00004\,X^5 - 0.00059\,X^4 + 0.00346\,X^3 - 0.17684\,X^2 + 3.357587 + C$$

$$\int_0^n f_{FS}(x) = -0.00008\,X^5 + 0.00225\,X^4 - 0.01447\,X^3 - 0.17058\,X^2 + 3.56585 + C$$

$$\int_0^n f_{FS}(x) = -0.00005\,X^5 + 0.00170\,X^4 - 0.01093\,X^3 - 0.18737\,X^2 + 3.56254 + C$$

When these equation was drawn in a graph in definite integral from 0 to n, where n is 10 (the total days of exposure), the results were as shown on Figure 4.

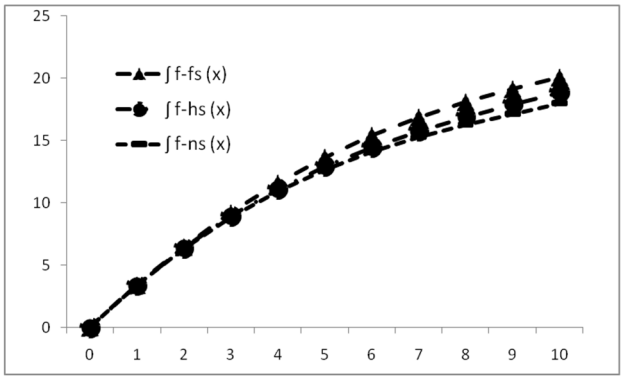

Figure 4. The water retention on all treatment of chili peppers as resulted from integration of the loosing weight equation.

Figure 4 showed the water retention that every all treatment of chili peppers always increasing each day but the the highest water retention happenned on full stem weight. Using definite integral from 0 to critical time of weght loose and from 0 to 10 days of exposure, the retaining weight of chilli paper, can be calculated, and the results were as follows:

Treatment	Critical period	%	10 days	%
FS	16,17	100,00	20,08	100,00
HS	6,16	38,14	18,86	93,90
NS	5,93	36,69	17,98	89,52

This integral results indicate that treatment up to critical time of losing weight, the treatment HS and NS respectively retaining only weight 38.14% and 36.69% compared to FS. Whereas when the comparisson was made up to 10 days of storage, the retaining weight of HS and NS treatments only 93.90% and 89.52% respectively compared to FS.

Analytical result from our research that related with all treatment on other parameter of the height of chili pepper presented as on Table 2.

Table 2. The changing of fruit height of chilli papers under three stem treatments during 10 days of exposure.

Days	FS (g)	HS (g)	NS (g)
0	8.63	8.13	8.59
2	8.76	8.13	8.36
4	8.59	7.72	8.34
6	7.9	7.267	7.893
8	7.705	7.363	7.794
10	7.739	7.22	7.824

Table 2 shows the average of height on three treatment for ten days of research in chilli peppers. The result shown that the height of chilli peppers is decreasing for ten days treatment because the water content on the chilli peppers was dried. The drying rate is shown on figure 2

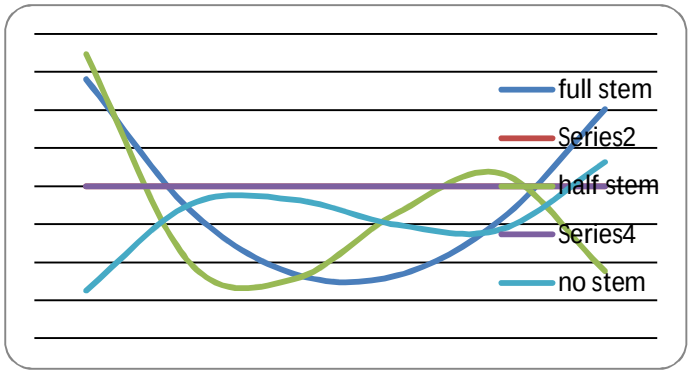

Figure 5. Drying rate of height on chili peppers fruit under three stem treatments during 10 days of exposure

Figure 5 showed that the drying rate of chilli peppers with full stem was decreasing on the first day until sixth day and then increasing until tenth day. On fourth day until sixth day, it had almost the same drying rate. The highest drying rate happen on the last day. Figure 5 showed that the drying rate of half stem was decreasing on the first day until the fourth day and then increasing until the eight day. On the tenth day the drying rate is decreasing. The highest drying rate happen on the first day. Figure 2 showed that drying rate of chili peppers with no stem on tenth day. And the result shown us on the first day until the fourth day the drying rate is increasing. Then, on the sixth day until the eight day is decreasing and on the last day the drying rate was increasing again.

As the result, the height of chili peppers in each treatment show the difference drying rate. On the first treatment, the drying rate decreasing on first day until sixth day but after that drying rate is increasing , but in the second, the drying rate was decreasing on zero day to fourth day before increasing each day. for the third treatment drying rate is increasing until fourth day and at day sixth dan eighth the drying rate is decreasing

Analytical result from our research that related with our all treatment on width parameters of the chili pepper presented on table 3.

Table 3. The changing of fruit width of chilli papers under three stem treatments during 10 days of exposure.

Days	FS (g)	HS (g)	NS (g)
0	0.766667	0.81	0.85
2	0.83	0.81	0.78
4	0.79	0.83	0.83
6	0.89	0.7	0.836
8	0.75	0.992	0.8
10	0.887	0.757	0.656

Table 3 shown the result of drying rate related with our all treatment on width parameters. and the graphic of drying rate is shown on the figure 7,8, and 9.

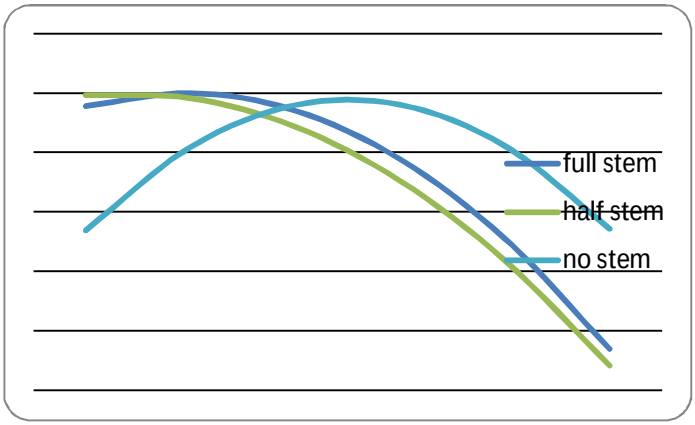

Figure 6. *Drying rate of width on chili peppers fruit under three stem treatments during 10 days of exposure*

Figure 6 showed that drying rate of chili peppers from the second day increasing until the last day. Although on the first day to the second day there only was a little decreasing. Figure 3 showed that drying rate was increase each day from the first day until the last day. And the highest drying rate happen on the last day of observation. Figure 3 showed that the lowest drying rate happen on the fourth until the sixth day. And on the first day until the fourth day there was decreased of drying rate but on the sixth day until the last day there was increasing drying rate.

CONCLUSIONS

Simple treatment of full fruit stem was demonstrated taking the longest time in keeping the fruit weight, i.e. 6,487996 days, followed with half fruit stem, i,e, 1,927447 days, and the treatment that fastest loosing the weight was without fruit stem, i.e. 1,861501 days. The full fruit-stem treatment also proved as the highest treatment in retaining druit weight. Up to critical time of losing weight, the treatment half fruit stem and without fruit stem respectively retaining only weight 38.14% and 36.69% compared to full fruit-stem. Where as when the comparisson was made

up to 10 days of storage, the retaining weight of half fruit stem and without fruit stem reatments only 93.90% and 89.52% respectively compared to full fruit-stem. The full fruit stem also proved the longest period in keeping the shape of the fruit, shown as the longest period in reducing the fruit height and width.

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EFFECTS OF DRIED AND FRESH JUICE RHIZOME OF JAVANESE TURMERIC (*Curcuma xanthorriza* Roxb.) ON THE QUALITY OF CHICKEN BROILER MEAT

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ABSTRACT

Rhizome of Javanese turmeric (*Curcuma xanthorrhiza* Roxb.) locally called as Temulawak has been known and used as Indonesia's herbal medicine. Traditionally the rhizome used as appetite increaser. Further research showed the rhyzome contains curcuminoid, xanthorrhizol, and some phenolic compounds which have some benefits for health such as increasing appetite, anti-oxidant, anti-cholesterol, cancer prevention and anti-microbes. The rhizome usually preserved in dried-form. This preservation technique however, is reducing some active compounds particularly those belong to phenolic. This studies aimed to find out the effect of dried and fresh rhizome on the quality of chicken meat. The meat quality was covering of blood pH, the concentration of glucose, lactose and triglyceride in the chicken blood, and the changing of pH after slaughtered. The studies were carried out by feeding ready to harvest chicken broiler with the dosage of 25cc and 50cc of fresh rhizome juice and of 10cc and 20cc of poured-dried rhizome, then the pH, glucose content, lactose content and triglyceride content of chicken's blood before harvest are observed, while the parameter of post-harvest observed is the pH of the chicken meat at the time when the chicken after slaugthered, 2 hours, 4 hours and 6 hours after slaughtered. The result shows that the use of 50cc fresh rhizome juice gives the best result of the meat quality considering the glucose, pH, lactose and triglyceride content in the blood, as well as the changing of meat pH after slaughtered.

Keywords : *Rhizome, Javanese turmeric, curcuminoid, xanthorrhizol, glucose, lactose, triglyceride, pH*

INTRODUCTION

Javanese turmeric, commonly called curcuma is classified as herbal plants that has been known and used as traditional medicine, coloring agent, and also food by Indonesian people (Paryanto & Srijanto, 2006). Rhizome is a part of curcuma, that used in food, beverage, or pharmaceutical industry. The chemical compounds used from curcuma's rhizome are starch,

curcuminoid, and volatile oil (Sidik *et al*, 1995). Starch is the main component in curcuma's rhizome. Starch is powdered form, yellowish white because it contains curcuminoid and easy to digest, so that it can be used as additive in baby's food, thickening agent for syrup, and as additive in bread making with purpose to reduce staleness (Herman & Atih Suryati, 1985). Curcuminoid is component of curcuma's rhizome that plays role as yellow dye, so that is common to use it as coloring agent in food industry. Curcuminoid can be classified in two groups; curcumin and demetoxycurcumin. Curcumin has colocenesis properties that useful to increase bile's production and secretion (Sinambela, 1985). Volatile oil commonly used as traditional medical, seasoning, cosmetic, and fragrance (Sidik *et al*, 1995). The other important component of curcuma is xanthorrhizol. Xanthorrhizol is a natural sesquiterpenoid that has been known to have anti-bacteria, anti-tumor and anti-metastatic activity (Min-Ah Choi, et al. 2005).

Overall, curcuma can be used as anti inflammatory, lipocholesterollemic, anti bacteria, anti fungal, diuretic, and anti tumor. The aim of this research is to compare the influence of dried rhizome against fresh rhizome according to chicken meat quality. The parameters used are blood pH, glucose level, lactose level, and tryglyceride level in pre harvest, and the parameter used in post harvest is the pH of chicken meat.

MATERIAL AND METHOD

One kg of fresh curcuma's rhizome was collected from Ungaran market and divided in two parts, 500 grams each. Both of them were peeled and sliced into small pieces. The first 500 grams of fresh rhizome were dried using oven for 24 hours at 60^{o}C. Then the dried rhizome were grinded using blender. The other 500 grams were extracted using juicer. Both the powder and the extract were brought to a poultry farm in Grabag and Secang, Magelang Regency. The chicken were not fed for about 3 hours before the treatment, after that they were treated with rhizome with different dosage. First, the dried rhizome were pured with boiled water until the concentration reach 10cc/liter and 20cc/liter while the extract were mixed with water till the concentration is 25cc/liter and 50cc/liter. Each concentration were given to 10 chicken rndomly chosen from chicken farms, and an hour after treatment the analyze of blood pH, the concentration of glucose, lactose and triglyceride in the chicken blood were conducted. After treatment, the chicken were slaughtered and the change of blood pH was measured at time 0, 2, 4, and 6 hours after slaughtered. Data were analyzed using one way anova. For the positive

control, the chicken were fed with a commercial herbal supplement named Vet-i while for the negative control the chickenen were fed with ordinary practices, and left untreated.

RESULTS AND DISCUSSION

Effect of Curcuma's Rhizome On Pre-Harvest

Some pre-harvest parameters inspected were blood pH, glucose level, lactose level, and tryglyseride. The data of those parameter are shown on Tables 1,2,3 and 4.

Table 1. Effect of Curcuma's Rhizome Treatment On Chicken's Blood pH

Treatment	Blood pH
Control	6,24 [a]
Dried 10cc/liter	6,29 [a]
Fresh 25cc/liter	6,31 [a]
Dried 20cc/liter	6,32 [ab]
Fresh 50cc/liter	6,36 [ab]
Vet-i	6,61 [b]

Note: Figures followed with a same letter indicates not significantly different at 95% degree of confident

Table 1. shows that there is no significance difference between the treatment using curcuma and control, but the table also shows that the treatment using 50cc/liter fresh curcuma leads to the higher pH compared to the treatment using dried and fresh curcuma at the concentration of 25cc/liter. This table also shows that the result of treatment using fresh curcuma at the concentration of 50cc/liter and poured hot water dried rgyzome at 20 cc/liter has no significance different compared to the positive control (Vet-i).

Table 2. Effect of Curcuma's Rhizome Treatment On Concentration of Glucose

Treatment	Concentration of glucose (mM)
Veti	10,804 [a]
Fresh 50 cc/liter	11,516 [ab]
Fresh 25 cc/liter	12,229 [bc]
Dried 20 cc/liter	12,304 [bc]
Dried 10 cc/liter	12,978 [c]
Control	14,582 [d]

Note: Figures followed with a same letter indicates not significantly different at 95% degree of confident

Table 2. Shows that the treatment using 50cc/liter of fresh curcuma leads to the lower concentration of glucose while the lowest concentration of glucose is the result of treatment using Vet-i (positive control), it also shows that the treatment using 50cc/liter of fresh curcuma leads to the most significance difference between the negative control.

Table 3. Effect of Curcuma's Rhizome Treatment On Lactose Concentration in the Blood

Treatment	Blood Lactose (nM)
Vet-i	5,614 [a]
Fresh 50cc/liter	6,209 [ab]
Dried 20cc/liter	6,309 [ab]
Fresh 25cc/liter	6,359 [b]
Dried 10cc/liter	6,511 [b]
Control	6,634 [b]

Note: Figures followed with a same letter indicates not significantly different at 95% degree of confident

Table 3. Shows that the use of fresh curcuma (50 cc/liter) leads to the lower lactose level, while the use of Vet-i (positive control) are the best. Fresh curcuma treatment 50 cc/liter has no significance difference with control. But that table also shows us that fresh curcuma 50 cc/liter has no significance difference with Vet-i.

Table 4. Effect of Curcuma's Rhizome Treatment On Triglyceride Concentration in Blood

Treatment	Triglyceride Concentration (mg/dL)
Vet-i	67,413 [a]
Fresh 50cc/liter	73,289 [b]
Dried 20cc/liter	75,105 [c]
Fresh 25cc/liter	75,810 [c]
Dried 10cc/liter	79,081 [d]
Control	84,229 [e]

Note: Figures followed with a same letter indicates not significantly different at 95% degree of confident

Table 4. Shows that the treatment of 50 cc/liter fresh curcuma still gave the good impact to trygliceride level. It shows the low level of triglyceride, compared to others except positive control (Vet-i). Fresh curcuma of 50 cc/liter treatment shows significance difference with others, and showed resulted in the lowest triglyceride concentration n the chicken blood compared to the other treatments, even though the concentration was still

significantly higher than the positive control.

Effect of Curcuma's Rhizome On Post-Harvest

The post harvest parameters observed were the changing of blood pH at the time of 0, 2, 4, and 6 hours after slaughtered. The result of this parameter can be seen on the Figure 1.

Figure 1. The Changing of Blood pH After Slaughtering

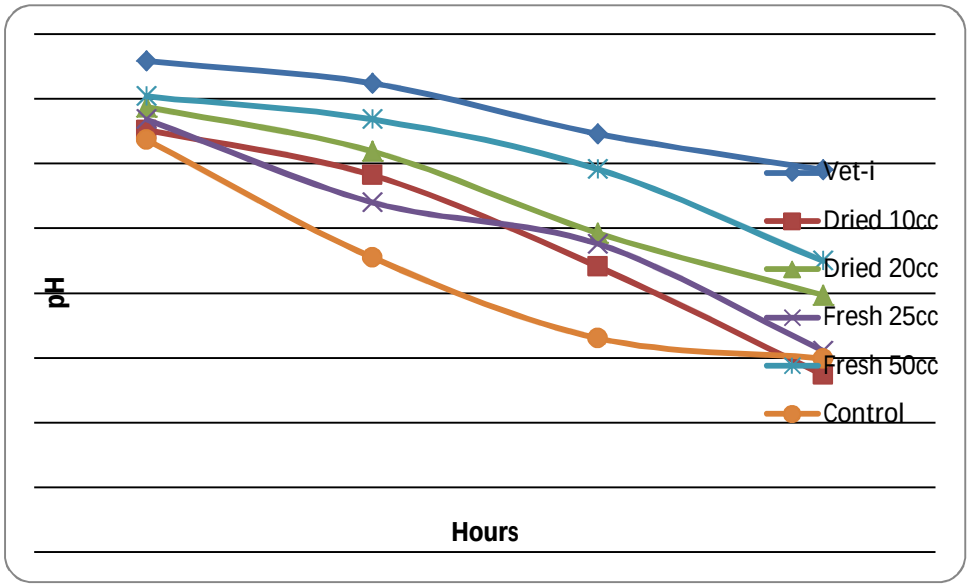

Figure 1. shows that the treatment od 50cc/liter of fresh curcuma at the time 0 give the highest pH compared to the other treatment using curcuma. This figure also shows that the rate of pH decrease was not significant at 2 and 4 hours after slaughtering while at 6 hours after slaughtering the chicken.

The change in pH was the result of glycogen that converted into lactic acid; the higher concentration of glycogen, the more lactic acid produced. Besides, the rate of this convertion can be accelerated by microbiological activities. It was suggested that the glycogen itself was derived from the glucose.

The slowest pH decrease can occurs due to the antibacteria properties of curcuma. This properties could prevent the microorganism's activities that could fasten the lactic acid formation. From the Figure 1. it can be seen that curcuma treatment significantly inhibit the decrease of chicken pH at post slaughter. Amongst the

treatments applied, fresh curcuma treatment with 50 cc/liter concentration showed the lowest rate in the declining of meat pH after slaughter.

The result above shows that the fresh extract of curcuma give more significant benefit than when it is used in the dried form. As it have known, curcuma contain 2 changed especially the volatile oil that will be evaporated during drying. This is the possibility that differ the effect of dried and fresh curcuma treatment.

The normal pH of chicken broiler meat is about 5,96 till 6,07, the higher pH the lower lactic acid content of the chicken meat itself (Prayitno, A.H., *et al*. 2010). The number of pH is depend on the glucose concentration. In the muscle, the glucose content is converted into glycogen, and the glycogen itself is the basic material that will converted into lactic acid, so the higher glucose content, the lower pH will be.

Lactose compare to other treatment fresh curcuma (50 cc/liter) leads to the lower lactose level. It is interesting to find out the meaning of fresh curcuma (50 cc/liter) roles that there's no significance difference with Vet-i (positive control) but there's no significance difference too, with control.

major active compound, they are curcuminoid and xanthorrhizol. Curcuminoid is a phenolic substances while xanthorrhizol is a sesquiterpenoid, certainly these active compound has different characterisics. When the curcuma's rhizome is dried using a high temperature, some of its component will be

When the lipid level is high, the pH will be low, due to the negative correlation. This leads to the increase of acidity. Liang *et al* (1985) said that curcumin could decrease lipid level inside body, help the secretion of bile and pancreas, that released by faeces.

According to Prayitno *et al* (2010), pH is one of the important factors affecting the quality of chicken. The normal level of chicken's pH are 5,96 to 6,07. While in the research, it is found out that the use of fresh curcuma in 50 cc/liter concentration could reduce the acidity from 6,60 become 6,10. It shows that the use of 50 cc/liter fresh curcuma was effective.

Cahyono *et al* (2011) said that the dried curcuma results in the more quantity than fresh curcuma. But from the research we've done, drying could reduce the curcuminoid content. It is showed from the color of curcuma. The color turns more pale, and curcuminoid indicates the yellow color of fresh curcuma.

Kiswanto (2008) said that the higher temperature, the lower volatile oil contents will be. It is due to the volatile properties of curcuma. In our research, drying is not better from fresh curcuma. It is showed from the effect or fresh curcuma (50 cc/ lliter) towards pH, glucose, and trygliceride levels. There are 2 possibilities that make the treatment using curcuma can increse the quality of chickrn meat, first, the curcumin content of curcuma that can elevate the pH, second the xanthorrhizol does. For certainty it needs more detail investigation.

CONCLUSION

The treatment using fresh curcuma at the concentration of 50cc/liter give the best result of the meat quality considering the lower concentration of glucose, higher pH, lower lactose and lower triglyceride content in the blood, also the slow decrease of meat pH after slaughtered. It could be suspected because of curcuminoid and xanthorrhizol activity which can be used as immunomodulation that could increase chicken's quality. But the certainty about the statement needs more detail investigation.

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EFFECTS OF HEAT PROCESSING AND TEXTURAL ANALYSIS METHOD TOWARDS BRASSICA VEGETABLES TEXTURE

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ABSTRACT

Brassica vegetables, such as broccoli, choy sum, and Chinesecabbage, are among the most popular vegetables, which are commonly consumed after being processed. Processing can change the physicochemical and functional properties of the vegetables; one of it is texture. Heat processing apparently is a dominant factor that influencing the changes of the vegetables' texture. However, the objective measurement method of these vegetables' texture may vary one from another since there is no standard method that can be applied to all. Therefore, this paper aims to reviews the effects of processing involving heat on the textural properties of Brassica vegetables and the effect of different objective measurement method on the hardness levels of the fresh and processed Brassica vegetables.Textural propertiesof fresh and boiled broccoli, choy sum, and Chinese cabbage were objectively analyzed by a texture analyzerwith using 2 different probes (V blade and square blade). Results show that longer time and higher temperature of the processing soften the texture more severely. There is atendencies that the softer the samples, the greater the range of hardness levels. The result from using V blade probe is showing more clear trendline than the result from using square blade. Therefore, there are many things need to be consider in measuring the texture of Brassica vegetables since there is no universal method that can be applicable to all.

Keywords: *Brassica vegetable, hardness, texture analyzer*

INTRODUCTION

Many Brassicavegetablesare widely recognized for their contribution to human nutrition and for other health benefits. Some studies have indicated that afrequent intake of Brassica vegetables, such as broccoli,cauliflower, leaf mustard, cabbage, Chinese broccoli,and turnip, can protect against cancer(Lin & Chang, 2005).In Indonesia, Brassica vegetables are very potentials because of their high daily consumption and production rate compared to other vegetables.

Brassica vegetables, just like other vegetables, are commonlyconsumed after being processed, e.g. by boiling, stir-frying and steaming.It is known that these processing can change the physicochemical and functional properties of the vegetables.

One of the changes from this processing is texture.

Texture is considered veryimportant parameters in the cooking quality of vegetables, andthey may strongly influence consumer purchases of these fooditems.Heat processing apparently is a dominant factor that influencing the changes of the vegetables' texture. Previous studies show that the combination of time and temperature during processing affects the hardness of the vegetables. Longer time and higher temperature of the processing soften the texture more severely (Yovendi, 2011; Prasatya, 2011; Jayanti, 2011). However, the objective measurement method of these vegetables' texture may vary one from another since there is no standard method that can be applied to all. Therefore, this paper aims to reviews the effects of processing involving heat on the textural properties of Brassica vegetables and the effect of differentobjective measurement method on the hardness levels of the fresh and processed Brassica vegetables.

MATERIALS AND METHODS

A review was done from several scientific studies on Brassica vegetables texture. The result from the review then was analyzed to generate a hypothesis of heat treatment and textural measurement method effect towards Brassica texture.

A small experiment was conducted to support the hypothesis from review result. The research was done by measuring the texture of broccoli, choy sum, and Chinese cabbage as a representative for Brassica vegetable. For broccoli, the main stem is cut into dice (1 cm x 1 cm x 1 cm). For choy sum, ± 4 cm of stem (from near root part to middle part) was used. For the Chinesecabbage, the stem was cut into 4 cm x 3 cm x 0.5 cm.

Heat Proccessing

Brassica vegetables wasboiled with modete flame for 0 min, 1 min, 5 min, 10 min, and 15 min. The water : vegetables ratio is 5: 1 and the water is heated until boiled first (96-98°C) before usage. After the boiling, samples were immediately cooled toambient temperature in an ice-water bath.

Texture Analysis

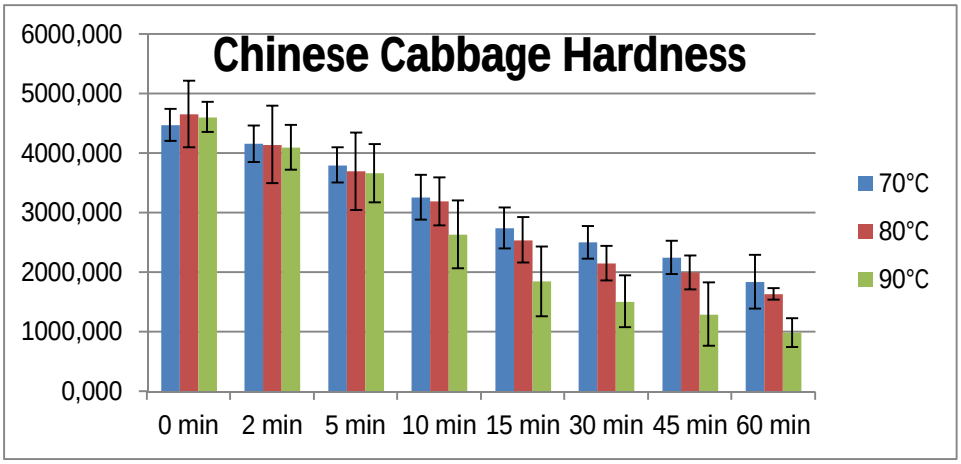
The texture of the vegetables was measure with Lloyd Texture Analyzer equipped with a 1 KN load cell. Single hardness test was done by using Warner Bratzler Shear Blade Square Cut and Warner Bratzler Shear V Blade. For broccoli, sample was measure with depression limit 30 mm, test speed 5 mm/s, trigger 30gf. For choy sum, sample was measure with depression limit 10 mm, test speed 5 mm/s, trigger 20 gf.For square blade, Chinese cabbage was measure with depression limit 7 mm, test speed 5 mm/s, trigger 35gf.For V blade, Chinese cabbage

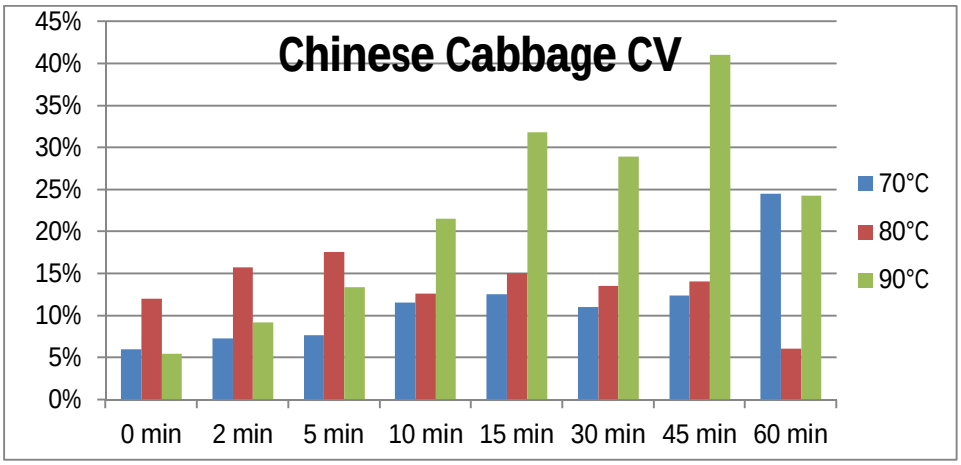
was measure with depression limit 25 mm, test speed 5 mm/s, trigger 35 gf.

RESULT AND DISCUSSION

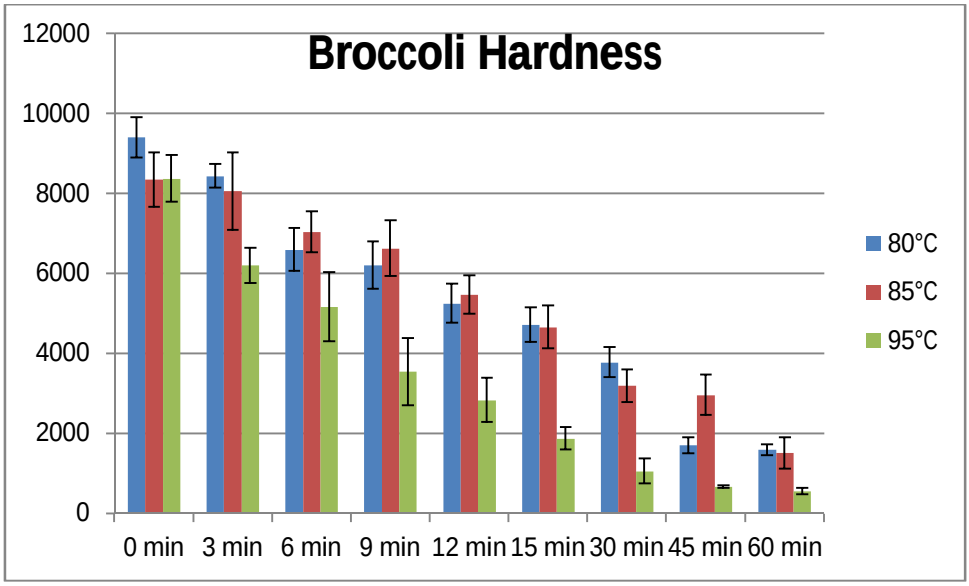
In the previous studies, the measurement method for Brassica texture mostly was conducted with usingsquare blade.The load cell use were 1 KN and different setting (depression limit, test speed, trigger, etc)is applyfor each vegetables. Even sometimes, different setting is apply for the same type of vegetables.

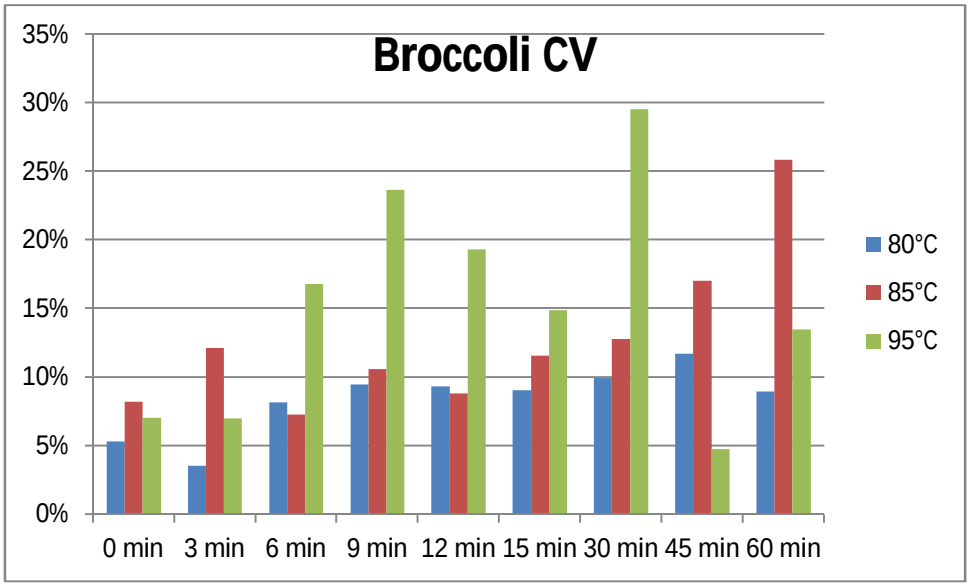
Some of thehardness result from the previous studies on Brassica texture can be seen in graph 1 until graph 3.The graph showed that longer time and higher temperature of the processing soften the texture of the vegetable more severely.Generally, thistexture softening can be ascribed to a combination of two factors. Initially, a rapid loss of hardness takes place due to membrane damage and the associated loss in turgor pressure. Furthermore, an important additional decrease in texture results fromthe depolymerisation and solubilisation of pectic polymers involved in cell–cell adhesion (Christiaens*et al*, 2011).There is also a tendency that as the sample got softer, the greater the range of hardness levels (shown in coefficient of variation graph). This means that the textural analysis method used in the previous studies can be consider as not very accurateornot suitable for measuring Brassica vegetables that was given a heat treatment.



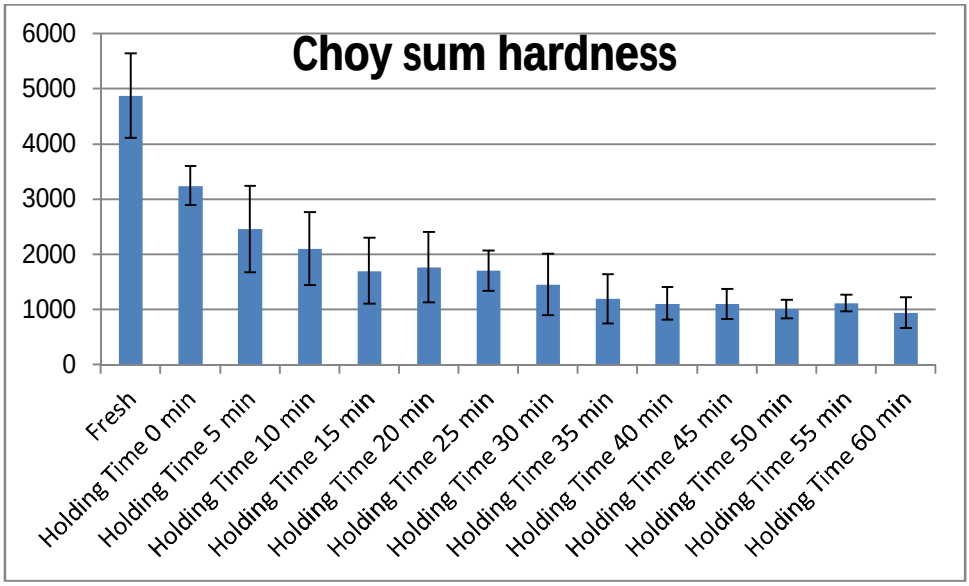


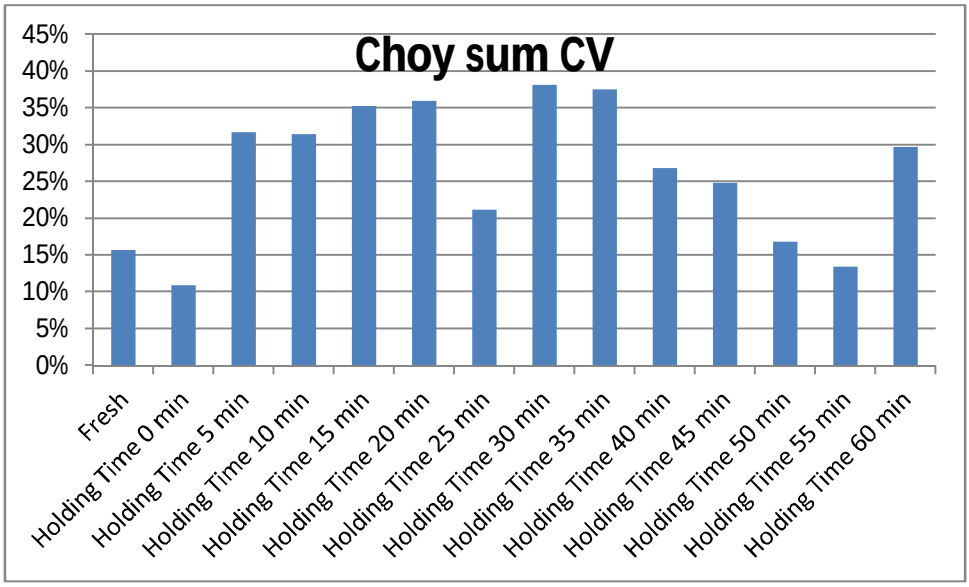
Graph 1. Chinese cabbage hardness and coefficient of variation (CV) (Jayanti, 2011)





Graph 2. Broccoli hardness and coefficient of variation (CV) (Prasatya, 2011)

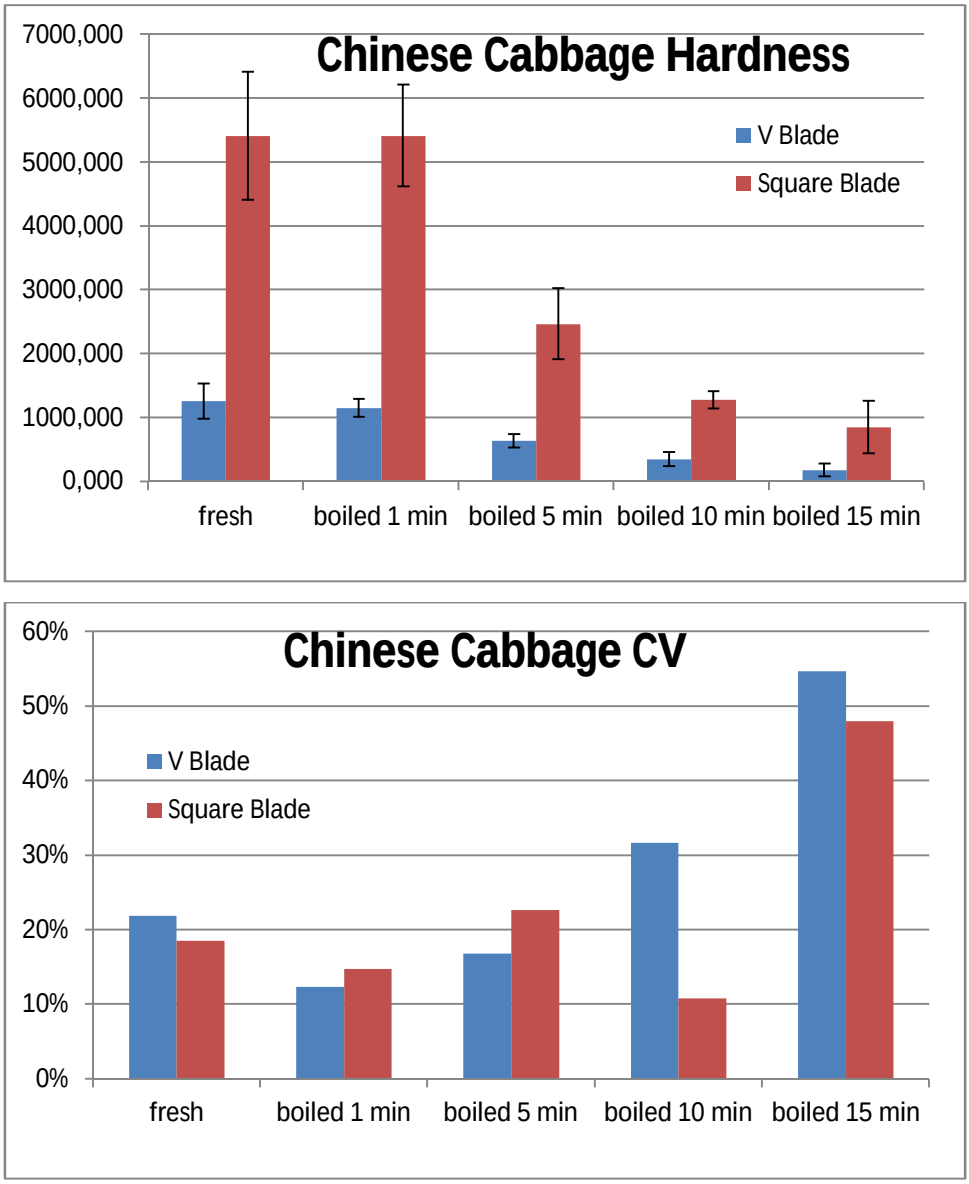




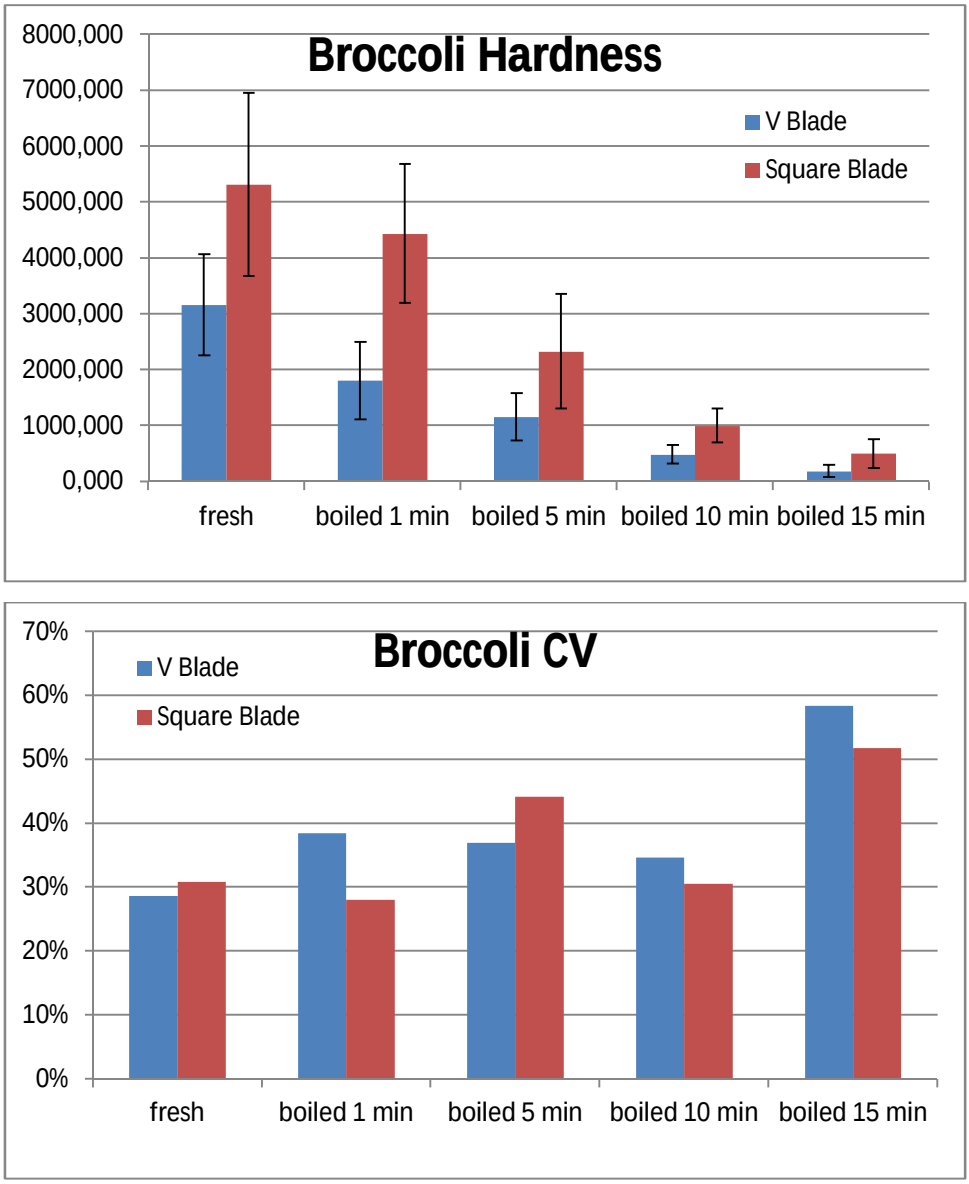
Graph 3. Choy sum hardness and coefficient of variation (CV) (Yovendi, 2011)

To support the findingfrom the review before, a simple experiment was conducted.Broccoli, choy sum, and chinese cabbage were chosen as the representative of each type of Brassica. These vegetables was process with boiling treatment. Boiling treatment was chosen as processing method for the vegetable since it makes the texture softer compare to steaming and frying (Miglio et al, 2008). Hence the experimental result will be able to used in proofing the tendency of greater CV in softer texture.

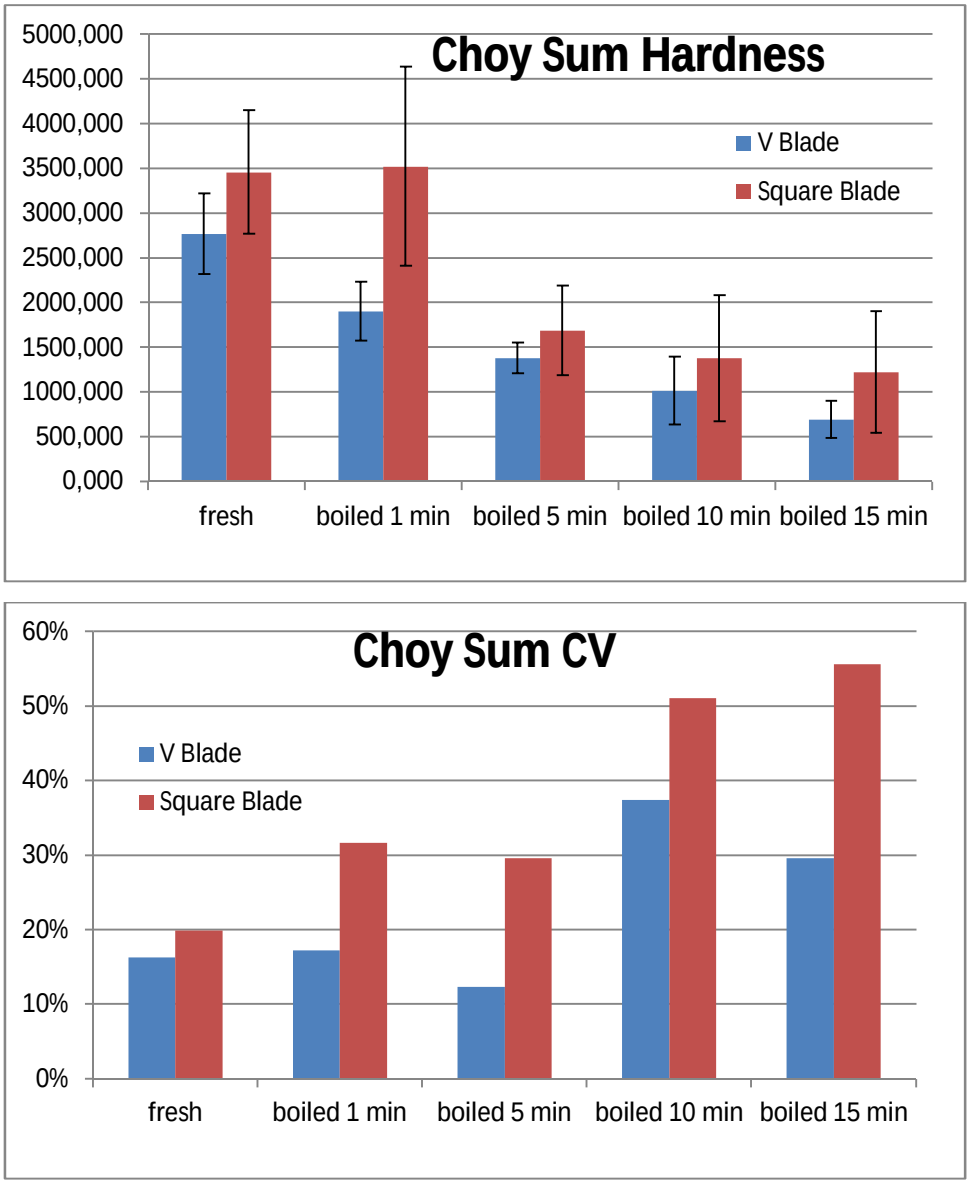
The experiment result was shown in graph 4 until graph 6. The experiment is giving the same result as the review result. The heat processing is making the texture of Brassica become softer. The longer the time of processing then the texture will become more softer. In the experiment, the same tendency also occur, in which the greater the range of hardness levels (shown in coefficient of variation graph) is found in the softer texture. The higher range of hardness level occur as the result of using 1 KN load cell(which is equivalent to 100 kg). Since the force of load cell used to cut sample is extrimely large therefore it become less sensitive as the sample goes softer.



Graph 4. Chinese cabbage hardness and coefficient of variation (CV)



Graph 5. Broccoli hardness and coefficient of variation (CV)



Graph 6. Choy sum hardness and coefficient of variation (CV)

From this experiment, 2 type of probe is used. For the same sample, the hardness result from square blade probe is much higher than the result from V blade. For all 3 vegetables, the texture analysis result with V blade is showing more clear trendline than the square blade result. It means that the V blade probe is more suitable to measure the Brassica vegetables texture.

CONCLUSIONS

Heat processing was known toinfluence the texture of Brassica vegetables.Longer time and higher temperature will soften the texture.There are no universal method that can be applied to measure texture ofBrassica vegetables. Therefore, there are many things need to be consider in measuring the texture of Brassica vegetables such as the probe and

the load cell used, the setting of measurement, and the dimetion of the sample. This consideration was needed in order to get more accurate and precise data.

During this experiment, texture profile analysis with the same setting as stated in above was also perfomed for the samples. However the result cannot be obtained since the sample was already cut in the first bite. Therefore this matter can be investigate more in the next experiment.

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ASIA HERBAL: APPLICATION AND THEIR FUTURE DEVELOPMENT ON FUNCTIONAL FOOD PRODUCT

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ABSTRACT

Herbs and spices reserve a greatest potential and diversity of its functional properties. Along with trends to increase local knowledge and functional properties about herbs and spices, many applications have been intensively held to make food herbal products and the biggest application lies in Asia. Herbs and spices can be divided into six main parts such as rhizome or roots, leaves, stems, flowers, flower petals, fruits, and seeds. Functional properties in these part can act as flavor compound for example seed from nutmeg contain myristicin, antioxidant from rhizome part of turmeric, antimicrobial from rose petal of *Rosa indica* L; and health enchancing for example eugenol in cinnamon stem. This article will review six main parts of herbs and spices about functional properties and the application of food herbal products also review about future development of herbs and spices in food industry.

Keywords: *herbs, spices, functional properties, food herbal*

INTRODUCTION

In the terms of functional food, herbs and spices could be regarded as real "functional food" terms because of its properties. For example, polyacetylenes content in celery leaves can reduce the formation of tumor also cuminaldehyde in cumin as flavor enchancer (Man, 2011).

With the increasing demand of healthy foods and great diversity of herbs and spices, the utilization of herbs and spices in food have been intensively held. For example, the manufacture of ginger ice cream can contribute to reduce fats in ice cream and improve melting resistances in ice cream with the addition of 4% ginger (Pinto *et al*., 2005).

Moreover, many parts of herbs and spices also provide many functional properties from roots, leaves, stems, flowers, flower petals, fruits, and seeds. For example, bay leaves or *Laurus nobilis* L. have flavouring properties

from its oil as medicine for rheumatism, gout, and the treatment of liver disease (Peter, 2001). According Sakagami *et al*., (2012) Another part of herbs like rose petals have a hydrolysable tannin called tellimagrandin which useful to reduce oxaocilin content of MRSA strains or multidrug - resistant *Staphylococcus aureus* through evolution process.

With so many diversity in herbs and spices, this article will review the functional properties in each part from roots, leaves, stems, flowers, flower petals, fruits, and seeds. Also the utilization of each part into healthy food with their future development.

RHIZOME FUNCTIONAL PART

A. ***Alpinia galangal***

According Abdurahman, (2006) rhizome a stem of a plant that is usually found underground. The role of its functional content in rhizome is very large, for example *Alpinia galangal* or *Laungas galangal* have antimicrobial properties against *Staphylococcus aureus*.

According Jirawan *et al*., (2006), one of monoterpenes in the essential oil from fresh galangal rhizomes is terpinen-4-ol. This functional substances effective against many microorganisms such as *Escherichia coli* and *Staphylococcus aureus*. The preparation of antimicrobial agent start by preparing a solution of ethanol 100% and extracting spices such as galangal, krachai, ginger, turmeric in one night. After preparation, the extract were tested against *Escherichia coli* and *Staphylococcus aureus*. The result show that *Staphylococcus aureus* is more sensitive on the extract than *Escherichia coli* and galangal ethanol extract show the biggest inhibition from ginger, turmeric, and krachai.

B. ***Acorus calamus* L.**

Not only galangal, other rhizome like *Acorus calamus* L. which have many effect like antiseptic, diuretic, antiphlogistic, anti-inflammatory, anti-tumor, also have antimicrobial activities. According Gyawali, (2009) many functional substances found after using GC-MS analysis such as 3-Methylbutanal, Ethanol, 2-Pentanone, Methyl 2, methylbutyrate, α-Pinene, Camphene, and Hexanal. With this many functional substances, a potential utilization of rhizome part can be used to make Tom-Kha from Thailand.

Tom-Kha is sixth most-order of top ten Thai foods and become popular because of its mild taste, sweetness and good flavor. Main ingredient in galangal coconut-milk soup are galangal rhizome, lemon grass, kaffir lime leaves and chili. According Pengseng *et al*., (2011), galangal coconut-milk soup mostly have its functional effect from the spices and the addition of

carbohydrates in Tom-Kha can increase the antioxidant activity by adding 5% glucose and sucrose with ratio 5:1 to 15:1.

ROOT AND STEM FUNCTIONAL PART

A. Root Functional Part

Armoracia rusticana or horseradish is a perennial crop belonging to the genus *Armoracia* of the *Cruciferae* famiily. According Jiang *et al*., (2006), horseradish have an unique characteristics with its high pungent odor when horseradish is cutting, grating, or contact with water. High content of pungent odor is released by thioglucosi-des (TGOs) with enzymatic process. Besides TGO, another main pungent odour are allyl isothiocyanate (ITC) and β-phenylethyl ITC.

Another functional component of horseradish is glucosinolates. Glucosinolates are plant secondary metabolites found exclusively high in dicotyledonous plants or *Brassicaceae* family. One of analysis about glucosinolates was carried out by Daniela *et* al., (2006), the analysis was carried out on Myrosinase or thioglucoside glucohydrolase which responsible for the hydrolysis of glucosinalates on horseradish. The result show the activity of this enzyme mostly affected by temperature about 55^{o}C to hydrolize glucosinolates into isothiocyanates, nitriles, thiocyanates, indoles and oxazolidinethiones.

With this characteristic, horseradish mainly used in meat products. According Istrati *et al.,* (2011), horseradish mainly used in storage or marination of meat products. Marination is a process of soaking foods in a seasoned, often acidic, liquid before cooking. Marination methods have many advantages such as prolong meat shelf life, enhancing flavor, act as antimicrobe activity against mesophilic aerobic bacteria, lactic acid bacteria, and reduce lipid oxidation in meat.

B. Stem Functional Part

According Peter, (2001), cinnamon spice is obtained by drying the central part of the bark and the final product usually powder. Among people, there is a lot of confusion between cinnamon and cessia about its difference. In the market, cessia is thick, hard, and has a flavour that extremely bitter while cinnamon is brittle and less bitter.

The main compound which have sweet taste in cinnamon is cinnamaldehyde. It is reported that cinnamaldehyde have many uses in food industry such as inhibit browning reaction in cut lettuce. According Fujita *et al*., (2006), cinnamaldehyde or trans-cinnamaldehyde were exposed by phenylalanine phenylalanine ammonia-Lyase which responsible for browning reaction during cold storage. The result show about 7,5 ug/ml trans-cinnamaldehyde inhibit PAL

about 91,6% and can inhibit browning reaction for 6 days in cold storage.

LEAVES. FRUIT, AND SEED FUNCTIONAL PART

A. Leaves Functional Part

Basilici herba or basil leaves is one of the most frequently used culinary and pharmacological raw materials, containing a significant amount of biological components with strong healing properties. Healing properties of basil herb such as *polyphenolic flavonoids* like orientin and vicenin which act as antioxidant, essential oils such as *eugenol, citronellol, linalool, citral, limonene* and *terpineol*, and natural pigment of Zeaxanthin (Dzida, 2010; Mangajji, 2012).

The preparation and serving method of basil leaves is very wide. It has been reported that basil leaves are used to flavor any vegetable, poultry, or meat dish. Not only flavoring, basil leaves also used in Italian panzanella salad, fruit salad, become one the main ingredients in *pesto*, a green sauce that is added to soups in Mediterranean cooking (Mangajji, 2012)

B. Fruits Functional Part

According Akdogan *et al*., (2012), the aromatic compound from fruit and oil of the *Juniperus communis* has been used in herbal treatment for a long time. Chemical composition from the fruit have more than 100 functional substances, such as 30% sugar, monoterpene derivatives like alpha and beta, mirsene, limonene, sabinene and terpinine-4-ol.

In recent years, the functional activities of *Juniperus communis* fruit has has been revealed that *Juniperus communis* fruit extract has antiherpetic, antimicrobial, antifungal, and anti-hypercholesterolemic. The role of anti-hypercholesterolemic effect is very useful to counter coronary heart disease (CAD).

It is known that *Juniperus communis* oil from the fruit effective against hypercholesterolemy in 50, 100 and 200 mg/kg doses. The result show a significant decreased of *Low Density Lipoprotein* about 26±7 for 50 mg/kg doses, 25±5 for 100 mg.kg doses and 19±3 for 200 mg/kg doses compared by Chol. group containing 2% cholesterol.

C. Seed Functional Part

Nigella sativa Linn seed or known as black cumin has been used for folk medicine in centuries because of its advantages as an antioxidant with diuretic, choloretic, digestant, anti-cholestrolemic, anti-inflammatory and antiasthmatic action (Ghada *et al*., 2006; Lotfy and Jayed, 2009).
According Ali and Blunden, (2003) black cumin contain both fixed and essential oils,

proteins, alkaloids and saponin. For example, the major component of thymoquinone which act as antioxidant and anticancer. The anticancer activity of black cumin has been reported by Chehl et al. (2009) by extracting the seed into oil extract and tested in PDA (pancreatic ductal adenocarcinoma) cells. The result show that thymoquinone induce apoptosis and inhibit proliferation of PDA cells.

FLOWER PETALS FUNCTIONAL PART

According Yassa *et al*., (2009) that *Rosa damascena* Mill. (*Rosaceae*) is a small plant with aromatic, light pink flower which appears in spring. Moreover, this flower have many advantages as cooling, soothing, astringent, and anti-inflammatory effects. For example, anthocyanin with glycosides, flavonols, cyanidin in *Rosa damascena* have been identified to act as antioxidant activity.

The result show that antioxidant activity of *Rosa damascena* have the highest antioxidant activity about 520 ± 9.68 compared by vitamin E about 20.98 ± 2.98 and BHA about 153.9 ± 7.24 using FTC method.

FUTURE DEVELOPMENT

From centuries, the utilization of herbs and spices only for folk medicines. According Verma and Singh, (2008) about 80 % of people in developing countries still relays on traditional medicine based largely on species of plants and animals for their primary health care. Lately, the demand of herbs increasing more and more due to toxicity and side effects of allopathic medicines. It is known that India have 20,000 medicinal plant species with more than 500 traditional communities use about 800 plant species for curing different diseases. This indicate that development of herbs and spices is very impressive when discuss about human's health.

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THE GASTRONOMICAL ASPECT OF GINGER UNDER JAVANESE CULTURE

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ABSTRACT

Ginger (*Zingiber officinale*) is a kind of spice which can be found throughout Indonesian territory. In Javanese culture, ginger is used as spices and as traditional medicine. People believe that ginger can recover strep throat, fever, interior cavity disruption and also increase appetite. Ginger contain many flavonoid and phenolic compounds such as gingerol, shogaol, and zingeron that compose oleoresin in ginger which give spiced flavor and have antioxidant activity. Gingerol is majority active compound in ginger which is stable at 37^0C and pH 4, but the structure will change if it is heated until 200^0C. The availability of these compounds will increase by increasing the planting-age of ginger. Total flavonoids and phenolics in ginger leaves are 7.05 ± 7.4 and 39.1 ± 9.2 respectively, in the stems are 1.77 ± 0.75 and 8.5 ± 0.81 respectively, and in the rhizomes are 4.21 ± 0.98 and 13.5 ± 2.26 respectively. Other studies also documented that some active compounds were also found in the peel. Gingerol and shogaol can be found mostly in the under of epidermic tissue of ginger rhizome. In Indonesia, there are many ways to process ginger like brewing, boiling, grilling, shredding, extracting and crushing. Therefore, gastrologically, these three parts of ginger plants can also be utilized under various way of cookings. However, gastronomically people prefer to utilize the ginger rhizome for any kinds of purposes instead of the leaves, root, peel or the other parts of the plant, and let these parts wasted. This paper reviewing the gastronomical perspective in ginger processing technology in respects with the people habitual status of ginger utilization.

Keywords: *gastronomy, ginger, Gingerol, way to serve, other part, rhizome, leaf*

INTRODUCTION

Ginger (*Zingiber officinale*) is a medical plant from *Zingiberaceae* family which is mostly using the rhizomes. Ginger comes from the Asia Pacific and nowadays, ginger is extensively cultivated from Asia to Africa and the Caribbean. Under Javanesse culture ginger is not only used as herbal remedy for ailments triggered by cold, damp weather but also can be use as cooking spice, flavoring agent and condiment (Kemper, 1999).

Ginger has various bioactive compound such as oleoresin (Deganhi *et al*., 2011) groups of phenolics, flavonoids, terpenoids,

and essential oil. These compounds distribute in all parts of ginger plant and have functional properties. Oloeresin and essential oil contribute to pungent flavor of Based on the gastrology aspect, all part of ginger plant can be consumed but under the javanese culture, people more prefer to consume the rhizome than the other part. Beside that, the processing play role in the product acceptance. This paper discuss about the gastronomical aspect of ginger, its part consumption and also the utilization.

METHODOLOGY

In the previous chapter, we exposed the context of the problem. The aim of this chapter is to describe and to justify the methodology to gather, to organize and to interpret the necessary information in order to develop step by step a strategic plan.

Research Problem and Objective of Investigation

The investigation needed to collect the data and analyze the gastronomical aspect of ginger under Javanese culture and explore the phenolic and flavonoid content of the other part of ginger. Quantitavie information from several data could be the consideration of author for making conclusion and to make analysis about new creation of ginger product. It should provide the whole material that suitable for the problem and giving the comprehensive review.

ginger (Sa-Nguanpuag *et al*., 2011). Oleoresin composed from gingerol, shogaol, zingeron and others (Tejasari *et al*., __).

Type of Research

There are many different kinds of research described in some literature that can be chosen for realize and investigation object. In this paper, the author used some technic for reviewing such as finding information about survey through internet, based on the study from the research in scientific journal and analysis both of first and second reviewing technic. Then the author conclude the processing way and synthesis the other possible way of cooking practice to achieve the aim of our research.

RESULTS AND DISCUSSION

Ginger Benefit and The Utilization Under Javanese Culture

Beside of having delicious flavor and aroma, ginger also a traditional medicine. Under Javanesse culture, ginger is usually used as body warmers, relieve cough, dizziness, improve digestion, increasing appetite, reducing nausea because oleoresin from ginger can stimulated mucous membrane of the stomach and intestine. Moreover can be use as spice seasoning with use a cut of the rhizome and cooking together with the food

to get the juice of ginger so that the dish can be more flavors (Yuliani *et al*., 2009).

Bioactive Compound of Ginger Plant

The bioactive compound in ginger which have functional properties are secondary metabolic compounds such as oleoresin (Deganhi *et al*., 2011), groups of phenolics, flavonoids, terpenoids, and essential oil. Gingerol, shogaol, and zingeron compose oleoresin in ginger which give spiced flavor and have antioxidant activity (Sa-Nguanpuag *et al*., 2011). These compounds have higher antioxidant activity than α-tokoferol. The antioxidant activity of these compounds is due to present of many hydroxyl groups in these structures (Tejasari *et al*., __). The antioxidant activity plays role in numerous chronic diseases such as coronary heart disease and cancer. Flavonoids are included into family of polyphenolic compounds (Ghasemzadeh *et al*., 2010a). Poyphenolic compounds have antioxidant activity due to their redox properties that neutralizing free radical (Ghasemzadeh *et al*., 2010b). Flavonoids have many functional properties such as blood glucose and lipid reducing, immune system modulating (Ghasemzadeh *et al*., 2010a), and free radical scavenging (Ghasemzadeh & Neda, 2011a).

Major compounds that compose flavonoids in ginger are rutin, quercetin, catecin, epicatecin, and naringenin. These flavonoid compounds accumulate in ginger leaves up to rhizomes. In ginger leaves, quercetin is found in highest concentration compared with another compounds (Ghasemzadeh *et al*., 2010c). Quercetin also can be found in stems of ginger. The concentration of quercetin in ginger stem is lower than in ginger leaves and rhizomes (Ghasemzadeh *et al*., 2010a). It has anticancer activities and can inhibit growth of cancer cell (Ghasemzadeh *et al*., 2010b).

In comparison with in the leaves, ginger rhizomes contained highly concentration of rutin. Catecin and epicatecin are also included as family of flavonoids that can be found in ginger. Both of them are found highly concentration in ginger leaves than in rhizomes. Catecin and epicatecin are secondary metabolic of ginger that have antioxidant activity. Naringenin is also bioactive compound that has health benefit to human body. It play role as antioxidant, free radical scavenger, anti-inflammatory, carbohydrate metabolism promoter, and immune system modulator. This compound is found highly concentration in ginger leaves than rhizomes (Ghasemzadeh *et al*., 2010c). Flavonoids concentration in leaves is higher than in rhizome and stems and also has highest antioxidant activity than in anothers parts of ginger (Ghasemzadeh *et al*., 2010a).

Another flavonoid compounds are apigenin, luteolin, and myricetin that found even higher in ginger leaves rather than in rhizome. Apigenin is also component of isoflavonoids that has anti-inflammatory, anti-carcinogenic and strong antioxidant activity. Luteloin is component of isoflavonols group that has anticancer activity. Myricetin is belonging to group of flavonols that also has functional properties such as anticancer and antioxidant activities (Ghasemzadeh & Neda, 2011a).

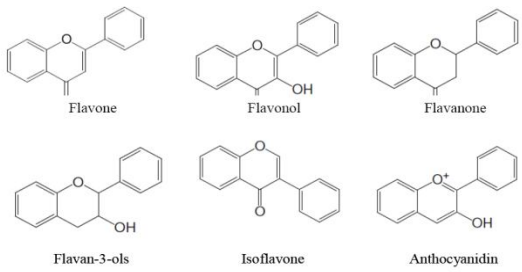

Figure 9. Structure of Some Phenolic Acid (Ghasemzadeh *et al*., 2010b)

Phenolic compounds in ginger include gallic acids, also have functional properties as well as flavonoids. Gallic acids found highly concentration in ginger leaves followed by rhizomes and stems (Ghasemzadeh *et al*., 2010a). Gallic acid has beneficial effect for human body such as scavenging free radical. Anothers phenolic compounds especially phenolic acids are vanillic acid, ferulic acid, tannic acid, and caffeic acid. These components are also found highly in ginger leaves compared with ginger rhizomes (Ghasemzadeh & Neda, 2011a).

Phenolic acid is also secondary metabolic that have various group includes hydroxybenzoic and hydroxycinnamic acids. In food plants, this compounds are founds in form of glycosides or esters combined with other natural compounds such as sterols, alcohol, glucosides, and hydroxyfatty acids (Ghasemzadeh & Neda, 2011b).

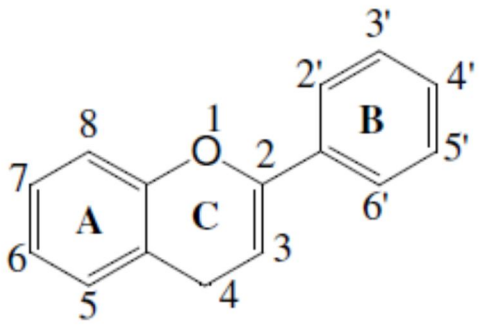

Figure 10. Phenol Structure (Ghasemzadeh & Neda, 2011b)

Gingerol is majority active compound in ginger. 6-gingerol is majority unsure that compose gingerol. This compound is heat stable compound. The antioxidant activity remains two-three after heat processing until 100^0C. But the highest stability of this compound is at 37^0C and pH 4. Its structure will change if it is heated until 200^0C. Degradation of this compound form aliphatic aldehyde such as zingeron. Degradation of gingerol due to dehydration form shogaol. The degradation of gingerol form these compound cause decrease

pungent aroma of ginger (Polasa & Nirmala, 2003). Formation of 6-shogaol is also due to oxidation of 6-gingerol during manufacturing and storage (Angeli *et al*, __).

Table 3. Total Phenolic and Flavonoid Contents of Methanolic Extracts in Different Parts of Two Different Type of *Zingiber Officinale*, H.Bentong and H. Bara (Ghasemzadeh *et al*., 2010b)

Chemical	Variety	Leave	Stem	Rhizome
Total Flavonoids	Bentong	5.54 ± 1.83	1.36 ± 0.85	3.66 ± 0.45
	Bara	7.05 ± 7.40	1.77 ± 0.75	4.21 ± 0.98
Total Phenolics	Bentong	33.0 ± 1.13	7.8 ± 0.65	10.2 ± 0.87
	Bara	39.1 ± 1.83	8.5 ± 0.81	13.5 ± 2.26

The 6-shogaol is a kind of bioactive compound that can be found in ginger, although in low concentration compared with gingerol. This compound is included phenolic antioxidant compound that compose oleoresin (Tejasari et al., __). 6-shogaol is formed by degradation of 6-gingerol during extraction at high temperature and acidic condition. 6-shogaol has beneficial effect for human body such as anti-inflammatory, antipyretic, and antioxidant properties. It has higher biologically activity than 6-gingerol (Bak *et al*., 2012).

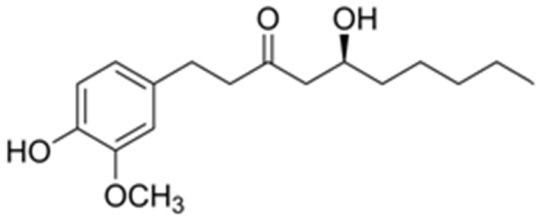

Figure 3. Chemical Structure of [6]-gingerol (Puengphian & Anchalee, 2008)

The availability of these compounds will increase by increasing the planting-age of ginger. After it is harvested, there are some kinds of post harvest treatment that can cause decreasing of ginger bioactive compounds. Heat processing such as drying can degrade gingerol form another compound that is due to present of heat unstable group in its structures. The heat unstable group is β-hydroxyl ketone (Puengphian & Anchalee, 2008). Flavonols is subgroup of flavonoids. There was some kind of flavonols such as quercetin, kaemferol, myricetin, isorhamnetin, and pachypodol (Ghasemzadeh & Neda, 2011b) which can be found highest concentration in fruits skin. Based on study of this compound, it's identified that ginger peels contain highest concentration of flavonols compared with another vegetable in that study, the concentration of flavonols in ginger peels in that study is 46.18 mg/kg (Naeem *et al*., 2009).

But under post harvest management the peel of ginger is removed and become waste.

The Way of Serving Ginger

Ginger can be used in a dried form or as fresh. The mature ginger root can be stewed in boiling water to make ginger tea that can be added by honey, slice of lemon or orange as a flavor adding. Ginger powder and syrup are the typically form of ginger that often use flavoring bread, cookies, and cake (Rajsekhar *et al*., 2012).

The Alternative of Ginger's Serving Way

Based on point number three (the way of serving ginger), there are many several way for serving ginger. When ginger rhizome was boiled around 100ºC for about 20 – 30 minutes, it can get better taste for traditional ginger drink because the bitter taste decreased. From the study, the drying of ginger rhizome caused decreased the 6-gingerol content can increase terpene hydrocarbon and converted some monoterpene alcohols to their corresponding acetates. At 120º C heat treatment, the antioxidant activity of ginger powders were stable. The boiling of elephant ginger rhizome at 6 minutes showed the best thermal processed sample because the zingerone compound total area increased from 5,685 to 6,32 % (Purnomo *et al.*, 2010). Based on that thing, we can declare that ginger can be processed to be food additive such as the flavoring agent for coffee drink, jam, syrup, mung bean soup and dawet. Just used it as ingredient and boiled it to make ginger tea. And it's safe for human digestion because it's gingerol compound could make ginger available for stomach acidity treatment and inhibited bacterial growth, however it dependent on dose (Malu *et al*., 2009). In Thailand, ginger leaves are eaten as salad (Ghasemzadeh *et al*., 2010a). Indonesia has indegenous drink such as bandrek, bajigur, sekoteng, wedang jahe, bir pletok and many more. Commonly under javanese culture, these drink products prefer using ginger rhizome than other parts. Whereas, the proccessing method of these product such as brewing, crushing, shredding, boiling and grilling, applied the extraction principal, so it can utilize the peels, leaves and stems beside its rhizome.

CONCLUSION

From that data and literature study, we can processed all part of ginger plant because each part has bioactive compound such as flavonoids and phenolics. There are have antioxidant activity that good for human health. It proved that not only the rhizome that can be used as food but also it's leaves, stems and peel, so the waste of ginger can be decrease.

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LOCAL BEVERAGE OF INDONESIA : IN TERMS OF ITS HISTORY, FUNCTIONALITY AND MODERNITY

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ABSTRACT

Indonesia is one of developing countries that well-known as a country with a lot of diversity such as cultural diversity, ethnicity, language, and local food and beverage of each region. Those diversity, which will be discussed specifically in this study is diversity of local beverage of Indonesia. One example of popular local beverage in Indonesia is jamu which known as herbal medicine that has undergone some inovations due to changing times. In ancient time, jamu used to be sold only by jamu vendor but now, jamu has been packaged well by industries. Jamu believed as herbal medicine due to its medicinal properties for body and rich in nutrients. Actually jamu is not the only one local beverage of Indonesia. There are many more example such as uwuh tea (*teh uwuh*), pletok beer (*bir pletok*), young coconut ice (*degan*), bandrek (*bandrek*), etc. These local beverages have either the interesting historical story or the functional value that can be able to be business opportunity. Although some local beverages have undergone modernization, but still many other local beverages that not known by public. If this continues, this kind of thing will result in the loss of diversity and local knowledge that could be used as a business opportunity. Therefore, in this study we will discuss about forgotten local beverage of Indonesia in order to reminding public that the local beverages has an interesting historical stories, functional aspects, and modernization aspects that can be used as a business opportunity

Keyword : *local beverage, functional, history*

INTRODUCTION

Indonesia is one of developing countries at south east Asia, and has its own diversity, especially on food and beverage. That can be happened because on each area of Indonesia has their own herb potention such as to be ingredient for traditional beverage. At the beginning, traditional beverage just trated as local knowlegde for health. But nowadays it has been approved that traditional beverage has a lot of active compound inside with its own function and benefits for human body. Several function of herb-based beverage were to stimulate antioxidant activity, to lowering blood sugar in diabetics, to lowering blood pressure, immunomodulatory, anti-inflammatory, etc (Astawan, -).

One famous example of functional natural ingredients and sometimes known as herbal medicine originated from Indonesia. In fact, jamu was only consumed to prevent disease not to heal disease (Anonim_a, 2012). Jamu is a beverage with bitter taste. To overcome this, jamu often consumed together with sugar solution. Furthermore, jamu nowadays produced with high technology and hygienically packaged in industry with several form such as liquid, powder, tablet, capsule, etc. These new revolutions have facilitate consumers to consume it. They didn't need to taste the bitterness of jamu but the functionality still the same. Eventhough, some other people still choose to consume jamu in traditional way by jamu vendor. They still believed that jamu made by jamu vendor was much fresher due to directly and daily made.

In fact, jamu was not only kind of local and functional beverage in Indonesia. There were many other examples such as uwuh tea, pletok beer, coconut water, etc. Those kind of beverages have a lot of benefits but being forgotten due to modernization. Each local beverages in Indonesia have its own history and functionality that actually can be used further in order to increasing human wealth. Therefore, the objectives of this paper is to to reminding public that the local beverages has an interesting historical stories, functional aspects, and beverage is jamu. Jamu was a mixture of modernization aspects that can be used as a business opportunity.

TEA-LIKE LOCAL BEVERAGE (UWUH TEA)

Uwuh tea is a refresher beverage from Bantul, South Jogjakarta. Uwuh tea is one example from many histories of traditional medicine. Uwuh tea was made from creativity (Handita, 2009). In javanese word, uwuh tea has the similar meaning with wedang uwuh. "Uwuh" means rubbish and "wedang" is like a hot drink. But uwuh tea is not the real rubbish like waste paper or waste vegetables. It's only name which represent that uwuh tea was made from many kind of herbs such as clove, lime, leave, secang, nutmeg, and cinnamon. All put in a glass look like a rubbish bin.

Figure 1. Ingredients of Uwuh Tea

Uwuh tea made by local people from a local area named Imogiri, south Jogjakarta city. It's kind a unique and traditional drink from the ancient time. There are no sources which explained about the creator of the herbs. It's just like another popular drinks

like 'wedang ronde' (drink made by roasted peanut), wedang jahe (drink made by ginger) and many others. They believe the uwuh tea was good for their health and able for healing some diseases, like cough and fever.

According to research, uwuh tea like a doctor for some diseases. The biggest two points why we should try uwuh tea are the fact that uwuh tea can lower the value of cholesterol and very rich of antioxidant compound. First ingredient, ginger is good for blood circulation. Ginger can stop problem like frozen blood (anti-coagulant) and it's better than onion and garlic do. Ginger is able to reduce cholesterol absorbed in blood and heart. A research done by Japanese scientist showing the ginger can reduce blood pressure also. The second ingredient is cinnamon. Cinnamon has good antioxidant activity and makes it taste well. The combination between ginger and cinnamon are able to moving up human immune because cinnamon has greater antioxidant (Handita, 2009).

Dr. Michael from Herbacure said that many compounds contained inside uwuh tea has a lot of function if described one by one. The main advantages is this beverage can increase body immune and accelerate blood circulation well. The combination of cinnamon and clove makes body warm and have an unique taste. Nutmeg leaves that rich in saponin, polifenol, and flavonid plays important roles in reducing pain, stomachache, cold, accelerating blood circulation, and healing grastritis problems (Handita, 2009). Another important component is secang (*Caesalpina sappan*), knew as ingredient for curious many diseases like blood cough and syphilis. Secang have similar ability like two components above. And the last one is sugar cube. Sugar cube gives sweet taste but it's not reduced unique taste and aroma from another component of uwuh tea (Anonym_b, 2012). Research done by Pharmacy Faculty of Gadjahmada university said that secang have ability to accelerate blood circulation, to ease breathing, antioxidant and anti-cancer (Handita, 2009)

COCONUT-BASED LOCAL BEVERAGE

Coconut water is the juice in the interior or endosperm of young coconut. Its water is one of the nature’s most refreshing drinks, consumed worldwide for its nutritious and health benefiting properties. Coconut water is trusted as Fat-free, cholesterol-free, low-calorie, super-hydrating, naturally rich in electrolytes. Coconut water contains a lot of unique chemicals such as sugars, vitamins, minerals, electrolytes, enzymes, amino acids, cytokine, and phyto-hormones. In general, young and slightly immature

coconuts harvested when they are about 5-7 months of age for the drink. In ancient time, our people believed that consuming coconut water will give great advantages to body. Nowadays, that belief has been proved by many scientist that coconut water is very rich in many nutritional compounds.

Coconut water is composed of many naturally occurring bioactive enzymes such as *acid phosphatase, catalase, dehydrogenase, diastase, peroxidase, RNA-polymerases* etc. In effect, these enzymes help in the digestion and metabolism. Its water is also a very good source of B-complex vitamins such as riboflavin, niacin, thiamin, pyridoxine, and folates. These vitamins are essential in the sense that the human body requires them from external sources to replenish. Coconut water contains a very good amount of electrolyte potassium. 100 ml of water has 250 mg of potassium and 105 mg of sodium. Together, these electrolytes help replenish electrolyte deficiency in the body due to diarrhea (loose stools). Further, fresh coconut water has a small amount of vitamin-C (Ascorbic acid); It provides about 2.4 mg or 4% of RDA. Vitamin C is a water-soluble ant-oxidant. (Sara, 2011).

Figure 2. Coconut

Table 1. Coconut Water (Fresh) Nutrition Value per 100 g

Principle		
Energy	19 Kcal	1%
Carbohydrate	3,71 g	3%
Protein	0,72 g	1,5%
Total fat	0,20 g	1%
Cholesterol	0 mg	0%
Dietary Fiber	1,1 g	3%
Vitamin		
Pholates	3 µg	0,75%
Niacin	0,080 mg	0,5%
Pantothenic Acid	0,043 mg	<1%
Pyridoxine	0,032 mg	2,5%
Riboflavin	0,057 mg	4%
Thiamin	0,030 mg	2,5%
Vitamin C	2,4 mg	4%
Vitamin A	0 IU	0%
Vitamin E	0 mg	0%
Vitamin K	0 mcg	0%
Electrolytes		
Sodium	105 g	7%
Potassium	250 g	5%
Minerals		
Calcium	24 mg	2,4%
Copper	40 mcg	4,5%
Iron	0,29 mg	3,5%
Magnesium	25 mg	6%
Manganese	0,142 mg	1,5%
Zinc	0,10 mg	1%

Source : USDA (2009)

Nowadays, coconut water is not the only one coconut-based beverage that have functionality. There are many other examples such as coconut milk, cendol, etc. They are now packaged well by industries

but have the same function with coconut water. Coconut milk is a milky white oil-in-water emulsion. It is obtained from extraction of coconut flesh with or without added water. It contains fat, water, carbohydrate, protein, and ash with the major components being water and fat (Tansakul & Chaisawang, -). Pure coconut milk naturally contains about 54% moisture content, 35% fat and 11% solid non fat (carbohydrate 6%, proteins 4% and 1% other solids). Besides, coconut milk also contains a lot of vitamins (vitamin C, B6, thiamin, niacin, folic acid, etc) and minerals (calcium, zinc, magnesium, iron, phosphor) (Enig, 2009).

Table 2. Vitamin and Mineral Contained in every 100gr Fresh Coconut Milk

Vitamins	Value of Vitamins	Minerals	Value of Minerals
Vitamin C	2.8 mg	Potassium	260 mg
Niacin (Vitamin B3)	0.76 mg	Phosphorous	100 mg
Folate (total)	16 mcg	Magnesium	37 mg
Pantothenic acid (Vitamin B5)	0.183 mg	Calcium	16 mg
Vitamin B6	0.033 mg	Sodium	15 mg
Thiamine (Vitamin B1)	0.026 mg	Selenium	6.2 mcg
Vitamin E	0.15 mg	Iron	1.64 mg

Source : McClements (1999).

One products from Indonesia which is popular as one of fifty top delicious drinks of the worlds is cendol. Ice Cendol or "Es Cendol" is is a traditional dessert originating from South East Asia which is popular in Indonesia, Malaysia, Singapore, Vietnam, Philippines, and Southern Thailand. The blend of sweet palm sugar, fresh jackfruit, soft cendol and cold shaved ice makes it suitable to drink in hot weather, delicious and also refreshing. The dessert's basic ingredients consist of coconut milk, a worm-like jelly made from rice flour with green food coloring (usually derived from the pandan leaf), shaved ice and palm sugar. Next to these basic recipe, other ingredients such as red beans, glutinous rice, grass jelly, creamed corn, might also included (Anonym_c, 2010).

Based on survey, there are some coconut based beverages from Indonesia which is famous among the world that will be shown on table below.

Table 3. Top 50 delicious drinks of the world

1. Water, Global	26. Irish car bomb, United States
2. Coca-cola, United States	27. Thai iced tea, Thailand
3. Coffee, Ethiopia	28. Chocolate milkshake, United States
4. Beer, Global	29. Caipirinha, Brazil
5. Tea, Global	30. Sparkling water, Global
6. Air Mata Kucing, Malaysia	31. Tequila, Mexico
7. Orange Juice, United States	32. Baileys Original Irish Cream, Ireland
8. Red Wine, Global	33. Carrot juice, Global
9. Gin and Tonic, England	34. Champagne, France
10. Hot Chocolate with marshmallov United States	35. Yerba Mate, South America
11. Sangria, Spanish	36. Martini, United States
12. Watermelon cucumber punch, global	37. Cider, England
13. Kool Aid, United States	38. Mojito, Cuba
14. Pastis, France	39. Scotch whisky, Scotland
15. Sake, Japan	40. Coconut water, Global
16. Anything from a hotel mini bar, global	41. Raksi, Nepal
17. Lemonade, Egypt	42. Shikuwasa juice, Japan
18. White Wine, Global	43. Fanta, Germany
19. Es Kelapa Muda, Indonesia	44. Sujeonggwa, Korea
20. Sex on The Beach, United States	45. Cendol, Indonesia
21. Eggnog, England	46. Pina Colada, Puerto Rico
22. Gatorade, United States	47. Guinness, Ireland
23. Milk, Global	48. Yakult, Japan
24. Raki, Turkey	49. Red Bull, Austria
25. Bubble tea, Taiwan	50. Mango Lassi, India

Source : CNN (2011)

HERB-BASED LOCAL BEVERAGE

Herbs described as tropical plants that grown well in Indonesia. Herbs could be part of plant such as flower, fruit, bark, tuber, leave, and rhizome or whole part of plant. Kind of herbs that widely cultivated in Indonesia for example ginger, turmeric, curcuma, clove, pepper, cinnamon, lemongrass and there are more other examples. Each herbs have its own specific taste, colour, aroma, and appearance so the combination of each other would be unique. That's local beverage normally made from combination of several kind of herbs. Naturally, there are some active compunds contained in herbs itself which have important role in health of human being for example antioxidant, antibacteria, antifungi, antiyeast, anticancer, antibiotic (Astawan, -)

There are many variety of beverage in javanese tradition such as *wedang jahe, wedang ronde, wedang secang*, etc. Generally, those kind of *wedang* has made from ginger extract for the soup. The advantages of those beverages were to warm body, heal cough, and immunomodulator (Handita, 2009). Ginger is a very important and highly valuable crop in Indonesia perhaps because ginger and its gingerol, limonene, myrecene, neral, piriene, shogal and zingerone (Abdulkareem *et al.*, 2010).

Studies have shown that ginger has pronounced anti-oxidant activity, reduces inflammation and help in arresting narcotic addiction. Ginger significantly inhibits the growth of both gram-positive and gram-negative bacteria. It is a stimulant, when chewed it increases the flow of saliva. When swallowed it acts as a stimulating tonic, increases the secretion of gastric juice, excites alimentary muscular system and dispels gases accumulated in stomach and bowels. Spicy aromatic ginger is advantageous to human body; it is effective for indigestion and also helps in preventing the systems of motion sickness (Abdulkareem *et al*., 2010)

Beside *wedang*, another herb-based beverage with an unique history is pletok beer. Pletok Beer is traditional beverage derivations (e.g. ginger oil, ginger powder, ginger syrup or juice and ginger flakes) have a lot of applications which include confectionaries, pharmaceuticals and beverages production. Ginger is composed of water, protein, fat, starch, fiber, ash, volatile oil and resinous matter. Some biologically active components are: asparaginase, borneol, chavicol, citral, cumene, cymene, geraniol, gingerdiorie,
from Betawi, Indonesia. Altough its named "beer" but didn't make people drunk. It was said that when Dutch Colonial Era, these beer was made from pepper, ginger, and secang. Word beer (*Bir in Indonesia*) comes from bi'run that means springs, while pletok means made from bamboo, placed inside teapot, and continuously shaken until sounds "pletok". Nowadays, pletok beer made from herbs such as ginger, pandan leave, and lemongrass then boiled. It was optional in addition of secang to increase colour. Making of pletok beer spent about 1-2 hours. Function of pletok beer for human being were to accelerate blood circulation, to overcome stomach pain and to overcome arthritis (Waluyani, 2012)

Figure 3. Pletok beer

COFFEE-BASED LOCAL BEVERAGE

Coffee can actually provide many health benefits when consumed moderately. An average amount of coffee is considered to be 3 eight-ounce cups consumed daily. More than 10 eight-ounce cups is considered to be "excessive." The nutrition of coffee can provide many health benefits from mental alertness to a healthy immune system.

Plant Phenols

Plant phenols are powerful antioxidants found in coffee. Plant phenols in coffee are similar to the antioxidants found in berries and include flavonoids and lignans. Researchers believe that plant phenols can protect the body from cellular damage and diseases involving the cardiovascular system and cancer. Plant phenols are also involved in the breakdown of lipids and carbohydrates in the body.

Chlorogenic Acid

Coffee is the main source of chlorogenic acid in the American diet. Coffee can contain anywhere from .5mg to 1mg of chlorogenic acid per 8-ounce cup. Chlorogenic acid prevents the growth of tumors and slows the growth of existing tumors. Chlorogenic acid is also believed to contribute to a healthy cardiovascular system by reducing triglyceride levels and decreasing blood cholesterol. Chlorogenic acid also regulates the movement of bile, thereby reducing bile stagnation, which is thought to reduce the effect of liver and kidney disease. Bile stagnation causes adverse effects in the liver, kidneys and gallbladder and can cause cancer and stone formation.

Caffeine

As stated above, for maximum benefits, coffee should be consumed in moderation. A moderate amount of caffeine can increase mental clarity and focus. It has also been suggested that caffeine improves cognitive function and could prevent the development of Parkinson's disease and Alzheimer's disease. Caffeine might not be healthy for some people who have heart conditions because caffeine can increase the heart rate and blood pressure. The caffeine in coffee could also be contraindicated with certain medications, such as stimulants or diuretics.

Tocopherols

Tocopherols in coffee contain vitamin E. Tocopherols in coffee act similarly to plant phenols. Tocopherols act like antioxidants and assist in the synthesis of carbohydrates and lipids. Tocopherols also protect cells against damage and destroy free radicals in your body. Tocopherols found in coffee are particularly important for ocular health and your skin. Tocopherols can also inhibit the

growth of gallbladder and kidney stones and may protect you against colorectal cancer.

The moderate consumption of coffee can provide many health benefits including cancer prevention and increased cognitive function. The nutrition in coffee has also been demonstrated to improve performance in endurance sports. It should be noted that coffee is intended to complement a healthy diet, not replace the antioxidants and other nutrients found in fruits and vegetables.

There is local coffee in Indonesia and people said this coffee is the most expensive coffee, Luwak coffee. For centuries, the volcanic island of Sumatra has been world renowned for producing exceptionally smooth coffee with low acidity. In addition, authentic Luwak coffee only comes from Sumatra, where the Luwak, or Civet cat, called a *Paradoxurus*, lives. Native to the island, Luwaks select only the highest quality, ripest Arabica coffee cherries and leave the rest, thereby naturally producing the best coffee available. The cherries are digested by the Luwak, while the beans inside pass through its digestive tract. The civet digests the soft outer part of the coffee cherry, but does not digest the inner beans and excretes them. Apparently the internal digestion ends up adds a unique flavor to the beans, removing the bitter flavor, and then beans are then picked up by locals and sold. Luwak coffee is the most expensive coffee according to guiness book of world record, which sells for approximately £215 ($300) per pound (0.45 kg). (Anonim, 2011)

In General, the flavor and aroma of Luwak coffee had its own characteristics. In addition to inheriting the usual coffee aroma, the scent of kopi luwak are firmer complete with addition of fragrance flora. There are two varieties of coffee; Robusta and Arabica. Robusta is more earthly and the Arabica has a full flavour (floral, spicy). After the process of Luwak, robusta which usually bitter and caffeinated will turn out to be a mild floral scent with vanilla mix and not bitter. At the time of the drink, scent of the coffee taste greatly, creamy and thick, and the coffee will feels smooth. For consumers who do not like the coffee acids, could try luwak robusta coffee, and for those who like scents that are varied and slightly acidic, can try Arabica luwak coffee.

Luwak coffee is increasingly well known by local coffee lovers and the world, because of its unique origin and the supplies are very limited. The annual coffee production is uncertain, depending on the nature, civet population and market demand. Luwak coffee is getting interest

from year to year, due to the help of the print media or TV who has been covering the special about coffee that is unique and legendary. According to the reports from the media and various sources, Luwak coffee production is in the range of 500 kg, and this capacity is greater than Vietman Weasel coffee Alamid PuTTY Knife and the Philippines. From the data obtained, the annual national production of Luwak coffee tends to increase. Because of the potential of specialty coffee is still great, Luwak began cultivated by farmers in the area of coffee plantations, especially in Sumatra.

FUTURE BUSINESS PROSPECTS OF LOCAL BEVERAGE

There are several business opportunities in Indonesia based on local beverage. Particularly with the existence of functional and healthy beverage. In the past, it produced traditionally. But, today it can be mass produce using brand new technology therefore its production and presentation already modern (can be compressed into powder/instant product, can be serve using sachet, sold using franchise system, etc.), without decrease or erase its functional benefits and traditional value. Tong Tji and wedang uwuh are some examples of local beverage which going in modern era without erase its traditional value, becasue they still keep their products appearance as we can see on the picture below. Another example is coconut based beverage. In ancient time, people consumed it with a whole fruits but nowadays, people can find it easier in supermarket with a new and interesting packaging which is much easier to consume.

CONCLUSION

Indonesia is very rich in variety. One real example is the variety of its herbal food and beverage on each region in Indonesia. This beverage variety totally depend on herbs potential. In ancient time, local beverage trusted as healing agent of some disease and nowadays local beverage has been proved that contained a lot of active compound. One example is jamu that very popular in Indonesia. Beside jamu, there are many other example beverages. Those beverages now being ignored because of modernization. So we should keep maintaining it to keep the wealthy of Indonesia.

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UTILIZATION OF POWDER *KELOR* LEAVES (*Moringa oleifera* Lamk) ACID PRETREATMENTS RESULT AND CATFISH POWDER ON ANEMIA RECOVERY *IN VIVO*

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ABSTRACT

Iron deficiency anemia is the most important micronutrient deficiency in the developing world today. The research work was investigated to find out wether the *kelor* leaves powder result from acid pretreatment and addition of catfish powder can support recovery iron deficiency anemia with iron and hemoglobin measurements in vivo study. This is monofactorial experimental study, with ANCOVA and LSD was used to analyse statistically. The utilization of iron to recover anemia was studied in 42 anemic rats for 14 days (criteria <80 µg/dl dan hemoglobin <10 g/dl) with haemoglobin and iron measurements in rats. Diet contained AIN 93 M, *kelor* powder and catfish powder as control and *kelor* powder with citric acid 0.5%, citric acid 0,5% + catfish powder (1:1), lime 0.5%, and lime 0.5% + catfish powder (1:1). *Kelor* leaves powder as control, *kelor* leaves powder result from citric acid pretreatment 0.5% (iron 90.3640 µg/dl and haemoglobin 10.6750 g/dl); lime pretreatment 0.5% (iron 115.5110 µg/dl and haemoglobin 12.1240 g/dl); lime pretreatment 0.5% + catfish powder (1:1) (iron 107.2910 µg/dl and haemoglobin 11.2480 g/dl) can use to recovery anemia in vivo. The best result show powder *kelor* leaves with lime pretreatment 0,5%.

Keywords : *iron deficiency anemia, iron, haemoglobin, acid pretreatment, Moringa oleifera*Lamk

INTRODUCTION

More than 3.5 billion people in the world are anemic, many due to iron deficiency and common condition in developing countries. It causes multi – factorial, caused inhibitor compound in food, food processing, infection, however the consumption of food with low iron bioavailability is likely the most important factor, and result decreased physical activity, cognitive, and decreased interaction with the environment. In order to solve the problems, we need to research alternative food source of iron, economic, and rarely studied (Monti, 2005; Rodriguez *et al*., 2007; Zlotkin *et al*., 2007). One of which is *Moringa oleifera* Lamk, as a source of iron (28,2 mg/100 g) (Katharina *et al.*, 2011). *Moringa oleifera* Lamk powder manufacturing is done by drying

process and acid pretreatment, because acid condition can promote absorption non heme iron compound and mechanism to change ferric iron to ferrous iron and prevent precipitation in intestinal. Adding catfish powder as heme iron source. Amino acid, cystine and histide content in it, can support reduction ferric iron to frrous iron (Etcheverry *et al.*, 2006; Reddy *et al.*, 2006). This research will assess utilization of powder kelor leaves (*Moring oleifera* Lamk) acid pretreatments result and catfish powder on anemia recovery in vivo.

MATERIALS AND METHODS

This is experimental laboratory with 42 rattus norvegicus strain wistar (200-300 g). Minimum iron daily intake for rat is 30 mg/kg (Rucker dan Storms 2002). Depletion period (7 days) with AIN 93 M (without iron) to make criteria for anemic rat (<80 µg/dl dan hemoglobin <10 g/dl). After it, rats were devided into 7 group diet (with daily intake 20 g/rat) for 14 days :

A: rats with AIN 93 M (control)

B: rats with kelor leaves powder (control)

C: rats with kelor leaves powder result citric acid 0.5% pretreatment

D: rats with kelor leaves powder result citric acid 0.5% pretreatment + catfish powder (1:1)

E : rats with kelor leaves powder result lime 0.5% pretreatment

F : rats with kelor leaves powder result lime 0.5% pretreatment + catfish powder (1:1)

G : rats with catfish powder (control)

Final measurement (day 15) rats blood drawn from their eyes (medial canthus sinus orbitalis) to analyzed haemoglobin with cyamethemoglobin and iron serum with nitro paps. (Tahono *et al*., 2000 dalam Aisyah *et al.*, 2003).

RESULTS AND DISCUSSION

Table 1. Iron Serum and Hemoglobin Rats Depletion

Diet	Iron Depletion (µg/dl)	Hemoglobin Depletion (g/dl)
A	76,8550 ± 0,3829	9,2183 ± 0,07683
B	80,4333 ± 0,7143	9,0400 ± 0,08737
C	76,4500 ± 1,0216	9,0233 ± 0,12572
D	79,5533 ± 0,8984	8,8383 ± 0,10454
E	77,8683 ± 1,6187	8,9133 ± 0,09025
F	78,9967 ± 0,9338	8,8000 ± 0,14168
G	79,8250 ± 2,0840	8,7540 ± 0,08812

Table 2. Iron Serum and Hemoglobin Rats after 14 days

Diet	Iron Post (µg/dl)	Hemoglobin Post (g/dl)
A	78,1080 ± 1,0370^{f}	9,2770 ± 0,0570^{f}
B	101,2240 ± 1,0420^{c}	11,1720 ± 0,0520^{bc}
C	90,3640 ± 1,0510^{d}	10,6750 ± 0,0520^{d}
D	80,5390 ± 1,0180^{ef}	9,9010 ± 0,0520^{e}
E	115,5110 ± 1,0130^{a}	12,1240 ± 0,0520^{a}
F	107,2910 ± 1,0100^{b}	11,2480 ± 0,0530^{b}
G	82,0380 ± 1,0240^{e}	9,9280 ± 0,0540^{f}

Based on iron serum and haemoglobin criteria anemic criteria (<80 µg/dl dan hemoglobin <10 g/dl), rats into 7 group had anemic for 7 days. The reduction of body iron has three main stages : (1) iron depletion which refers to a decrease of iron stores, (2) iron deficient erythropoeisis when storage iron is depleted and there is

insufficient iron absorption to counteract normal body losses, and (3) iron deficiency anemia which ensuses if the hemoglobin concentration falls below a statistically. Insufficient intake of iron in the body can inhibit the formation of red blood cells, this is because each molecule of hemoglobin contains four iron atoms, and the availability of iron is an important factor to maintain hemoglobin levels. Furthermore, the depletion of iron caused red blood cell size less and pale than normal, impaired hemoglobin synthesis because cells couldn't carry oxyen from the lungs and affected the cytochrome C to metabolism energy in the cells and result low hemoglobin value (Guyton, 1991; Widman, 1995; Whitney & Rolfes 2002; Zulaekah, 2007).

After iron depletion period for 7 days, rats conducted feeding and the final measurement indicates there has been a synthesis of the formation of iron and hemoglobin due to the addition of iron from food.Statistic result from LDS test for iron serum rats after 14 days showed the iron value was highest in serum iron for rats with kelor leaves powder result lime 0.5% pretreatment (115.5110 ± 1,0130 µg/dl); followed rats with kelor leaves powder result lime 0.5% pretreatment + catfish powder (107,2910 ± 1,0100 µg/dl); rats with kelor leaves powder (control); (101.2240 ± 1,0420 µg/dl); rats with kelor leaves powder result citric acid 0.5% pretreatment (90.3640 ± 1,0510 µg/dl); rats with catfish powder (control) (82,0380 ± 1,0240 µg/dl). Value iron for rats with kelor leaves powder result citric acid 0.5% pretreatment + catfish powder (80.5390 ± 1.0180 mg / dl) no significant difference with feed reats AIN 93 M. Lowest value obtained in rats feed AIN 93 M (78.1080 ± 1.0370 mg / dl). For Hemoglobin parameters, test results at the end of the test LSD hemoglobin value which was highest in rats by feeding treatment with kelor leaves powder result lime 0.5% pretreatment (12.1240 ± 0.0520 g / dl), followed by rats by feeding treatment with kelor leaves powder result 0.5% lime pretreatment + catfish powder (11.2480 ± 0.0530 g / dl). Feeding with kelor leaves powder (control) (11.1720 ± 0.0520 g / dl) was not significantly different from rats feeding kelor leaves powder result lime 0.5% pretreatment + catfish powder. The next difference is testing rats with rats feeding kelor leaves powder powder result citric acid 0.5% pretreatment (10.6750 ± 0.0520 g / dl); rats with kelor leaves powder result citric acid 0.5% pretreatment + catfish powder (9, 9010 ± 0.0520 g / dl), rats with catfish powder (control) (9.9280 ± 0.0540) and the last is the AIN 93 M (9.2770 ± 0.0570 g / dl) were similar to rats with catfish powder feed.

When iron stores in the body decreases, the absorption of iron fom non heme source would increase but not more than 20% without compounds that help to absorption of iron (Tatala *et al.*, 2007). Acidic condition can increase the absorption of iron, for example rats by feeding kelor leaves powder result lime 0.5% pretreatment than rats with kelor leaves powder control feed. The percentage of the final iron shows that acid compounds ia able to support the iron absorption and hemoglobin value. The ability of natural compound, ie citric acid and ascorbic acid, capable of minimizing the effect of inhibitors compound (phytate and oxalate) from kelor leaves and reinforcing iron absorption (Fahey, 2005; Murray, 2003; Monti; Munoz *et al.*, 2011). The process of soaking with acid pretreatment causing hydrolysis phytic acid and oxalate, because water can dissolve some salt phytic acid; acid pH will break down inositol hexa and penta phosphate into a smaller size, and minize the loss of iron. Inhibitor compound is a component and can make a complex bond with iron at the time in the gut lumen and will reduce the bioavailability of iron (Levy *et al.*, 2005; Williams & Cloete, 2010; Aify *et al.*, 2012).

The different result got from rats with kelor leaves powder result citric acid 0.5% pretreatment. Citric acid and lime make more protons that affect some minerals and vitamins that are water soluble and not resistant to acids will get leaching process. Soaking also give effect to the passive diffusion reaction in water soluble in several vitamins and minerals, thus eliminating abortion dueto soluble in water. Total iron can be lost due to presence of acid and pH. Soaking and drying processing can lead to reduction the nutrition of kelor leaves due to leaching and acid penetration can changes the carboxyl structure (Hotz; 2007; Ongendangenda & Ojumu, 2011). Acidity may reduce the level of zinc, magnesium, and several other mineral processing, and the further affected the ability of DNA complex and the activity of enzyme reaction. This is because some vitamins and minerals to support anemia recovery need a role of enzyme, while enzymes are very sensitive with pH, because pH can cause enzyme become inactive or unstable. In contrast, between kelor leaves powder result lime 0.5% pretreatment and kelor leaves powder result citric acid 0.5% pretreatment are nutrition loss due to kelor leaves powder result citric acid 0.5% pretreatment can replace, because citric acid itself does not have the composition or substances – nutrients that can replase the loss substance. Associated with acidity, pH value greately affects the availability of iron during processing. Deficiency of any vitamin and mineral substances can affect iron metabolism in the body. This why, the value of iron and

hemoglobin at the and – although the same: get the acid pretreatments, but the difference compositon of the type pretreatment lead rats with kelor leaves powder result lime 0.5% pretreatments has higher iron serum and hemoglobin value than than rats with kelor leaves powder result citric acid 0.5% pretreatment (Variotii & Gabriela, 2007; Ewing, 2012).

The different compounds between citric acid 0.5% pretreatment and lime 0.5% pretreatment can affect the different iron serum and hemoglobin results. Kelor leaves powder result lime 0.5% pretreatment contains a number of compounds, including ascorbic acid, citric acid, malic acid, succinic acid, and combination of them, to effectively iron absorption. The largest percentage of the acid content in lime is citric acid, followed by ascorbic acid, are capable of individually or together to support non heme absorption. Fructose in the lime is possible to protect cells from oxidative damage by chelating iron (Izuagie & Izuagie, 2007; Ravi et al., 2010). Ascorbic acid in lime may increase of iron – non heme because it acts as as strong enhancer in reducing Fe^{3+} into Fe^{2+}, make it easily absorbed in the duodenum and small intestine and increased the iron abosrption until four times. At the time of non heme iron enteres the intestine, ascorbic acid will reduced inhibition of binding ligands to produce iron becomes more alkaline through the mechanims of chelate. An increase pH will be kept back by ascorbic acid (Bohn et al., 2008; Esch et al., 2010; Nadimin et al., 2011). Rats with kelor leaves powder result citric acid 0.5% pretreatment which acts kind of acid is citric acid only, while the ability of citric acid to enhancer iron absorption is relative low than ascorbic acid. It is because citric acid has bigger role to keep iron in dissolved form. Although it has the ability to make iro chelate, citric acid does not have the ability to reduce and sometimes less stable (Chavasit et al, 2003; Porres et al., 2004; Walczyk et al., 2005).

The test result showing that decerese value of iron serum and hemoglobin final when catfish powder added to rats feed. A lot of research explains that the addition of food intake from heme iton, able to increase iron absorption (15% - 40%) than non heme iron absorption (1-5%) because the mechanism of porphyrin complex, while the non heme iron must be rmoved inhibitor compounds (oxalate and phytate). Amino acid structure and sulfhydryl groups should be able to reduction Fe^{3+} and convert it into Fe^{2+}. Some studies have also revealed the content of cystine and histidine in the catfish powder, will increased iron absorption (Etcheverry et al., 2006; Reddy et al., 2006; Soliman et al., 2010).

The difference result in this research with theother research due to differences in the process. Increase processing stages, such as high processing temperature, will change the solubility and chemical reactivity so that it can modify its shape. Several stages of processing can affect the nutritional value catfish powder are staming, pressing, and drying catfish. Steaming and pressing process will removal some of the oil an water (Murwanto, 2000; Miles & Jacqueline, 2011).. It is possible to cause losses some vitamins that are fat soluble (vitamins A and E). Vitamin A and E are fat soluble and habe a role to recovery anemia. Vitamin A serves to keep the iron in the intestinal luman in order to dissolve and keep losses due to effect of phytic acid; while vitamin E function affects the red blood clell membrane stability. Loss of these vitamins will influence the availability of iron in the body, which in turn will affect the value of hemoglobin at the final stage (Almatsier, 2002).

Drying process cause denaturation stresser, including breakdon amino acid component, which lead to functional properties biological vaue. Denaturation of protein during drying process can lead to inactivication enzyme, and reducing cystine and histidine formation. Cystine has a very important role in heme absorption in the body. This amino acid can convert ferric to ferrous, and maintain a complex solution to easy absorb, and then eliminate oxidation from free sulfhydryl residues contained in meat protein (Lall and Anderson, 2002; Lucca et al., 2002). Oxidation process during drying catfish will lead to more loss of methionine, cystine and disulfide bonds thereby increasing the redox reaction. It can reduced biological value and recat with lysine residue, because protein SS bond and proteolitic activity enzyme is limited and decreasing function lysine in the body. Oxidized fats produce free readical or hydroperoxide, which when reacted with the protein wil reduce bioavailability (Ljokjel et al., 2000; Micgalczyk and Kryzsztof, 2007; D'Amelio et al., 2008).

Other reaction are very involved and caused bioavailability and affect iron and fehoglobin final are Maillard reaction. This reaction depends on several parameters, such as temperature, water activity, pH, moisture and chemica composition. Maillard reaction can occur since temperature 37^0C, browning can occur at A2 0.6 – 0.85 and pH 10. This reaction will imhibit several enzyms, causes loss some vitamins and directly react with the side chain of amino acid residues (including arginine and lysine) (Ames, 2009; Bastos et al., 2010).

Maillard reaction involving the carbonyl group of reducing sugars with free amino acids, which is supported by the presesnce

of heat can lead to make Schidd bases formation. This reaction is unstable, and continue lead Amadory cyclic which are more stable. The longer heating will begin to form aldehyde from Stecker degradation. The final reaction is formation of browning polymers (melanoidin). Maillard reaction causing food difficult to digest because limited proteolitic enzyme and reduction lysine component. Drying can cause loss amino acids (lysine) reach up 50%, and reduction in bioavailability of iron and magnesium (Cramer et al., 2007; Bastos et al., 2010).

Lowest value obtained in rats with feeding AIN 93 M. The low value compared to other treatment because of the type of iron that is in AIN 93 M is ferric citrate, and only containing iron 16.5%. Composition of Fe^{3+} need to change Fe^{2+} to be absorbed wwll in the body. Without acid pretreatment to support iron absorption, it is usually diffult and need moch time to absorp. The same formation (ferric citrate) result from kelor leaves powder with citric acid 0.5% pretreatment but give different process (with acid pretreatment), make kelor leaves powder result citric acid 0.5% pretreatment easier to be processed in the body because pH from acid pretreatment impact the ability and solubility (Songklanakarin, 2005; Womeni et al., 2012).

The value of iron and hemoglobin at the final feeding rats showed rats with kelor leaves powder result citric acid 0.5% pretreatment and rats with kelor leaves powder result citric acid 0.5% pretreatment + catfish powder (1:1) lower than rats with kelor leaves powder result lime 0.5% pretreatment and rats with kelor leaves powder result lime 0.5% pretreatment + catfish powder (1:1). This difference is related organic compound present in lime 0.5% pretreatment, will facilitate bioavailability in the body, and make active transfer. Gradually, mechanism passive absorption and interaction between some minerals and other nutritiens that enhance chelate absorption bay amino acid transport system. This would resuld increase iron serum and hemoglobin, because the possibility of an interaction between organic compound with enzyme in synthesis process. Low bioavailability of the inorganic compounds probably due to some antagonist reaction between itself and other minerals, thereby reducing iron bioavailability. Inorganic compound contain some mechanism and cause oxidative reaction. In Orgaic compounds, it is able to maintain oxidation due to natural component such as vitamins A, C and E. It is capable to minize oxidative process. The oher reason because organic iron more soluble than inorganic iron, and it can be utlized in the body to effort recovery. Less solubility from inorganic iron compounds is

affect the secretion of gastric acid reduction (Leduox and Marcia, 2005; Fernandaes et al, 2008; Mahima et al., 2012).

CONCLUSIONS

This research has showed kelor leaves powder result from citric acid pretreatment 0.5% (iron 90.3640 µg/dl and haemoglobin 10.6750 g/dl); lime pretreatment 0.5% (iron 115.5110 µg/dl and haemoglobin 12.1240 g/dl); lime pretreatment 0.5% + catfish powder (1:1) (iron 107.2910 µg/dl and haemoglobin 11.2480 g/dl) can use to recovery anemia in vivo, and have successfully iron and hemoglobin criteria. The best result show powder kelor leaves with lime pretreatment 0,5%.

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