EFFECT OF FERMENTATION TIME AND RATIO OF CO-CULTURES USING *Bacillus subtilis* var. natto AND *Lactobacillus delbrueckii* KSM 10 ON PHYSICOCHEMICAL AND SENSORY PROPERTIES OF COWPEA (*Vigna unguiculata* L. Walp) NATTO

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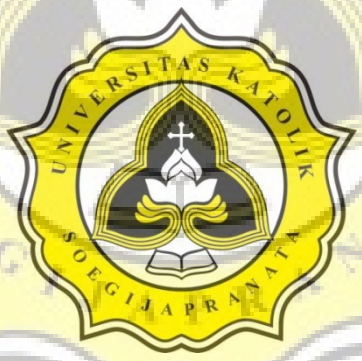
BACHELOR THESIS

Submitted in partial fulfillment of the requirements for a Food Technology Bachelor's degree in Faculty of Agricultural Technology

By:

NOVANI SUTIKNO

15.I1.0106



DEPARTMENT OF FOOD TECHNOLOGY
FACULTY OF AGRICULTURAL TECHNOLOGY
SOEGIJAPRANATA CATHOLIC UNIVERSITY
SEMARANG

2019

STATEMENT OF BACHELOR THESIS AUTHENTICTY

The undersigned below:

Name	: Novani Sutikno
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I hereby declare that the bachelor thesis entitled "**EFFECT OF FERMENTATION TIME AND RATIO CO-CULTURES USING *Bacillus subtilis* var. natto and *Lactobacillus debrueckii* KSM 10 on PHYSICOCHEMICAL AND SENSORY PROPERTIES OF COWPEA (*Vigna unguiculata* L. Walp) NATTO**" contains no work that ever purposed to acquire a bachelor title in a University and along to my knowledge. There are no works ever written or published by other, except the ones used as references and mentioned in the list of references.

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Novani Sutikno
15.I1.0106

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SUMMARY

Fermentation process can improve the flavor, texture, nutritional quality, and increase the bioactive compounds of beans. Natto is one of a traditional Japanese food products which is usually prepared by fermenting soybeans with *Bacillus subtilis* and has unique odor, mucus material, and viscous texture. Cowpea (*Vigna unguiculata L. Walp*) is a kind of legume which has known as excellent sources of protein and also rich in vitamins, minerals, and insoluble dietary fiber. But, the consumption of cowpea for daily food was limited. The industrial processing of cowpea was not being optimally improved and the beneficial effects of bioactive compounds also unexplored. The whole cowpea fermented by *B.subtilis* natto mixed with LAB as probiotics carrier food was not investigated. To develop the bioactive compounds such as total phenolic content and antioxidant, the optimum fermentation conditions such as fermentation times and ratio of co-cultures need to determine. The objective of this research was to know the effect of fermentation time and ratio of co-cultures on the physicochemical properties such as pH, color (L value), antioxidant activities, total phenolic content, and sensory properties of cowpea natto. The fermentation of cowpea by 4 levels of the ratio of co-cultures (100% *B. subtilis* natto,75% *B. subtilis* natto: 25% LAB, 50% *B. subtilis* natto: 50% LAB, 25% *B. subtilis* natto: 75% LAB) incubated at 37°C for 4 levels of the fermentation time (24, 48, 72, and 96 hours). Based on the pH, fermentation of natto was considered as alkaline fermentation with the pH value up to 9.08 at 72 hours of fermentation. The color (L value) of cowpea natto was decreased gradually from 72 to 96 hours of fermentation due to the white-colored mucus substances has absorbed the color of cowpea. Cowpea natto with the same ratio of *Bacillus subtilis* var. natto and lactic acid bacteria (50% *B. subtilis* natto: 50% LAB) at 72 hours of fermentation has resulted the highest antioxidant activity (47.97 ± 2.49 %) and total phenolic content (95.67 ± 2.46 µg GAE/g). Commercial natto compared with cowpea natto (75% *B. subtilis* natto and 25% LAB) in the sensory analysis included on the same category of drawing and smell item even though had a significant different score.

RINGKASAN

Proses fermentasi diketahui dapat meningkatkan flavor, tekstur, kandungan nutrisi, dan senyawa bioaktif pada kacang. Natto adalah salah satu makanan tradisional Jepang yang dibuat melalui fermentasi kacang kedelai menggunakan Bacillus subtilis dengan aroma khas, berlendir, dan memiliki tekstur yang lengket. Natto sebagai makanan probiotik sangat mudah dicerna karena protein kompleks didalamnya telah diurai oleh bakteri selama proses fermentasi. Kacang tolo atau tunggak (Vigna unguiculata L. Walp) merupakan jenis kacang dengan sumber protein yang sangat baik dan juga kaya akan vitamin, mineral, dan serat tidak larut. Namun, konsumsi kacang tolo sebagai makanan sehari-hari terbatas karena susah dicerna. Proses pengolahan kacang tolo belum dikembangkan secara optimal dan kandungan senyawa bioaktif dalam kacang tolo juga belum dimaksimalkan. Kacang tolo yang difermentasi oleh B. subtilis natto dan dicampur dengan bakteri asam laktat sebagai makanan probiotik belum pernah diteliti. Sehingga, untuk mengembangkan senyawa bioaktif seperti kandungan fenolik dan antioksidant, kondisi fermentasi yang optimal seperti waktu fermetasi dan rasio kultur perlu ditentukan. Tujuan dari penelitian ini adalah mengetahui efek dari perbedaan waktu fermentasi dan rasio kultur ditinjau dari aspek fisikokimia seperti pH, warna, aktivitas antioksidan, total fenolik, dan aspek sensoris pada natto kacang tolo. Fermentasi kacang tolo dilakukan melalui 4 tingkat perbedaan rasio dari kedua kultur (100% B. subtilis natto, 75% B. subtilis natto: 25% BAL, 50% B. subtilis natto: 50% BAL, 25% B. subtilis natto: 75% BAL) yang diinkubasi pada 37℃ pada 4 tingkat waktu fermentasi (24, 48, 72, dan 96 jam). Berdasarkan pH, fermentasi natto termasuk dalam fermentasi basa dengan pH sampai dengan 9.08 pada waktu fermentasi 72 jam. Natto kacang tolo menjadi lebih gelap pada waktu fermentasi 72 dan 96 jam dikarenakan senyawa pada mucus menyerap warna dari kacang tolo. Natto kacang tolo dengan rasio Bacillus subtilis var. natto dan bakteri asam laktat yang sama pada waktu fermentasi 72 jam menunjukkan hasil antioksidan (47.97±2.49%) dan total fenolik tertinggi (95.67±2.46 µg GAE/g). Sedangkan dari segi sensoris, natto kacang tolo (75% B. subtilis natto dan 25% bakteri asam laktat) yang dibandingkan dengan natto komersial tergolong dalam kategori penampakan dan aroma yang sama walaupun memiliki skor yang berbeda secara signifikan.

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Semarang, 10th July 2019

Author,

Novani Sutikno

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