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THE EFFECT OF DIFFERENT STORAGE TEMPERATURES ON THE SHELF LIFE OF SPONGE CAKE PREMIX

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ABSTRACT

Sponge cake premix is ready-made mixtures that contain all the ingredients and additives for making sponge cake. The ingredientshave their own characteristic and may affect the shelf-life of sponge cake premix.The shelf-life and performance of sponge cake premix was investigated. Premix products were stored in climate chamber for twelve weeks at 21^{o}C and 27 ^{o}C, and six weeks at 37^{o}C with 75% relative humidity. The shelf-life of sponge cake premix based on batter density was 119 days at 21^{o}C, 56 days at 27^{o}C, and 17 days at 37^{o}C. The Q_{10} value was 3.267. In the product quality test, there were physical and chemical analyses on the product before preparation stage, during preparation stage and after baking. Parameters that will be tested are moisture content and water activity of premix powder, batter density, and cake characteristic (volume expansion and TPA). The correlation analysis showed that the increasing of batter density was followed by the increasing of cake texture attribute, moisture content, and water activity. The increasing of batter density was followed by the decreasing of cake volume expansion.

Keywords:*sponge, cake, premix, temperature, shelf life*

INTRODUCTION

Bakery products are very popular in Indonesia, especially cake product. Producing cakes in quantity is relatively easy if the baker has good, well-balanced formulas, scales ingredients accurately, and understands basic mixing methods well (Gisslen, 2005). Bakery industries saw that opportunity and invented a bakery premix products.

shelf life. This was accompanied by easier storage, for it was sufficient to keep just a single

In Code of Practice for Premix Food Operation (2005), premix is defined as mixtures of food additives or mixtures of one or more food additives with food materials or water used as carriers, not intended for direct consumption by humans. The purpose of premix invention is making a product consist of mixture of ingredients with well-balanced formulas that were easy to use, easy to find, and has a long

product instead of a whole collection of different ingredients.

One important factor that affects premix product shelf life is storage temperature. Storage temperature of premix product may vary from production line until consumer. Therefore, it was very important for the producer to give more attention to the characteristic of premix product under various storage conditions.

Prediction of premix product shelf life can be analyzed by storing the premix product at normal temperature or room temperature (± 27^{o}C). This method gives more accurate data, but it needs a lot of time and costly. Therefore, a method that can predict the premix product shelf life quickly, easily, and cheaply is needed. Accelerated Shelf Life Test (ASLT) is a method that can be used to predict the shelf life and degradation of product quality by storing the product in extreme condition or abnormal condition to accelerate the degradation rate of the product (Kilcast&Subramaniam, 2000).

The objectives of this research are to analyze the effect of different storage temperatures to physical and chemical characteristics of sponge cake premix, to determine the shelf life in each temperature using Arrhenius equation, and to calculate the degradation rate of premix during storage (Q_{10}). Another objective of this research is to analyze the correlation between batter density and sponge cake premix characteristic as well as sponge cake characteristics.

MATERIALS AND METHODS Materials

The ingredients in this experiment are sponge cake premix, fresh whole eggs, oil, water, and margarine. Sponge cake premix contains cake flour, corn starch, sugar, emulsifier, baking powder, and vanilla flavour.

Sponge Cake Premix Storage

Sponge cake premix products were stored in Climacell by using three different temperature treatments (21^{o}C, 27^{o}C, and 37^{o}C). The Relative Humidity (RH) was set at 75%. There were two repetitions for each treatment.

Schedule of Product Quality Test

Observation would be done every 2 weeks for premix that stored at 21^{o}C and 27^{o}C for 12 weeks and every week for premix that stored at 37^{o}C for 7 weeks. On observation period, sponge cake premix products would be used to make sponge cake and the quality of product would be observed.

Preparation of Sponge Cake

Sponge cake premix (500 g), the liquid whole eggs, and water were mixed with with whisk manually for 1 minute. Then the mixture were mixed in Hobart mixer (GMNH77652 with machine speeds from 1 to 3) at speed 3 for 7

minutes. Oil was added after the first-mixing stage. Sponge cake batter with oil addition was mixed at speed 1 for 1 minute. The cake batter (450 g) was poured at round cake pan (20 cm diameter) and baked in electric oven (Mahyih MY-724E) at 180°C for 50 minutes.

Chemical Analysis

Water Activity (a_w)

The water activity of premix would be analyzed using aw meter (RotronicHygropalm AW1). The sponge cake premix was put in a plastic container. The measurement would take about 15 minutes.

Physical Analysis

Batter Density

Batter density would be analyzed using overrun bowl with three repetitions. Batter was filled into overrun bowl immediately after mixing, leveled off using aluminum spatula. Then the batter was weighed. Batter density value was calculated by dividing the weight of a standard cup of batter by the weight of an equal volume of water (Kim & Walker, 1992).

Cake Volume Expansion

Cake volume was measured by the millet seed displacement method (modified from Hui, 2006). To measure volume expansion of sponge cake, firstly, the sponge cake batter was made. After that, the batter was baked in the oven at 180°C for 30 minutes. Volume expansion of sponge cake measurement will count using this equation:

$$V \frac{A\ B}{B} x100\%$$

V= volume expansion

A= volume of sponge cake

B= volume of sponge cake batter

Texture Profile Analysis

Texture properties would be analyzed using Lloyd texture analyzer. The analysis would use round probe (modified from Bourne, 2002). Operating condition was 2 mm/s test speed, trigger was 20 gf, 10 mm penetration distance and 50% compression. There would be five repetitions on different spots. The attribute that would be tested was hardness, springiness, and chewiness.

Analysis of Product Shelf-life

Shelf life will be calculated using ASLT method Arrhenius model ((Kilcast&Subramaniam, 2000). Data will be analyzed using simple linear regression to know K value. The equation was:

$Y = ax + b$

Y = Characteristic value

x = Storage time

a = Characteristic value change rate

b = Characteristic value in early storage

Arrhenius equation will be used for determining the quality degradation rate. The equation was:

$$k \quad k_0 e^{-E/RT}$$

k = reaction rate constant

k_0 = Frequency reaction factor

R = Gas constant (1.986 kal/ml K)

T = Temperature that will be used in Kelvin degrees

E = Activation energy, the value will assumed has constant value in certain temperature.

Shelf life of food product in order 0 could be count using this equation:

$$t_s = \frac{}{}$$

Qo= new sample quality

Qe= crucial sample quality

t_s = time (shelf-life)

k = reaction constant rate

While the shelf life of food product in order 1 could be count using this equation:

$$t_s = \frac{}{}$$

Qo= new sample quality

Qe= crucial sample quality

t_s = time (shelf-life)

k = reaction constant rate

The Q_{10} of the product is calculated using this equation:

$$Q_{10} = \frac{}{0}$$

Q_{10}= ratio between rate of reaction Ea= activation energy

R= Gas constant (1.986 kal/ml K)

T= Temperature (K)

Data Analysis

Data from this research will be analyzed using Microsoft Excel. Analysis on significant level would use Two Way Anova Duncan Test and correlation analysis would use Bivariate Pearson Correlation (2 tailed) on SPSS (Statistical Package for The Social Science) for Windows v.16.00. Data that has been obtained will be showed in tables and graphics.

RESULTS AND DISCUSSION

The result of water activity analysis on sponge cake premix was shown in Table 1. The research showed that the water activitywas not affected much during the storage process of sponge cake premix. At the same time period, the water activity was higher when stored at higher temperature.

Cauvain and Young (2006) stated the humidity within the product is in equilibrium with that of the atmosphere surrounding it. Edward (2007) stated that if the product was held at its own water activity, it would neither gain nor lose weight.

If the product ERH is higher than the relative humidity of the surrounding atmosphere then it will lose moisture and dry out, but if the product ERH is lower than the relative humidity of the surrounding atmosphere it will gain moisture.

In general, methods used to characterized cake batter are batter density analysis. Batter density is one of parameters that affect the quality of sponge cake. Chaiya and Pongsawatmanit (2011) stated that density is a key measurement used to characterize aeration. It is generally measured by weighing a known volume of batter. Kim and Walker (1992) stated that a sufficiently high batter viscosity could keep the air bubble from rising out of batter and providing increased batter stability at room temperature.

Table 1. Sponge cake premix water activity

Week	21°C	27°C	37°C
0	0.598 ± 0.001 a1	0.598 ± 0.001 a1	0.598 ± 0.001 a1
1	-	-	0.623 ± 0.005 c2
2	0.605 ± 0.002 a2	0.662 ± 0.001 b2	0.663 ± 0.001 c3
3	-	-	0.646 ± 0.001 c3
4	0.595 ± 0.001 a3	0.681 ± 0.002 b3	0.666 ± 0.001 c4
5	-	-	0.668 ± 0.001 c5
6	0.611 ± 0.005 a3	0.691 ± 0.002 b3	0.671 ± 0.000 c6
7	-	-	-
8	0.616 ± 0.001 a4	0.716 ± 0.006 b4	-
9	-	-	-
10	0.671 ± 0.004 a5	0.727 ± 0.007 b5	-
11	-	-	-
12	0.641 ± 0.002 a6	0.714 ± 0.011 b6	-

The values are mean ± standard deviation.
The values within the same row followed by different superscripted letters were significantly different between each temperature ($p<0.05$) based on Duncan's test.
The values within the same column followed by different superscripted numbers were significantly different between each sampling point ($p<0.05$) based on Duncan's test.

Batter density analysis on sponge cake premix's batter was measured on batter after addition of oil. The results of batter density after oil added analysis were shown in Table 2.

The research results showed that the longer the storage time, the higher the batter density value. The higher the storage temperature is, the higher the batter density value. Batter density values were increasing during storage period, not only when premix sample was stored at 37°C, but also when premix sample was stored at 21°C and 27°C.

The initial batter density value after oil addition was 360.46 g/L. The batter density values after oil addition at the end of observation period were 424.11 g/L (21°C), 460.29 g/L (27°C), and 690.42 g/L (37°C).

Table 2. Batter density after oil addition (g/L)

Week	21°C	27°C	37°C
0	360.46 ± 5.93 a1	360.46 ± 5.93 a1	360.46 ± 5.93 a1
1	-	-	382.11 ± 3.59 c2
2	367.87 ± 2.14 a2	385.12 ± 4.52 b2	418.50 ± 6.18 c3

3	-	-	440.61 ± 18.67 ^{c4}
4	376.20± 2.73 ^{a5}	402.75 ± 5.18 ^{b5}	468.11 ± 4.22 ^{c5}
5	-	-	551.16 ± 32.08 ^{c6}
6	385.26± 1.98 ^{a4}	413.85 ± 7.56 ^{b4}	690.42 ± 18.88 ^{c7}
7	-	-	-
8	393.03± 3.29 ^{a5}	444.89 ± 5.32 ^{b5}	-
9	-	-	-
10	438.24± 0.64 ^{a6}	461.29 ± 4.64 ^{b6}	-
11	-	-	-
12	424.11± 2.87 ^{a7}	460.29 ± 3.36 ^{b7}	-

The values are mean ± standard deviation.
The values within the same row followed by different superscripted letters were significantly different between each temperature ($p<0.05$) based on Duncan's test.
The values within the same column followed by different superscripted numbers were significantly different between each sampling point ($p<0.05$) based on Duncan's test.

The result of batter density analysis showed that there was increasing of batter density value during storage. The increasing of batter density meant there was coalescence and growth of bubble size which increase buoyancy properties (Cauvain& Young, 2006). Growth of bubble size inside cake batter resulted on de-aeration in cake batter after mixing process. Thus, the batter density was high or became heavier and the batter viscosity became lower because the foam structure was not formed well.

The increasing of batter densitywas caused by the activity of emulsifier that got lower and not effective. Aging had made emulsifier effectiveness reduced. If the effectiveness of emulsifier reduced, then the emulsifier could not stabilize the air bubbles in the cake batter. Cauvain& Young (2006) states that fats and emulsifiers play key roles in the stabilization of the gas bubbles. Such stabilization mechanisms are important in keeping the bubbles trapped in the batter otherwise the relatively low viscosity of the system and the natural buoyancy of the air bubbles would allow them to rise to the surface of the batter and lost to the surrounding atmosphere.

The volume expansion of sponge cake was measured on the difference between cake volume and initial cake batter with initial cake batter. The volume expansion value of sponge cake was decreasing as the batter density was increasing. But there was increasing of volume expansion value of sponge cake. The increasing value of volume expansion could be seen between week 8th (day 56th) and week 10th(day 70th) for premix stored at 21^{o}C, between week 6th (day 42nd) to week 10th (day 70th) for premix stored at 27^{o}C, and between week 3rd(day 21st) to week 4th(day 28th) for premix stored at 37^{o}C.

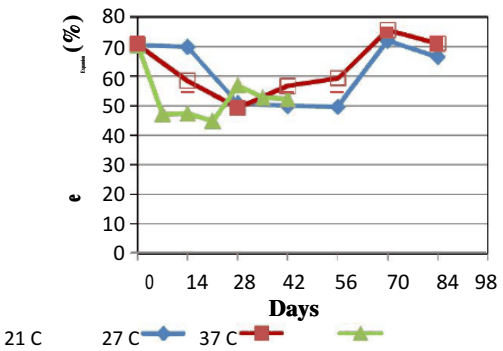

Figure 1. Sponge Cake Volume Expansion

The increasing of volume expansion value of sponge cake was caused by the cake volume did not decreasing much as the cake batter volume. During storage, there was growing gap between cake batter volume and cake volume. It was caused by the difference of length of shelf-life between emulsifier and baking powder. When the volume expansion increasing, it was when the emulsifier was not very effective at stabilize the gas bubble in cake batter. This was resulting in decreasing of cake batter volume. Even though the cake batter has low volume, upon baking the cake volume keep increasing because there was baking powder.

Baking powder used in the mix contained sodium bicarbonate. Sodium bicarbonate is an inorganic compound used to generate carbon dioxide through its reaction with an acid. Carbon dioxide can only be driven off by heating sodium bicarbonate alone once the temperature has reached 90°C (Cauvain& Young, 2006). So only when in the baking process, baking soda would release carbon dioxide.

The other factor affecting volume expansion was sugar. Yamazaki and Kissell (in Kim & Walker, 1992) stated sugar in high-ratio cake formula plays important role in delaying starch gelatinization during cake baking so that the air bubbles can be properly expanded by carbon dioxide and water vapor before cake sets. Thus, the resulting cake structure is highly aerated and has higher final cake volume.

There were three attribute of texture profile analysis on sponge cake premix. The values of hardness, springiness, and chewiness were increasing during storage. The increasing of hardness value meant that the cake became harder during storage. The increasing of springiness value meant that the cake became less springy during storage. The increasing of chewiness value meant that the cake became chewier during storage.

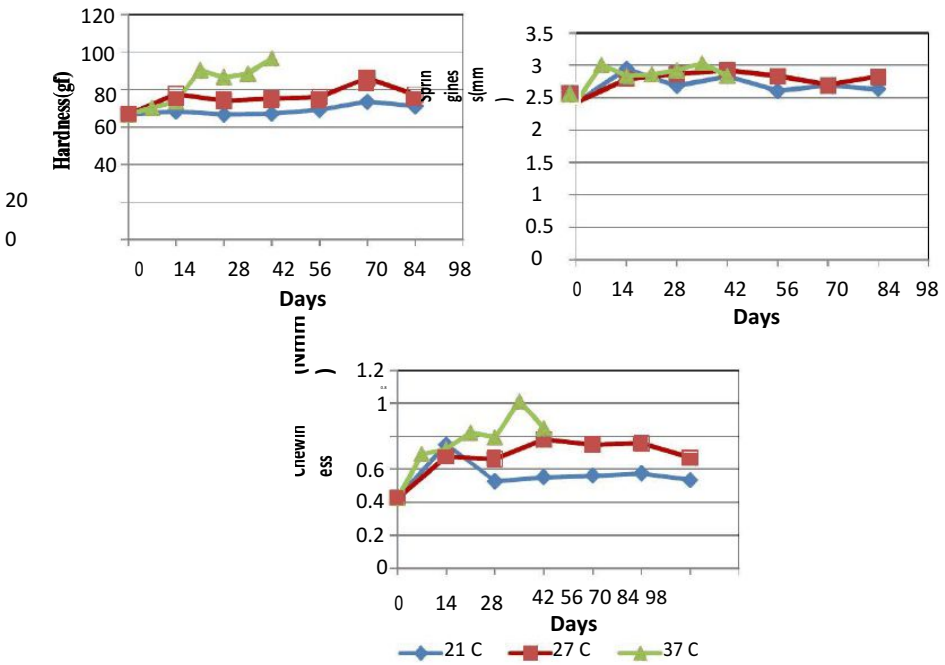

Figure 2. Sponge Cake Texture Attributes

McGinn (in Kilcast&Subramaniam, 2000) stated that shelf life is the period between when the product was made until where the product could be consumed safely based on its physical, chemical, and microbiological properties under recommended storage treatment. Method of predicting the shelf life of a product may be done using Accelerated Shelf-life Testing (ASLT). That is by storing the product at the environment that will make it quickly degraded, be it is at higher temperature condition or higher RH.

The research was done by using the Arrhenius model for 12 weeks (84 days) at 21^{o}C, 27^{o}C, and 6 weeks (42 days) at 37^{o}C. The shelf life prediction of sponge cake premix was done by using cake batter density (after oil addition) value as the main attribute. As known, batter density is an important measurement to characterize the quality of the cake. The critical control point of batter density after addition of oil was 450 g/L.

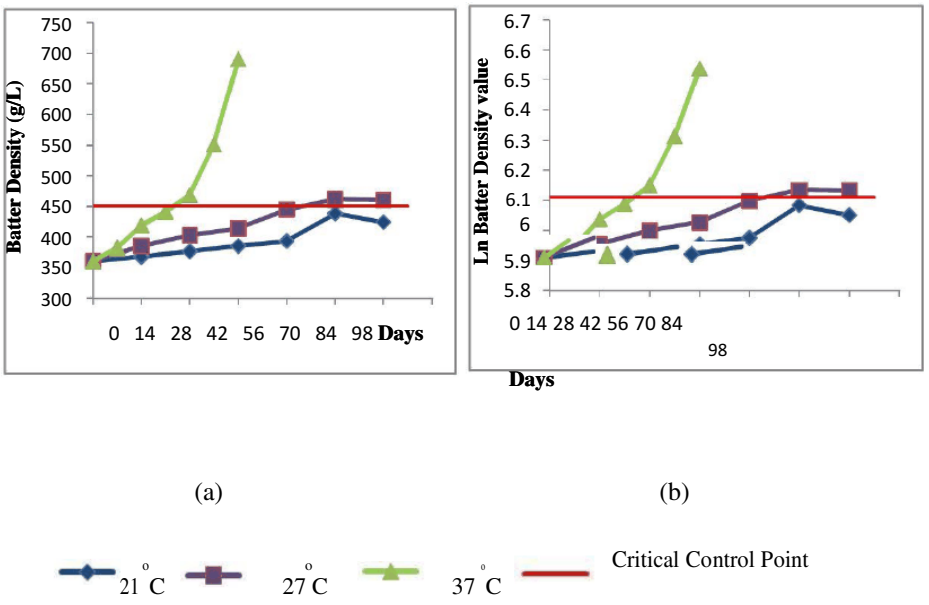

Figure 3. Linear equation of batter density after oil addition;
(a) zero-order; (b) first-order

Table 3.Linear equation of zero-order and first-order sponge cake premix based on batter density after oil addition attribute

Temperature (°C)	Order 0	Order 1
21	y= 0.8891x + 354.83 R² = 0.8603	y = 0.0022x + 5.8749 R² = 0.8763
27	y= 1.2601x + 365.46 R² = 0.9654	y = 0.003x + 5.9047 R² = 0.9613
37	y= 7.0285x + 325.45 R² = 0.865	y = 0.0143x + 5.8372 R² = 0.9223
Total R^2	2.6907	**2.7599**

The total of R^2 value of order 1 is larger than R^2 value of order 0. Reaction of changes in the value of batter density before oil added of sponge cake premix stored at 17°C, 27°C, and 37°C would be calculated using the reaction of order 1.

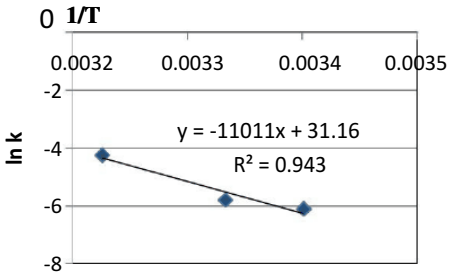

Figure 4. The relation between storage temperature and ln k value of sponge cake premix batter density after oil addition

Figure 4 showed the relation between storage temperature (1/T) and reaction rate constants (ln k) of order 1 forming a curve with linear equation y = -11011x + 31.167. The value of the slope of the curve was 11011, that was the E/R value from Arrhenius equation. Based on Figure 4, ln k values were -6.285 (21^{o}C), -5.536 (27^{o}C), and -4.352 (37^{o}C). The k values were 1.863 x 10^{-3} (21^{o}C), 3.941 x 10^{-3} (27^{o}C), and 1.288 x 10^{-2} (37^{o}C). The shelf-life of the sponge cake premix based on batter density characteristic after addition of oil was 119 days for sponge cake premix stored at 21^{o}C, 56 days for sponge cake premix stored at 27 ^{o}C, and 17 days for sponge cake premix stored at 37^{o}C. The Q_{10} value was 3.267.

CONCLUSIONS

The cake batter density, cake hardness, cake springiness, cake chewiness, and sponge cake premix water activity were increasing during storage. The cake volume expansion was decreasing during storage. The increasing of volume expansion might be caused by the difference between emulsifier shelf-life and baking soda shelf-life.

The shelf life of sponge cake premix based on batter density characteristic was 119 days for sponge cake premix stored at 21^{o}C, 56 days for sponge cake premix stored at 27^{o}C, and 17 days for sponge cake premix stored at 37^{o}C. The Q_{10} of sponge cake premix based on batter density characteristic after addition of oil was 3.267.

REFERENCES

Bourne, M.C. 2002.Food Texture and Viscosity Concept and Measurement 2nd Edition.Academic Press. New York.

Cauvain, S.P. and L.S. Young. 2006. Baked Products: Science, Technology and Practice. Blackwell Publishing. UK.

Chaiya B. and R. Pongsawatmanit. 2011. Quality of Batter and Sponge Cake Prepared from Wheat-Tapioca Flour Blends. Kasetsart J. (Nat. Sci.) 45:305 - 313. (http://kasetsartjournal.ku.ac.th/kuj_files/2011/A1106211655184223.pdf, accessed on September 24th, 2013).

Code of Practice FCH/NU/66-16/04. 2005. Code of Practice of Food Premix Operation.

(http://www.sightandlife.org/fileadmin/data/Books/coppremixoperations.pdf, accessed on September 30th, 2013).

Gisslen, W. 2005.Professional Baking Fourth Edition.John Wiley &Sons, Inc., Hoboken, New Jersey.

Hui, Y.H. 2006.Bakery Products Science and Technology.Blackwell Publishing Professional, USA.

Kilcast, D. and P. Subramaniam. 2000. The Stability and Shelf-Life of Food. Woodhead Publishing Limited. England.

Kim, C.S. and C.E. Walker. 1992. Interaction Between Starches, Sugars, and Emulsifiers in High-Ratio Cake Model Systems. Cereal Chem. 69(2): 206-212.

Yamazaki, W.T., and L.T. Kissel. 1978. Cake Flour and Baking Research: A Review. Cereal Food World 23:114.