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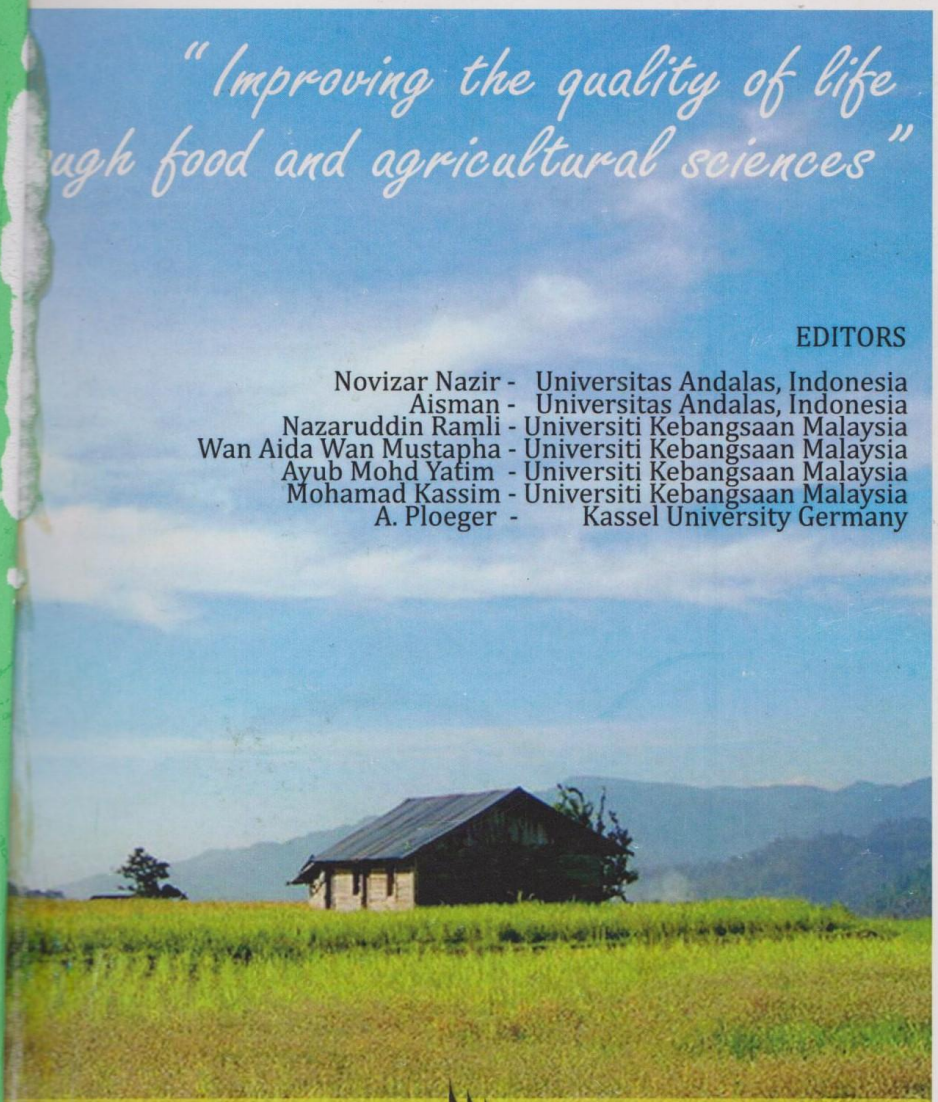

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Content

B19

STUDY ON THE USE OF STABILIZER AND EMULSIFIER TOTHE PHYSICAL AND CHEMICAL PROPERTIES OF ICE CREAM BASED ON AGRICULTURAL PRODUCTS

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ABSTRACT

Pumpkin (Curcubita moschata) and banana (Musa sp) is a cellulose source of agricultural product. Ice cream is kinds of semi-solid food are made by freezing. The softness of the texture is strongly influenced by the role of stabilizer (CMC) and emulsifiers (milk cream). Development of the ice cream industry requires raw materials based on cheap agriculture product; easily available, therefore necessary looked into raw material modification. Pumpkin and banana can be a CMC replacement option as stabilizer and soya bean milk is full cream substitute materials as emulsifiers. The purpose of this research is to determine the effect of raw material modification to the quality of ice cream produced in the views of the physical and chemical properties. This study uses completely randomized design of factorial based on factor perceived namely types of fruit difference (banana and pumpkin) and milk type difference (skimmed milk and soy milk) by four treatment combination and one control. The results of physical measurements show that the highest overrun was ice cream with banana-skimmed milk treatment, while the longest time for melting ice cream was pumpkin-soy milk. Results of the analysis on ice cream chemical composition show that the fat and protein level of ice cream sample is in the quality standard was prescribed

Key word: pumpkin, banana, ice cream

INTRODUCTION

Ice cream usually made for dessert. This dish is popular and favorite, especially among children. Ice cream is also good for children growth because it is made from milk which is rich of protein and energy [1] (Chan, 2008). According to Watt and Annabel 1963 in Wibowo [2], ice cream contains of 4.0% protein, 12.0% fat and 20.6% of carbohydrate. The high fat content of ice cream causes a lot of people are reluctant to consume ice cream, especially in the present, where many products developed low-fat food. Therefore, other materials needed with low-fat content as a mixture ingredient in the manufacture of ice cream.

Ice cream industry will continue to grow as we get ice cream consumers in Indonesia. According to Hidayat [3] in the last five years, the growth rate of ice-cream market in Indonesia at least 20% every year. According to Hadiwerdoyo [4]), ice cream consumption in Sumatra 100% increased in the year [illegible]. Therefore, it is natural if the ice cream [illegible] competition getting tighter because of the [illegible] continues to appear. However, as in the [illegible] in general, the ice cream business [illegible] providing a very promising because the [illegible] very popular in all levels of Indonesian [illegible] children to adults. Moreover, ice cream [illegible] easy, anyone can run and without the [illegible] employees [5] (Anon, 2003). In addition, [illegible] of the Indonesian state in the equator [illegible] the development of ice-cream business [illegible] 2009a). Therefore, the research conducted [illegible] influence of raw material modification to [illegible] ice cream

Ice cream has a lot of variations. Some [illegible] ice cream with a distinctive character and [illegible] from the others. At this time many ice cream [illegible] add other ingredients such as chocolate [illegible] fresh fruits, either mixed or just sprinkled [illegible] addition to taste, these materials can also [illegible] performance of ice cream, thereby increasing [illegible] interest [1] (Chan, 2008). In general, each [illegible] with high solids content can be used in the [illegible] of ice cream. In this study, ice cream was [illegible] using a banana (*Musa paradisiaca* L) and [illegible] (*Curucubita moschata*), because the fruits are [illegible] widely available, have a favorite flavor and [illegible] inexpensive. These fruits serve as a substitute [illegible] fat solids in skim milk. In addition, these [illegible] serve as stabilizers. According to Farrall [illegible] (2008), stabilizers are used in order to [illegible] texture of ice cream that is to keep water [illegible] cream not too cold and reduce the large [illegible] Stabilizer which is often used in the manufacture [illegible] cream and frozen dessert is the CMC (Carboxyl [illegible] Celulose), gelatin, alginates, karagenan, [illegible] and pectin. According to Glicksman [illegible] Setianawati et al [8], the use of CMC as a [illegible] ice cream products will provide better [illegible] used in conjunction with one or more other [illegible] materials

Factors that influence the ice cream texture [illegible] of homogenization, stabilization and [illegible] content. According to Saleh [9], rough texture [illegible] cream is the damage caused by the [illegible] stabilization and homogenization, and slow [illegible]

letting a long wait before it is inserted into . According to Saroso [10], the function of is as body that forms the texture. Whereas contents same as content of cream within ice which is between 8% to 16%. However, the price milk on the market are relatively expensive, so other ingredients instead of skim. This examined the production of ice cream using as a substitute for skim milk

is a nutritious drink, mainly because of the content. But public attention is still lacking, the price of soy milk is cheaper than milk products [11] (Anonymous, 2009[b]). According (2007), soy milk has several advantages, do not contain lactose, the protein does not allergies, low in fat, cholesterol free, highly relatively simple manufacturing technology, costs are relatively inexpensive, and can be processed into ice cream , yogurt, mayonnaise, Meanwhile, according to [13] Anonymous , the composition of the soy milk is similar to milk. Quality of protein in soy milk is similar to milk protein quality. Soy milk is an attractive for the people who can not stand to milk

study aims to determine the effect the use banana and soy milk as a raw material of to the physical quality (overrun and melting the level of consumer preference and chemical fat and protein content) of ice cream

METHODOLOGY

Instruments

instrument used in this study are cutting weighted, Ohaus analytical balances of 210 gram steamer, gas stoves, tools diminutive size blender), Kenwood ice cream maker of 1.5-liter mixer (Philips), plastic containers, ovens, pipettes drops, measuring measuring flask, Soxhlet, filter paper, kjeldahl 250 ml Erlenmeyer and 650 ml desiccators and equipment (refrigerator and freezer).

Material

Materials used in this study were banana, soy milk, skim milk powder, full cream milk sugar, eggs, gelatin, water, aquadestillate, H_2SO_4, 50% NaOH, 0.1 N HCL, and diethyl

Observation Parameters

Variables were observed in this study consisted physical quality of ice cream (overrun, melting chemical properties of ice cream (fat and content) and Organoleptic properties (color, mouthfeel and general appearance)

Design of Experiment

study design used was Completely Randomize (RAL) factorial with two different factors. The is the difference in the fruit as a filling with two types of fruit. The second factor is milk as an ingredient emulsifiers with two types of milk from which the four combinations of treatment and control (without the addition of pumpkin, banana and use skim milk

Research Stages:

Making of Ice cream

Ice cream making process based on Elisabeth et al.[14] (2007) research conduct. Pumpkin and bananas are washed, peeled and steamed, then ground using a blender or food processor separately. Egg yolk in shake until fluffy; add dry ingredients which have been dissolved in water. Followed by pasteurization at 80-85°C temperature for 25 seconds and cooled. The admixture was ready incorporated into ECM, (Ice Cream Maker), then stored in a refrigerator at 4°C temperature for 4 hours to the aging process. Homogenization was repeated for 15 minutes with the ECM and the mixture stored in the freezer until half frozen at a temperature -5°C until 8°C and agitation for 15 minutes. The admixture was ready packed in the container and save it back into the freezer at a temperature of -25°C to-30°C

Physical Quality Testing of Ice Cream

At this stage, the physical properties of the factors that affect the quality of ice cream were analyzed, that is overrun and melting rate. Developing of the ice cream volume was expressed as overrun and calculated based on the volume difference of product to the first admixture volume at the same mass, or based on mass differences of products to the first admixture mass at the same volume [2]. Initial admixture inserted into graduated cylinder at a certain volume and mass. Afterwards, ice cream inserted into a graduated cylinder at the same volume then measured the mass. The melting rate was expressed in minutes, as the resistance of ice cream against melting when served at the room temperature. Overrun percentage can be calculated by following formula.

$$\text{Overrun} = \frac{M1 - M2}{M2} \times 100\%$$

where : M1 = mass of initial admixture
M2 = mass of ice cream

Chemical Quality Testing of Ice Cream

Chemical properties analysis was conducted on fat and protein content which affects the quality of ice cream

Fat Content Test (AOAC, 1995)

Water free sample extracted using ether solvent inside soxhlet extraction apparatus for 6 hours. Extraction result was left in the open air and then dried in an oven at a temperature of 100° C for 30 minutes and cooled inside desiccators until constant weight

$$\text{Fat content } (\%) = \frac{B_2}{B_1} \times 100\%$$

Note : B_1 = Weight of initial sample (gram)

B_2 = Weight of fat (gram)

Protein Level (Kjedahl Method/AOAC, 1995)

Samples that have been refined as much as 0.1 grams inserted into a 30 ml Kjedahl flask, added 2.5 ml of concentrated sulfuric acid, 1 gram of catalyst and boiling stones, respectively. Boiled for 1 to 1.5 hours until the liquid becomes clear. The flask cooled, transferred to the distillation equipment and add 15 ml of 50% NaOH solution, then rinsed with distilled water. Erlenmeyer containing 25 ml of 0.02 N hydrochloric acid placed under the condenser, previously added 2 to 3 drops of nitrogen indicator. End of condenser tube immersed within a chloride solution. Distilled was conducted until 25 ml of distillate within Erlenmeyer. Distillate titrated with 0.02 N NaOH until the green color changes to purple. Blank determination was done in the same way

$$\text{Crude Protein } (\%) = \frac{(Y-Z) \times 1.4 \times 5.25}{W} \times 100\%$$

Note: Y = ml NaOH titre for blank

B = ml NaOH titre for sample

N = normality of NaOH

W = weight of sample (gram)

Data Analysis

Test results data of the physical properties analyzed using analysis of variant (ANOVAs). If there were significantly, the Tukey test performed as subsequent test using 95% of confidence interval (α = 0.05) [15, 16,17] (Djarwanto, 2001; Yitnosumarto, 1993; Zar, 1984)

RESULT AND DISCUSSION

Physical properties of Ice Cream: The influences of Raw Materials against Ice Cream Overrun

Overrun is defined as the development of the ice cream volume toward the initial admixture due to air trapped in ice cream (Arbuckle, 1986 in Wibowo, 1992). The result data of overrun average value shown in Figure 1.

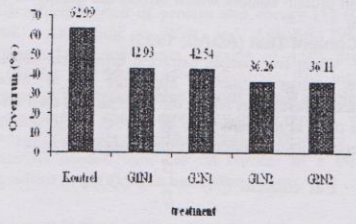

Figure 1. Effect of raw material on ice cream overrun

Figure 1 shows that the use of different types of fruit and milk as raw material of ice cream production may affect ice cream overrun value. The use of different types of fruit and milk as raw material made the overrun value lower. The overrun ice cream value from the highest to the lowest was the ice cream using of the control treatment, G_1N_1, G_2N_1, G_1N_2 and [illegible] respectively. The highest overrun value produced by the G_1N_1 treatment product for 42.93%, but when compared to controls (62.99%), the overrun is still under control. whereas the lowest overrun produced by the G_2N_2 treatment products in the amount of 36.11%. According to Padaga et al. (2005), ice cream which has high-quality has overrun of 70-80%, whereas 35-100% for home industry. Based on this fact, the overrun in this study was still in the ice-cream quality standard. Overrun variation analysis shown in Table 3.

Tabel 3. Table of Anova

Source of Variance	Degree of freedom	Sum of square	Central square	F_{count}
Treatment	3	128,27	42,99	1074,75
Error	8	0,30	0,04	
Total	11	128,57		

Analysis of variants (ANOVA) results showed that the use of combinations of fruits and type of milk give a significantly between treatments in the significance level of 5% toward the ice cream overrun produced, which F_{count} value greater than the value of F_{table} ($F_{count} > F_{table}$).

Results of further tests by the Tukey method showed that the ice cream overrun by using G_1N_1 treatment was not significantly to G_2N_1 treatment, but highly significant to treatment using G_1N_2 and G_2N_2. The discrepancies of the overrun values by using different types of milk presumably because soy milk has a deposition that will further increase the thickness of the ice cream admixture. This is also in accordance with Suprayitno et al. (2001) [12]), that an increase in ICM (Ice Cream Mix) viscosity will increasingly restrict the mobility of water molecules because the space between particles in the ICM becomes increasingly narrow. Narrowness of the space between the particles causes the less of the air coming into the ICM during the agitation so overrun resulting value lower.

The influence of raw materials against Melting rate of Ice Cream

Good quality of ice cream characterized by the resistant to melting. Melting quality assessed by [illegible] in the mouth, i.e. whether the product can easily melt and give the impression of gliding easily in the mouth or stiff and difficult to melt. Melting power is identical with the time required to completely melting at room temperature. (Setianawati et al., 2002). The [illegible] averaging values calculated of melting rate can be seen in Figure 2

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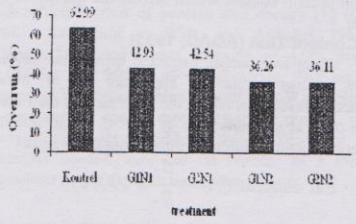

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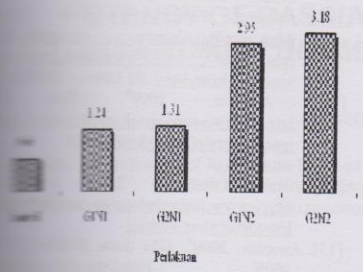

Figure 2. Material effect on the ice cream melting rate

Figure 2 shown that the use of different types of milk as raw material affects the melting rate of ice cream. Melting time of ice cream will be longer by using different types of fruit and milk as raw material. The melting rate of ice cream, from the highest to the lowest was the sample of ice cream with control treatment (G_0N_0), G_2N_1, G_1N_2 and G_2N_2, respectively. The highest melting rate produced by the product with control treatment Go, namely 0.66. The lowest melting rate produced by the product with G_2N_2 treatment in the amount of 3.18. The overrun analysis is shown in table 4.

Table 4. Anova Table

	Degree of freedom	Number of Squares	Central Squares	F_{count}	F_{table} (5%)
	3	10,70	3,57	19,817	4,07
	8	1,44	0,18		
	11	12,14			

Analysis of variants (ANOVA) showed that the treatments of fruits and milk type was significantly between treatments in the 5% level of significance of the ice cream melting rate that is known which F_{count} value greater than the value of ($F_{count} > F_{table}$) . Tukey tests performed as a follow-up test to see the significantly between treatments.

Further tests results of Tukey method showed that ice cream melting rate on G_2N_2 treatment was significantly to G_0N_0 samples, but significantly to G_0N_0, Ice cream made of G_1N_1 was significantly to G_0N_0 samples This shows that the treatment of ice cream by using different fruits, but with the same milk type, does not provide a significant to the melting rate of ice cream sample. The combination of ice cream with different kinds of fruit significantly to the melting rate of each ice cream sample. When compared to the melting rate of ice cream for 1.25 minutes, the rate of the ice cream melts in this study was not much different. According to [8], the rate of melting ice cream is related to the ice cream texture. Ice cream with rough texture would melts easily because of low of viscosity and melting resistance.

Chemical Properties of Ice Cream

Influence of Raw Material against Ice Cream Fatty contents

Fat test conducted on the most preferred panelist sample which is ice cream made of skimmed milk and pumpkin. With the percentage of skim milk and pumpkin of 7.5%: 2.5% shows contained fat amounted to 9.966%. The results of this test were under the SII quality standard, where the allowed fat content at least 8%. Whereas Padaga and Beads [18] categorize the ice cream with fat content of 10-12% in the standard category. This decrease in fat levels presumably because the use of pumpkins in the ice cream. Pumpkin has a relatively low fat content in the amount of ± 0.30%

Influence of Raw material against protein contents of Ice Cream

Protein test conducted on the most preferred panelist sample which is ice cream made of skimmed milk and pumpkin. The test results on the protein content of ice cream by using skim milk and pumpkin (7.5%: 2.5%) showed levels of protein are contained by 4.3311 grams and according to the SII (Indonesian Industrial Standard) No. 1617 of 1985 in [18] there is no quality standard for protein content of ice cream. But according to Buckle et al. (1985), the average composition of ice cream for the protein content amounted to 4.6 grams. Meanwhile, when compared to fat content in the 4 grams of diamond ice cream, then the protein content of ice cream samples in this study was still higher. High content of fat in ice cream sample suspected because of pumpkin has a protein content of ± 1.10% whereas skim milk of ± 3.5%

CONCLUSIONS

Based on research observations, the influence of modifications to the quality of ice cream can be concluded as follows:

1. Ice cream which has the highest overrun was made from bananas-skim milk.
2. banana-skim milk ice cream was melts the fastest, whereas melting power of pumpkin-soy ice cream (G_2N_2) was the longest.
3. Chemical composition of ice cream shows that the levels of fat and protein content of ice cream samples still in the quality standard.

To do further research on consumer acceptance of ice cream, technique/method of making ice cream and shape of the final product consumer preferred.

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