The Innovation of Making Powder Milk From Jackruit Waste (Artocarpus Heterophyllus) with Maltodextrin Addition

Rita Sunartaty¹, Irmayanti², dan Mirza Afwadi³

¹Food Technology Division Program, Agriculture Faculty, Serambi Mekkah University
²Agricultural Industry Technology Division Program, Agriculture Faculty, Serambi Mekkah University
³Food Technology Division Program, Agriculture Faculty, Serambi Mekkah University

Abstract. Research has been carried out with the title of the innovation of making powder milk from jackfruit seed waste (Artocarpus Heterophyllus) with the addition of Maltodextrin which is aims to produce low-fat milk and have economic value. This study using a completely randomized design model (CRD) design consisting of 2 factors, the addition of Maltodextrin (M) consisting of 3 levels, which is M₁=5%, M₂=10%, M₃=15% and Drying Time (T) which consists of 3 levels, namely T₁=12 hours, T₂=14 hours, T₃=16 hours. The parameters observed in this study were water content, fat content and organoleptic taste, color and aroma. The results showed that the addition of maltodextrin (M) had a very significant effect (P≤0.01) on fat content, moisture content and no significant effect (P> 0.05) on organoleptic test (color, aroma and taste) of powder milk from jackfruit seed waste. Drying time (L) had a very significant effect (P < 0.01) on moisture content and no significant effect (P > 0.05) on fat content and organoleptic test (color, aroma and taste) of jackfruit seed powder. The interaction between addition of maltodextrin and drying time (ML) had a very significant effect (P < 0.01) on moisture content and no significant effect (P > 0.05) on fat content and organoleptic test (color, aroma and taste) of milk powder from jackfruit seed. The best treatment for addition of 15% maltodextrin 16 hours drying time (M₃L₃) produces good quality of powder milk with chemical properties 5.27% moisture content, 1.43% fat content, 4.17 (likes) organoleptic taste, flavor 4.13 (likes) and colors 4.00 (likes).

1. Introduction
The need for food is increasing by the increasing of population. To fulfill amount of food needs, various efforts could be made, such as by utilizing agricultural products. Agricultural products are processed so that it will provide added value in the agricultural processing chain. One of them is by using waste. The potential of jackfruit seed waste (Artocarpus heterophyllus) has not been utilized optimally. The low utilization of jackfruit seeds in the field of food is only about 10% due to the lack of community interest in processing jackfruit seeds. Though jackfruit seed starch could be hydrolyzed to jackfruit seed starch and processed into glucose syrup. Jackfruit seeds have many useful ingredients, including minerals and vitamins. The content of vitamin A, vitamin C and vitamin B1. Mineral contents such as calcium (Ca), phosphorus and other minerals such as iron. The content of vitamin B1
in jackfruit seeds is the highest compared to other carbohydrate food sources (Adikhairani, 2012). Based on these problems, jackfruit seed waste needs to be utilized considering jackfruit seeds contain amount of nutrients that produce useful products. One of them is the processing of jackfruit’s seeds could be used as manufacture of powdered milk products with combination of maltodextrin. This thing is very good to do because jackfruit seeds contains calcium about 33%, fat 0.1% and protein 4.2% which is useful as supporting ingredient in milk production. In addition, jackfruit seeds are easily available so that they can reduce agricultural waste [1].

One of method to extend the shelf life of milk is to turn it into powder (dry particle granules). Milk powder has been produced starting 100 years ago and has grown rapidly in the past 50 years. The production of milk powder is one of the most successful and important ways of preserving milk[2]. Previous research has been carried out by [3] about the use of jackfruit seeds as an ingredient in production milk. The results showed that the best treatment was found in maltodextrin 10% variation and 0.4% sodium metabisulfite. Then [4] has also conducted previous research on the manufacture of powder soybean milk. The results showed that the best treatment was at 15% maltodextrin concentration within 14 hours drying time. The renewal of this research with previous research is looking at variations in the duration of drying jackfruit seeds powder toward the concentration of maltodextrin. The results of this study are expected to contribute of jackfruit seed waste usage to be used as economic value products. Based on the description below, the researcher wants to examine about. The purpose of this study include: (1) To determine the effect of adding maltodextrin toward the milk quality, (2) To find out the best drying time for milk quality, (3) To determine the effect of interaction with the addition of maltodextrin and the duration of drying toward the milk quality.

2. Methodology
The ingredients used are include jackfruit seeds as basic ingredients, chemicals including: Sodium metabisulfite, maltodextrin and aquadest. Research Implementation of Making milk powder from jackfruit seeds according to Veny (2014), as describe below:
3. Results and Discussion

Based on data of the analysis shows that the water content ranged between 5.27 - 9.29%, with an average of 6.69%. The highest moisture content was obtained on the addition of 10% maltodextrin (M2) with 12 hours drying time (T1) of 9.29%, while the lowest average moisture content was obtained by adding 15% maltodextrin (M3) within 16 hours drying time (T3) of 5.27%, the average data of addition of maltodextrin and drying time could be seen in Table 1.

### Table 1. Average data analysis of milk contents of jackfruit seed powder

| Penambahan maltodekstrin (M) | Lama pengeringan (T) | T1= 12 jam | T2= 14 jam | T3= 16 jam |
|-----------------------------|----------------------|------------|------------|------------|
| M1 = 5%                     |                      | 7.47       | 6.64       | 6.19       |
| M2 = 10%                    |                      | 9.29       | 7.52       | 5.48       |
| M3 = 15%                    |                      | 6.18       | 6.16       | 5.27       |

Based on the analysis of variance showed that the addition of maltodextrin and drying time and the interaction between the addition of maltodextrin and drying time had a very significant effect (P≥0.01) on the moisture content of powder milk from jackfruits seeds. The effect of the interaction of addition of maltodextrin and drying time can be seen in Figure 4.1.

**Figure 1. Milking Powder Process**

**Figure 2. The Effect of interaction between maltodextrin addition and drying time on water content from jackfruit seed powder milk (BNT0.01=1.11 and KK=7.04)
(The same notation shows an unreal differences.)**
From Figure 2 shows that the addition of maltodextrin and drying time decrease the water content produced by jackfruit seed powder milk. It is suspected that the addition of high concentration of maltodextrin caused the increasing of water content. It is because of the characteristic of maltodextrin which is hygroscopic (the ability to absorb water) so that the moisture content increases by the addition of maltodextrin. According to [5] dextrin is hygroscopic which can absorb water in the material but even though it can absorb water, when it is drained the water absorbed by the maltodextrin will be released. Therefore, the higher concentration of maltodextrin caused more water absorbed and more water is evaporated so that the moisture content of the material tends to decrease.

Water content is the percentage of water content of a material that can be expressed based on wet weight (wet basis) or based on dry weight (dry basis). Water is a component in food ingredients that can affect the organoleptic and taste of its food that contains a certain amount of water in dry foods. Moisture is very important to determine the durability of food ingredients because it affects physical, chemical, microbiological changes and enzymatic changes. Water content in food ingredients also determines on consumer acceptance, freshness and durability of ingredients. High water content in the ingredients causes low material resistance. To extend the durability of an ingredient, some of the water in the ingredients must be removed in various ways depending on the type of material [6].

Based on the data from the analysis shows that the water content of powder milk from jackfruit seed does not comply with quality requirements of instant powder as food ingredients for all. According to SNI requirements, the maximum water content of milk powder from jackfruit seed is about 5%, while the water content produced from this research is about 6.69%

**Fat Level**

From the Analysis result is found that the average Fat level ranged from 0.14 to 1.43%, with an average of 0.60%. The highest fat content was obtained in addition of 15% maltodextrin (M3) with 16 hours drying time (T3) of 1.43%, while the lowest average fat content was obtained by the addition of 5% maltodextrin (M1) and 16 hours drying time (T3) is about 0.14%, the average data of addition of maltodextrin and drying time showed in Table 2 below.

| Maltodextrin Addition (M) | Drying Time (T) | T1= 12 hours | T2= 14 hours | T3= 16 hours |
|---------------------------|-----------------|--------------|--------------|--------------|
| M1 = 5 %                  |                 | 0.27         | 0.52         | 0.14         |
| M2 = 10%                  |                 | 0.61         | 0.35         | 0.85         |
| M3 = 15%                  |                 | 0.69         | 1.02         | 1.43         |

Based on the analysis of variance showed us that the addition of maltodextrin significantly effect (P ≥0.05) while the drying time and interaction between the addition of maltodextrin and drying time had no significant effect (P> 0.05) on the fat content of milk powder from jackfruit seed. The effect of the addition maltodextrin can be seen in Figure 2.
Figure 3. The effect of maltodextrin addition toward the fat content of jackfruit seed powder milk (BNT$_{0.05}$=0.85 and KK=39.95). (The same notation shows an unreal difference)

From Figure 3 it can be seen that the addition of maltodextrin affects the fat content produced by jackfruit seed powder milk. This is presumably because maltodextrin has "mouthfeel" which is similar as butter oil and is used as a fat substitute or a material that provides fat in food formulations such as margarine, cheese, salad dressings, dairy products and frozen foods. [7]. Based on the results is shown that the fat content of jackfruit seed powder milk is comply with the quality requirements of instant powder as food ingredients for all. The SNI requirements of fat content from jackfruit seed powder is maximum of 1.5%, while the fat content produced in this research is about 0.60%

**Organoleptic Test**

Organoleptic testing is a test based on the sensormethode. The data processing method that is often used is by using variance analysis / analysis of variance (Analysys of variance or ANOVA). This following data below is result of organoleptic testing collected from the senses of 15 panelists who were given the task of assessing their actions against a number of examples. In this part of the test the panelists were asked to determine the level of their preference for sweetness from 5 with the score of impression as follows: 1: very dislike, 2: dislike, 3: dislike, 4: Likes and 5: very like).

**Flavor**

Flavor is one of the main factors in food that can be accepted by consumers. The flavor is produced by volatile compounds from a food product, when the product is in the mouth, the aroma will be detected by the olfactory system in the nose (Winarno, 2004). From the data obtained of the analysis, the organoleptic flavor test ranged from 3.63 (like) - 4.13 (like) with an average value about 3.99 (like). The highest organoleptic flavor test was obtained on addition of 15% maltodextrin (M$_3$) and 16 hours drying time (T$_3$) of 4.13 (like), while the lowest organoleptic value of flavor was obtained by adding 10% maltodextrin (M$_2$) and drying time 12 hours (T$_1$) of 3.63 (likes). The average value from the analysis of organoleptic flavor test can be seen in Table 4.3.
Table 3. Average Value analysis result of Organoleptict Test of jackfruit seed powder milk

| Maltodextrin Addition (M) | Drying Time (T) |   |   |   |
|--------------------------|----------------|---|---|---|
|                          | $T_1$ = 12 hours | $T_2$ = 14 hours | $T_3$ = 16 hours |   |
| $M_1 = 5\%$             | 4.03           | 4.07           | 4.00           |   |
| $M_2 = 10\%$            | 3.63           | 3.87           | 4.10           |   |
| $M_3 = 15\%$            | 4.07           | 4.03           | 4.13           |   |

Based on the analysis of variance showed that the addition of maltodextrin and drying time and the interaction between addition of maltodextrin and drying time had no significant effect ($P \leq 0.05$) on the organoleptic test of the flavor of jackfruit seed powder milk. The relationship of drying duration with hedonic value of flavor shows the longer drying time cause the decreasing level of panelist’s dislike toward the flavor of jackfruit seed powder milk. This is caused by the flavor of jackfruit seeds is thought to be lost due to drying time. In accordance with Iqbal's statement (2014) that drying has weaknesses such as changes in taste. When water evaporates from the surface of a foodstuff, a small amount of volatile substances will be carried away. The higher concentration of dextrin caused the higher of hedonic value of jackfruit seed powder milk. This is due to the 5% concentration does not cause the distinctive flavor of jackfruit seed powder milk but the dominant flavor detected is burnt, while with a concentration of 15% maltodextrin the flavor of jackfruit seed powder milk can be slightly maintained.

Color
Color is the first assessment of the product to be tested (visual). The color of one product greatly affects consumer interest where color is the main part of the product in determining the level of consumer acceptance of a product. A material that is considered nutritious, tasty and has a very good texture will not be eaten if it has an unsightly color seen or gives the impression that it has deviated from the color that should be (Winarno, 2004). From the data obtained from the analysis, the color organoleptic test ranged between 4.00 (likes) - 4.50 (likes) with an average of 4.19 (likes). The highest color organoleptic test was obtained on the addition of 10% maltodextrin ($M_2$) with 16 hours drying time ($T_3$) of 4.50 (like), while the lowest color organoleptic average value was obtained by adding 15% maltodextrin ($M_3$) within 16 hours ($T_3$) drying time is about 4.00 (likes). The average data from the analysis of the color organoleptic test can be seen in Table 3. Based on the analysis of variance showed that the addition of maltodextrin and drying time and the interaction between the addition of maltodextrin and drying time had no significant effect ($P \leq 0.05$) on the color organoleptic test of the jackfruit seed powder milk. The color of the jackfruit seed powder milk looks white. This is because the addition of maltodextrin concentration added more and more so the color brightness level is also getting higher. Maltodextrin has a color that tends to be white so that when mixed with white jackfruit seeds will give it a bright color related to the number of maltodextrins addition, the level of brightness of jackfruit seed powder milk is also increasing. Although maltodextrin has low browning properties, high temperature exposure can cause discoloration to become blackish brown [8].

Taste
Taste is one of the main factors that influence one's acceptance of food acceptable. The taste of a food has an important role, because with the taste indicator, consumers would feel they could know and judge whether the food is good or not, the taste in a food is influenced by the basic ingredients used (Winarno, 2004). From the data obtained from the analysis, shows that the sense of organoleptic test ranged from 4.07 (likes) - 4.27 (likes) within an average value of 4.17 (likes). The highest taste of organoleptic test was obtained with addition of 15% maltodextrin ($M_3$) with 12 hours drying time ($T_1$) of 4.27 (like), while the lowest taste of organoleptic value was obtained by addition of 5% maltodextrin ($M_1$) and drying time 12 hours ($T_1$) of 4.07 (likes). The average data of the analysis of the taste of organoleptic taste can be seen in Table 4.5.
Based on the analysis of variance test showed that the addition of maltodextrin and drying time and the interaction between the addition of maltodextrin and drying time had no significant effect (P ≤ 0.05) on the organoleptic test of the taste of jackfruit seed milk powder. The relationship between maltodextrin concentration and taste score showed that more maltodextrins were added, further increasing the taste score of jackfruit seed milk powder. This is related to [8] that the addition of maltodextrin caused in instant beverage powder coated with a layer of maltodextrin so that the flavor components in it could be maintained.

4. Conclusion
The addition of Maltodextrin (M) has a very significant effect (P≤0.01) on fat content, moisture content and no significant effect (P≤0.05) on organoleptic tests (color, flavor, and taste) on milk powder from jackfruit seeds. Drying time (L) has a very significant effect (P≤0.01) on water content and has no significant effect (P≤0.05) on fat content and organoleptic test (color, flavor and taste) of milk powder from jackfruit seeds. The interaction between addition of maltodextrin and drying time (ML) had a very significant effect (P≤0.01) on moisture content and had an unrealistic effect (P≤0.05) on fat content and organoleptic test (color, flavor and taste) of milk powder from jackfruit seeds. The best treatment for addition of 15% maltodextrin and 16 hours drying time (M₃L₃) produces milk powder with good quality with chemical properties below, 5.27% moisture content, 1.43% fat content, 4.17 (likes) organoleptic taste test, aroma 4.13 (like) and color 4.00 (like)

References

[1] Adikhairani, “Utilization of Jackfruit Seeds (Artocarpus heterophyllus L.) Waste for Making Various Types of Food in the Framework of Diversifying Food Supply,” Universitas Negeri Medan, 2012.
[2] Town, Food Storage Techniques. Jakarta: Erlangga, 2005.
[3] N. Iqbal, “Study of Jackfruit Fruit Processing in Instant Drink Making,” Universitas Muhammadiyah Sumatera Utara, 2014.
[4] Veny, “Effect of Maltodextrin Amount and Duration of Drying on Organoleptic Properties of Yoghurt Soy Milk Powder,” Universitas Negeri Semarang, 2014.
[5] P. Wulansari and S. Anggarini, “Application and Feasibility Analysis of Natural Antioxidant Red Powder Dyes from Areca Fruit Extract as a Substitute for Synthetic Dyes in Food Products,” Ind. J., vol. 1, no. 1, pp. 1–9, 2010.
[6] F. G. Winarno, Food and Nutrition Chemistry. Jakarta: PT Gramedia Pustaka Utama, 2014.
[7] Y. H. Hui, Encyclopedia of Food Science and Technology. New York: Jhon Wiley and Sons Inc, 1992.
[8] E. Putra, Purwijantingsih, and F. S. Pranata, “Quality of Mangosteen (Garcinia mangostana Linn.) Instant Powdered Beverages with Maltodextrin Variation and Heating Temperature,” J. Biol., vol. 1, no. 1, pp. 1–15, 2013.