J. Agric. Food. Tech., 1(11) 200-203, 2011

© 2011, TextRoad Publication

ISSN 2090 – 424X
Journal of Agriculture and Food Technology
www.textroad.com

PROCESS ENGINEERING OF MAKING POWDER MILK WITH DRYING FOAM-MAT METHOD (STUDY OF INFLUENCE TYPE AND EMULSIFIER CONCENTRATION ON MILK POWDER PHYSICAL QUALITY)

Arie Febrianto M*, Sri Kumalaningsih, Ta' Gayuh Gilang Ghozali

Department of Industrial Agricultural Technology, Faculty of Agricultural, University of Brawijaya, Malang, Indonesia

ABSTRACT

This study aimed to determine the best results from the addition of the type and emulsifier concentration (Tween 80 and lecithin) on the physical quality of milk powder made by the foam-mat drying methods. Experimental design used is randomized block design with nested patterns using two treatment factors. There is the type of emulsifier and the concentration of each emulsifier is used. The first factor consists of two types of emulsifier level, Tween 80 and Lecithin. The second factor is the concentration of each emulsifier consists of three levels, Tween 80 with concentration of 0.5%, 1%, and 1.5% v / v of fresh milk, while for lecithin concentration used of 2.5%, 5%, and 7.5% v / v of fresh milk, each level is repeated three times. Data was analyzed using SPSS 17 software. The results showed that the best results from the addition of milk powder type and concentration of emulsifier when adding of Tween 80 with 80 with a concentration of 1% v / v of fresh milk. Milk powder produced by the foam-mat drying method with the addition of 1% v / v Tween 80 fresh milk produced milk powder solubility value of 34.01%. The water content value in milk powder of 3.11% and milk powder yield value of 21.32%. Average of protein content is 11.089% that they are not enough of the milk powder SNI value that reached 25%.

Keywords: Milk, Foam-mat Drying, Emulsifier, physical quality, milk powder, SPSS.

INTRODUCTION

Milk is a perishable food, because it has high water content, about 87% - 90%, and has a complete nutritional value; therefore it is necessary for processing to maintain quality [1]. Another alternative in the processing of milk is milk powder manufacture. Powdered milk is evaporated milk as much as possible so that the water loses and the milk becomes powder. The water content in milk powder is about 5% [2].

In this study we used Foam-Mat Drying methods and vacuum dryers to make milk powder. In the manufacture of instant beverages by using the foam-mat drying methods is necessary to add filler material. The goal to adding filler material are coating the flavor components, increasing the volume and speeding drying, also preventing heat damage [3]. Heater used is drying vacuum. In the foam-mat drying method, besides requiring filler filler as well as an emulsifier as lowering the surface tension between the milk powder produced and water as a solvent so that the milk powder can soluble in water.

So far this has never disclosed that the combination of type and emulsifier concentration that added in the production of milk powder by foam-mat drying method affects the quality of the physical (solubility and water content) of milk powder. The study design using a randomized block design with nested patterns using two treatment factors, the type of emulsifier and the concentration of each emulsifier is used. The first factor consists of two types of emulsifier level of Tween 80 and Lecithin. The second factor is the concentration of each emulsifier consists of three levels. The purpose of this study was to determine the best results from the addition of the type and concentration of emulsifier (Tween 80 and lecithin) on the physical quality of milk powder made by the foam-mat drying methods.

MATERIALS AND METHODS

The main ingredient used to make milk powder is fresh milk obtained from one breeder in the Batu, a town in East Java. Additional materials used were Lechitin and Tween 80 as emulsifiers and Dextrin as filler.

Treatment design using randomized block design with nested patterns using two treatment factors are the type of emulsifier and the concentration of each emulsifier is used. The first factor consists of two types of emulsifier level of Tween 80 and Lecithin. The second factor is the concentration of each emulsifier consists of three levels is to use the Tween 80 concentration of 0.5%, 1%, and 1.5% v / v of fresh

***Corresponding Author**: Arie Febrianto M, Department of Industrial Agricultural Technology, Faculty of Agricultural, University of Brawijaya, Malang, Indonesia. E mail: ariefebrianto15@yahoo.com.

milk, while for lecithin concentration used of 2.5%, 5%, and 7.5% v / v of fresh milk, each level is repeated three times.

Stages of making milk powder from fresh milk is fresh milk is measured as much as 200 ml or less than 205.6 grams, then mixed with each emulsifier in accordance with a predetermined experimental design. Mixing is done on glass size 500 ml beaker and stirred with a mixer around 3 minutes.

Then, milk mixed with dextrin as the filler as much as 12.93% ˜ 13% w / v of fresh milk. Mixing is done on glass size 500 ml beaker and stirred with a mixer for ± 5 minutes. Once the pan is poured on a stainless steel 25 x 30 cm with a thickness of ± 5 mm and inserted in a vacuum drying which has set the temperature and pressure. The temperature used in the vacuum dryer is ± 61 ° C and a pressure of atm -1 ±. After that, mixed milk is checked every 90 minutes which aims to determine the condition of milk so as not to scorch. Estimated time required for drying into powder milk ± 4 hours. Last, dry milk blended and then filtered with ± 80 mesh size.

Data processing is done using SPSS 17 software. Selection of the best alternative based on Multiple Attribute method.

RESULTS AND DISCUSSION

Solubility

Based on research that has been done, an average of milk powder solubility capability with the addition of lecithin and Tween 80 as emulsifier can be seen in Table 1.

Table 1. Average of Powder Milk Solubility Capability with the Addition of Lecithin And Tween 80 As Emulsifier

Emulsifier	Concentration (% v/v fres milk)	Average (%)	Notation
Lecithin	2,5	47,17	a
Lecithin	5	49,64	b
Lecithin	7,5	30,32	b
Tween 80	0,5	27,29	ab
Tween 80	1	37,03	ab
Tween 80	1,5	44,41	ab

From the Table 1, it can be seen that in general the solubility increasing of the type of emulsifier lecithin and Tween 80 is directly proportional to the emulsifier concentration which is added, the greater the concentration of which is added the higher the solubility.

The diversity analyses provide results that types of emulsifiers significantly affect the solubility of milk powder. The concentration of emulsifier which is added also significantly affects the solubility of milk powder on the type of emulsifier Tween 80 and lecithin emusifier. This means that the interaction between the emulsifier type factors with a concentration factor that is used on each type of emulsifier significantly different.

This is because of the ability of each emulsifiers type in lowering the surface tension is different. Differences in the ability of lowering the surface tension on any type of emulsifier used because of HLB values (hydrophilic-lipophilic balance) are different. According to the International Flora Technologies, Ltd. [4], the HLB system provides a choice of emulsifier to be used to meet the requirements of the emulsion type.

It is based on the balancing between hydrophilic and lipophilic proportions that give each function. Also in use, the amount of emulsifier concentration also affects the ability to lower the surface tension of an emulsion.It is fit with the statement delivered by Sumingkrat (1992) in [5] which states that the Critical Micelle Concentration or CMC is one of the important properties of surfactants which demonstrate a critical surfactant concentration limits in a solution.

The use of emulsifier doses beyond the CMC price resulted the condition of emulsion behind (reemulsification) which indicated by the resulting product becomes soluble in the solvent water and lumps occur, as it also is not economically profitable.

Average milk powder solubility is influenced by the interaction of the addition of Tween 80 emulsifier has a regression equation (Y: 29.643 - 3.697 X 6.047 + X^2) where Y is the solubility of the output, while X is the concentration of Tween 80 were added.

Average milk powder solubility is influenced by the interaction of the addition of emulsifier lecithin has a regression equation (Y: 30.869 + 5.914 X - 0.465 X^2) where Y is the solubility of the output, while X is the concentration of lecithin is added.

Water Content

Based on the research as above, the average water content of milk powder with the addition of lecithin and Tween 80 as emulsifier can be seen in Table 2.

Table 2 Average Moisture Milk Powder with Addition of Lecithin and Tween 80 as Emulsifier

Emulsifier	Concentration (% v/v fres milk)	Average (%)	Notation
Lecithin	2,5	5,11	a
Lecithin	5	9,67	a
Lecithin	7,5	12,67	a
Tween 80	0,5	4,89	b
Tween 80	1	3,11	ab
Tween 80	1,5	4,78	c

From Table 2 it can be seen that the average of the highest water content obtained from treatment of the addition of lecithin emulsifier with concentration of 7.5% v / v of fresh milk. While, the average of the lowest water content obtained from treatment of the addition of Tween 80 emulsifier with concentration of 1% v / v of fresh milk.

Results of diversity analysis provide results that in general the emulsifier type is very real effect on the water content of milk powder. The emulsifier concentration which is added also significantly influenced the water content of produced milk powder, in the addition of Tween 80 and lecithin as emulsifier. In other words in general the using type and emulsifier concentration in the manufacture of milk powder is very real effect on the water content of milk powder produced.

This is because the type of emulsifier used affects the water content contained in milk powder produced. Natural emulsifier made without going through a complicated process will remain high water content, so the moisture content of milk powder is also higher. Tween 80 is one of the artificial emulsifier processed artificially so it's possible to have less water content compared with natural emulsifiers. Besides differences in water content in each additional type of emulsifier concentration is also due to differences in the number of each type of emulsifier is added, the average addition of emulsifier lecithin greater than Tween 80. If HLB of the emulsifier matches or close to the required HLB value in an emulsion it will be more perfect in lowering the surface tension between oil and water contained in the emulsion, so that less the water or oil content because both can be mixed evenly.

The mean value of the water content of milk powder which is influenced by the interaction of the addition of Tween 80 emulsifier has a regression equation (Y: 4.094 - 0.583 0.551 X^2 + X) where Y is the water content is generated, while X is the concentration of Tween 80 were added.

The mean value of the water content of milk powder which is influenced by the interaction of the addition of emulsifier lecithin has a regression equation (Y: 3.538 0.750 + 0.067 X^2 + X) where Y is the water content is generated, while X is the concentration of lecithin is added

The yield

Based on research conducted, average yield of milk powder with the addition of emulsifier lecithin and Tween 80 can be seen in Table 3.

Table 3 Average yield of milk powder with the addition of Emulsifier Lecithin and Tween 80

Emulsifier	Concentration (% v/v fres milk)	Average (%)	Notation
Lecithin	2,5	21,38	a
Lecithin	5	23,63	a
Lecithin	7,5	24,36	a
Tween 80	0,5	20,75	b
Tween 80	1	21,32	b
Tween 80	1,5	22,01	b

From Table 3 it can be seen the highest yield average values obtained from the addition of lecithin emulsifier concentration of 7.5% v / v of fresh milk. While, the lowest average yield obtained from the addition of emulsifiers Tween 80 with a concentration of 0.5% v / v of fresh milk.

The diversity analyses provide result that the first factor are the emulsifier type used is not a real effect on the yield of milk powder produced. The second factor is the adition emulsifier concentration which also not a real effect on on the yield of milk powder produced by the addition of emulsifier type emusifier Tween 80 and lecithin. This means the use of type and concentration of emulsifier in the manufacture of milk powder is not a real effect on the yield of milk powder produced by the manufacture method of foam-mat drying.

This is because the type and concentration of emulsifier used does not affect the yield of milk powder, but greatly affect the solubility of milk powder produced. The yield is strongly influenced by the addition of filler which in this study using a dextrin with a concentration of 13% w / v of fresh milk. It is in accordance with the Nurika statement (2000), which states that the nature of dextrins did not evaporate during drying and can increase the total dissolved solids in the material thus obtained a greater yield. Overall yield of milk powder produced increases with increase in the number concentration of emulsifier is added. This is because the concentration of emulsifier is added is also higher at each recurrence..

The mean value of the yield of milk powder which is influenced by the interaction of the addition of Tween 80 emulsifier has a regression equation (Y: 0.176 20.570 + 0.530 X^2 + X) where Y is the yield produced, while X is the concentration of Tween 80 were added.

Average of milk powder yield are influenced by interactions with the addition of emulsifier lecithin has a regression equation (Y: 20.435 + 0.565 X - 0.003 X2) where Y is the yield produced, while X is the concentration of lecithin is added.

Selection of Best Alternative

The best treatment is the addition of Tween 80 emulsifier with a concentration of 1% v / v of fresh milk. Analysis results showed the solubility of milk powder of 34.01%, 3.11% water content and 21.32% yield and the mean value of protein contained in milk powder reached 11.089%

Model Validation

Based on the results of regression analysis using SPSS 17 software produces a regression equation of the relationship type and concentration of emulsifier used against the value of solubility, water content, and yield of milk powder produced. This validation needs to be carried out to compare the solution results of calculations with experimental results of using this type of emulsifier Tween 80 with a concentration of 1%. In table 4 there is a comparison between the average experimental results with the results of the calculation of the equation.

Table 4 Validation Test

Response	Equation	Average (%)	Validation (%)
Solubility	29,643 – 3,697 T + 6,047 TT	34,01	32,011
Water Content	4,094 – 0,583 T + 0,551 TT	3,11	4,06
Yield	20,570 + 0,176 T + 0,530 TT	21,32	21,276

From validation test (table 4) can be seen that solubility, water content, and yield not shown wide gap betwen the average experimental results with the results of the calculation of the equation.

CONCLUSION

The milk powder best result from the addition of type and concentration of emulsifier is the addition of Tween 80 with a concentration of 1% v / v of fresh milk. Milk powder produced by the foam-mat drying method with the addition of 1% v / v Tween 80 fresh milk produced solubility value milk powder of 34.01%. The value of water content in milk powder is 3.11% and yield value milk powder is 21.32% and protein content is 11.089%.

REFERENCES

1. Anonymous. 2009. Unsolved Problem in Chemistry. www.forumsains.com. Access on 7 Ocober 2010 09.23 WIB.
2. Suharyanto. 2009. Pengolahan Bahan Pangan Hasil Ternak. http://suharyanto.wordpress.com. Access on 23 December 21.37 WIB
3. Anonymous. 2009. Unsolved Problem in Chemistry. www.forumsains.com. Access on 7 Ocober 2010 09.23 WIB.
4. International Flora Technologies, Ltd, 2009. Hydrophile-Lipophile Balance System. Technical Work Instruction, Page 1 of 4
5. Supriyo, E. 2007. Pengaruh Konsentrasi Surfactant Pada Formulasi Propuxure 20 Ec Dan Efektifitasnya Dalam Membasmi Nyamuk Aedes Aegypti. Thesis. Master Program, Diponegoro University. Semarang