

The Effect of Adding Caragenan as A Microencapsulant Material in The Production of Powdered Yoghurt with The Foam Mat Drying Method

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Abstract

Yogurt products that are currently available on the market are mostly in liquid form. The weakness of liquid food products is that they cannot be stored for a long time compared to powdered products. The purpose of this study was to apply the foam mat drying process on the production of powdered yogurt. The variables studied in this research were the ratio of maltodextrin, carrageenan and tween 80 (15:15:5, 15:20:5, 15:25:5, and 15:30:5) as well as the drying temperature (40, 45, and 50°C) The analysis method includes analysis of water content, ash content, protein content and fat content. The results showed that the highest water content is 1.0037% the lowest is 1.0028%, for the highest ash content 0.819% the lowest is 0.864% while for the highest protein content 3.223% the lowest is 3.029% for the highest fat content 1.863% the lowest is 1.125%.

Keywords: yogurt, foam mat drying, microencapsulation, tween 80.

INTRODUCTION

Yogurt is a functional food obtained from milk fermentation using lactic acid bacteria. Bacteria commonly used in the yoghurt-making process include *Bifidobacterium* sp, *Lactobacillus* sp, and *Streptococcus thermophiles* (Nuraeni et al., 2019). These bacteria help the milk fermentation process by replacing milk lactose into lactic acid (Masyhura et al., 2021). Yogurt products currently on the market are mostly in liquid form. The weakness of liquid food products is that they cannot be stored for long at room temperature; as a result, it is necessary to change the form from liquid yoghurt to powdered yoghurt. Powdered yoghurt can be made by drying. The yoghurt drying process can be done using several methods, namely spray drying, freeze drying and foam mat drying. The specifications for this study chose the foam mat drying method because this method is simpler when compared to the other two methods (Prasetyaningrum et al., 2012., Kurniasari et al., 2019). In addition to the drying process, making powdered yoghurt also requires fillers or encapsulants and foaming agents. Commonly used fillers are maltodextrin, soy

lecithin, skim milk, gum arabic, whey, and carrageenan, while the foaming agent commonly used is tween 80 (Purbasari, 2019).

There are several previous studies that discuss powdered yogurt using the foam mat drying method, such as that conducted by Masyhura et al. (2021), who conducted research on the application of maltodextrin in making jackfruit seed powdered yogurt, where this study shared that the addition of 10-25% maltodextrin will increase water content, total microbes, and water content. The process of making powdered yogurt using the foam mat drying method using soy lecithin as filler in various concentrations was also carried out by Manisha et al. (2019). A study on powdered yogurt containing probiotic bacteria with added egg white was conducted by Miskiyah et al. (2019). There is a review of the results of research conducted by Kumar et al. (2004), regarding powdered yogurt, both in terms of the technology of its utilization process and how to store it. Seeing the enormous potential of yoghurt for health, further research is needed on yoghurt, especially powdered yoghurt using the foam mat drying method.

RESEARCH METHOD

Materials and equipment

The materials used in this research including yogurt, carrageenan, maltodextrin, and tween 80. Meanwhile the equipment used were including beaker glass, Erlenmeyer, measuring cup, stirrer, digital analytical balance, petri, test tube, autoclave, Laminar air flow (LAF), incubator, and drying food dehydrator.

Variables used

The variables used in this study were the variables of adding maltodextrin which were varied with carrageenan and tween 80 with a ratio of 15:15:5, 15:20:5, 15:25:5, and 15:30:5. All variables were carried out at temperatures of 40, 45, and 50°C by recording the weight loss carried out every 2 hours.

Procedure

Liquid yogurt is added with encapsulant material according to variation and foaming agent, then stirred using a homogenizer. After homogenization, the mixture is dried using an oven with a temperature according to variation to produce powdered yogurt. The drying process is carried out at a temperature of 40-50°C and records the decrease in sample weight at intervals of 2 hours.

Analysis

Analysis of powdered yogurt includes analysis of water content, ash content, protein content, and fat content.

RESULT AND DISCUSSION

The Effect of Carrageenan Addition on Water Content and Ash Content

Water content is one of the factors that greatly influence the durability of processed materials, the lower the water content, the slower the growth of microorganisms and food ingredients can last longer. Conversely, the higher the

water content, the faster the microorganisms reproduce, so that the decay process takes place quickly Simatupang, (2001). Furthermore, Winarno, (2008) stated that the lower the water content of a product, the higher its durability. Figure 1 shows the addition of carrageenan flour with a treatment of 20 grams has the highest water content, which is 1.0037% and the addition of 30 grams of flour has the lowest water content, which is 1.0028%. The high water content in the 20 gram treatment is thought to be because carrageenan flour is hydrophilic. Ash content is an inorganic substance left over from the combustion of organic materials.

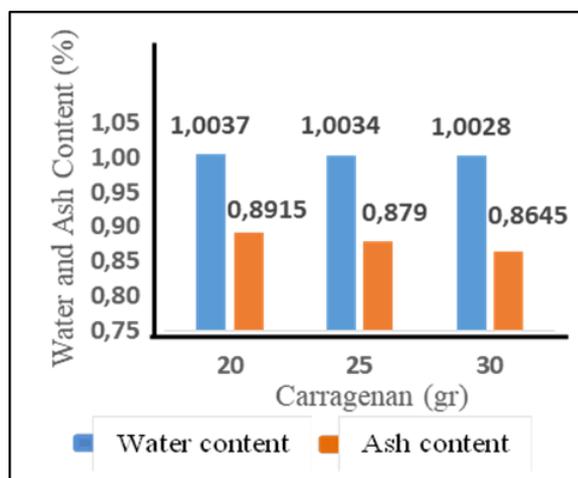


Figure 1. Effect of Carrageenan Addition on Water Content and Ash Content

The ash content and its composition depend on the type of material and the method of ashing. Ash content is related to the minerals of a material. Minerals found in a material can be two types of salts, namely organic salts and inorganic salts. Therefore it is usually done by determining the remaining combustion of the mineral (Sudarmadji et al., 2007).

Figure 1. Shows the addition of 20 gr of carrageenan flour has the highest ash content of 0.8915% while the addition of 30 gr of carrageenan has the lowest ash content of 0.8645%. This is thought to be because carrageenan flour has organic content. Based on the results of the study, it was found that the ash content obtained by adding carrageenan flour with the treatment of 20 gr (0.8915%), 25 gr (0.789%), 30 gr (0.8645%). The ash content value obtained is still acceptable because the maximum ash content of yoghurt powder based on SNI 2891-2009 is 1.0%.

Effect of temperature on water content and ash content

Figure 2 shows the effect of temperature on the lowest water content in powdered yoghurt at a temperature of 40°C. The results of the water content when compared with SNI (2006), meet the established quality standards. The quality requirement for water content in making powdered yoghurt is a maximum of 5%. The results of this study are lower than the research of Juniwati et al. (2019) which

reported that the water content in making powdered yoghurt was 2-5%. From the results of this study, the best treatment was at a temperature of 50°C of 1.0028%.

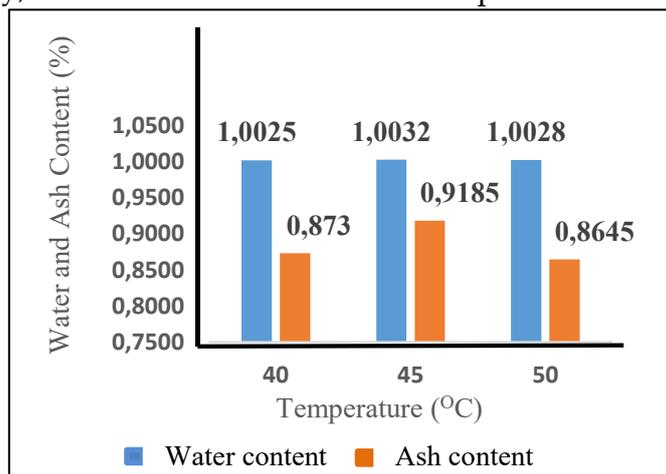


Figure 2. Effect of temperature on water content and ash content

Based on Figure 2, it shows that the difference in the treatment of the amount of carrageenan flour used did not significantly affect the ash content obtained. The difference in the concentration of carrageenan flour did not affect the ash content of each treatment. According to SNI 01-2981-1992, the maximum ash content of yoghurt is 1.0%. Based on the analysis, the ash content of powdered yoghurt ranges from 0.8645 - 0.9185%. These results show and prove that the ash content of the resulting powdered yoghurt is in accordance with the quality requirements recommended by SNI (BSN, 2006). The results of this study are greater than the research of Nuraeni et al., (2019) who reported that the ash content of the goat milk based yoghurt was 0.77%.

The Effect of Carrageenan Addition on Protein and Fat Content

Protein content is formed from elements that are almost the same as carbohydrates and fats, namely carbon, hydrogen and oxygen but added with nitrogen elements (Susanto and Tri, 2004). The results of this analysis indicate that the difference in the amount of carrageenan concentration in making powdered yogurt does not significantly affect the protein content. This is because carrageenan binds water so that the resulting protein content is relatively reduced. The higher the concentration of carrageenan, the lower the protein content obtained. This is in line with the opinion of Jorgensen (2019) which states that the protein contained in yogurt is the total amount of protein from the ingredients used.

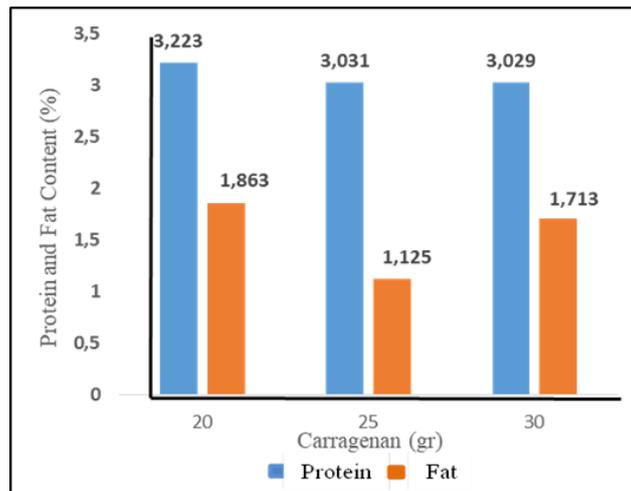


Figure 3. Effect of adding carrageenan on protein and fat content

The addition of 20 grams of carrageenan flour has the highest protein content, which is 3.223%, while the addition of 30 grams of carrageenan has the lowest protein content, which is 3.029% (Figure 3). The results of the study of powdered yogurt with the addition of carrageenan flour on protein content showed a significant decrease in protein value. Based on SNI 2981-2009, the minimum protein content for powdered yogurt is 2.7%. This is thought to be because the addition of carrageenan flour increases the bound water content. The results of this study are greater than the research of Masykur, et al. (2015) which reported that the protein content in making yogurt powder was 2.7-3.0%.

Fat content is one of the elements in food ingredients, because fat functions to improve the shape and physical structure of food ingredients, increase nutritional value and calories, and provide a savory taste to pagan ingredients. From the results of the study, the addition of 20 gr of carrageenan flour had the highest fat content of 1.863% while the lowest was the addition of 25 gr, which was 1.125%. This is because fat is not soluble in water so that fat does not change with the addition of carrageenan. Based on the research results, the fat content with the addition of carrageenan flour at 20 gr (1.863%), 25 gr (1.125%), and 30 gr (1.713%), from the results of this study is lower than Nuraeni, et al. (2019) who reported that the fat content in goat milk based yogurt is 5.40%. The fat content value of the powdered yogurt in this research still does not meet the minimum standard for yogurt powder based on SNI 2981-2009 which is 3.0%.

The Effect of Temperature on Protein and Fat Content

Based on Figure 4, it shows that the addition of carrageenan flour with different concentrations significantly affects the protein content. The protein content of the yoghurt powder produced is influenced by the temperature factor. This is thought to be caused by the protein content in the food ingredients starting to denature due to the increasing drying temperature. Food processing with high heating rate will cause protein to denature (Strzelczak et al., 2021). Heating can

damage amino acids where the resistance of protein to heat is closely related to the amino acids that make up the protein, so this causes the protein content to increase. This is reinforced by the statement of Naibaho et al. (2021), that the higher the drying temperature affects the protein content, this is because the high temperature makes the evaporation of water in the material very fast so that the water in the material decreases and affects the protein in the material.

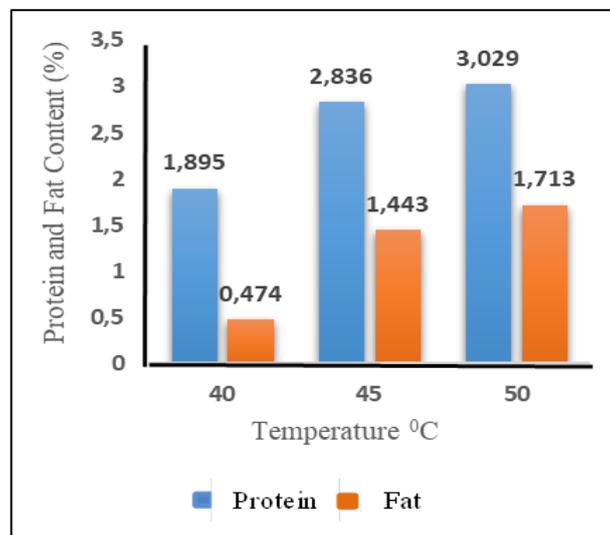


Figure 4. Effect of temperature on protein content and fat content

The average protein content is 1.895-3.029%. The highest protein content at a temperature of 50°C with a concentration of 30 grams of carrageenan flour then the lowest at a temperature of 40°C with a concentration of 20 grams of carrageenan flour. From the results of the analysis of carrageenan concentration variations, it can be explained that yogurt powder with the addition of different carrageenan flour has a significant effect on the protein content value. From the results of this study, the best treatment in terms of temperature influence is at 50°C, which is 3.029%.

Based on the results of Figure 4, it shows an average fat content of 0.474-1.713%. The highest fat content is at a temperature of 50°C with a concentration of 30 grams of carrageenan powder, while the lowest fat content is at a temperature of 40°C with a concentration of 30 grams of carrageenan powder. From the analysis of variations, it can be explained that yogurt powder with the addition of different carrageenan flour has a significant effect on the fat content value. From the results of this study, the best treatment in terms of temperature influence is at a temperature of 50°C with a value of 1.713%.

CONCLUSION

The effect of adding carrageenan has a significant effect on water content, while the effect of temperature has no significant effect on water content. The results of the study were 20 gr (1.0037%), 25 gr (1.0034%), 30 gr (1.0028a %). The effect of adding carrageenan has a significant effect on ash content, but the effect of temperature has

no significant effect. The results of the study were 20 gr (0.8915%), 25 gr (0.879%), 30 gr (0.864%). The effect of adding carrageenan did not have a significant effect on protein and fat levels. The effect of temperature on protein and fat content has a significant effect.

REFERENCES

- Badan Standarisasi Nasional. 2006. Standar Nasional Indonesia (SNI). SNI-01-2970-2006. Susu Bubuk. Dewan Standarisasi Indonesia. Jakarta.
- Jorgensen C E., Abrahamsen R K., Rukke E O., Hoffmann T K., Johansen A G., Skeie S B., 2019, Processing of high-protein yoghurt: A review, *International Dairy Journal* 88 (2019) 42-59.
- Juniwati, Miskiyah dan Ayu Kusuma, 2019, Penambahan enkapsulan dalam proses pembuatan yoghurt powder probiotik dengan metode spray drying, *Jurnal penelitian pascapanen pertanian*, vol 16 no 2, hal 56 – 63.
- Kumar and H. N. Mishra, 2004, Yoghurt powder – A review of process technology, storage and utilization, *Food and Bioproducts Processing*, 82(C2) : 133 – 142.
- Kurniasari F, Hartati I, dan Kurniasari K, 2019, Aplikasi metode Foam mat drying pada pembuatan bubuk jahe (*Zingiber officinale*), *Jurnal Inovasi Teknik Kimia*, vol 4 no 1, hal 7 – 10.
- Manisha M. and Sharma A, 2019, Optimisation of Foam- mat drying of yoghurt and properties of powered yoghurt, *International Journal of Dairy Technology*, vol 72 no 3, page 381 – 387.
- Masykur A, dan Kusnadi J. 2015, Karakteristik kimia dan mikrobiologi yoghurt bubuk kacang tunggal (*vigna unguiculata L*) metode pengeringan beku (Kajian penambahan starter dan dekstrin), *Jurnal Pangan dan Agroindustri*, vol 3 no 3, hal 1171 – 1179.
- Masyhura MD, Misril Faudi dan Surnaherman, 2021, Aplikasi maltodekstrin pada pembuatan yoghurt bubuk biji nangka, *Jurnal Teknologi Pertanian Andalas*, vol 25 no 1.
- Miskiyah, Juniawati, K.Ayu and A H Mulyati, 2019, Study on Yoghurt Powder Probiotic Quality using Foam-mat drying method, 2nd^{Int}ernational Conference on Agriculture Postharvest handling and processing, IOP Conf. series : Earth and Environmental Science 309, IOP Publishing.
- Naibaho N M, Anwar R, Lisnawati A, Ariyani F, Popang E G, Rudito, dan Hamka, 2021, Pengaruh Suhu Pengeringan Berbeda terhadap Sifat Kimia Tepung Bawang Tiwai (*Eleutherine palmifolio (L) Merr*), *Buletin LOUPE Vol. 17 No. 02*, Desember 2021
- Nuraeni S., Purwasih R., Romalasari, A., 2019. Analisis Proksimat Yogurt Susu Kambing dengan Penambahan Jeruk Bali. *Jurnal Ilmiah Ilmu dan Teknologi Rekayasa | Volume 2 Nomor 1*, Maret 2019 25-29

- Prasetyaningrum A, Asiah N, Sembodo R, 2012, Aplikasi metode Foam mat drying pada proses pengeringan spirulina, *Jurnal Teknologi Kimia dan Industri*, Vol 1 no 1, hal 461 – 467.
- Purbasari D, 2019, Aplikasi metode Foam mat drying dalam pembuatan bubuk susu kedelai instan, *Jurnal Agroteknologi*, vol 13 no 1.
- Simatupang, P.1990. Comparative Advantage and Government Protection Structure of Soyben Production in Indonesia. Comparative Advantage and Protection Structure of Livestock and Feedstuff Subsector in Indonesia. Bogor.
- Sudarmadji, S., Bambang dan Suhardi. 2007. *Prosedur Analisa untuk Bahan Makanan dan Pertanian*. Yogyakarta : Liberty.
- Strzelczak, A.; Balejko, J.; Szymczak, M.; Witczak, A. Effect of Protein Denaturation Temperature on Rheological Properties of Baltic Herring (*Clupea harengus membras*) Muscle Tissue. *Foods* 2021, 10, 829. <https://doi.org/10.3390/foods10040829>
- Winarno F. G, 2008. *Kimia Pangan dan Gizi*, Gramedia Pustaka Utama, Jakarta.