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Preparation of Natural Coloring Powder from Miana Leaves (Coleus scutellarioides (L) Benth) Using Foam Mat Drying Method

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ABSTRACT. Food color is one of the things that consumers consider when choosing and sorting food. So the use of coloring in food seems to be a necessity for every food producer. The health impact of using synthetic dyes is a reason for us to go back to nature by using natural dyes. Natural dyes can be an alternative dye that is non-toxic, renewable and environmentally friendly. Miana (Coleous scutellarioides (L) Benth) is a tropical plant that grows wild in Indonesia. This plant contains anthocyanins which have potential as natural dyes. This research aims to determine the effect of maceration time on total anthocyanin coloring powder from miana leaves as a source of natural coloring substances using the foam mat drying method. The research began with preparing the ingredients, then macerating 25 grams of miana leaves using 250 mL of distilled water with varying times of 6, 12, 18, 24, 30 and 36 hours. The maceration results are then filtered and centrifuged. In the foam mat drying method, maltodextrin filler is added with a concentration of 8% and egg white foaming agent with a concentration of 5%. Based on the research results, the best conditions were obtained at a maceration time of 36 hours. The analysis results showed that the dye powder yield was 57.643%, the water content was 2.237%, the solubility was 97.711% and the total anthocyanin concentration was 2.171 mg/25 g.

1. INTRODUCTION

Color is one of the attractions for consumers when choosing a product, prompting manufacturers to vary the colors of the products they create. Advances in technology have enabled the creation of synthetic dyes in various color variations. The development of the textile industry in producing various types of food has led to an increased use of synthetic dyes. The limited availability of natural dyes in the market has resulted in a rise in the use of synthetic coloring agents. As a result, the use of natural dyes is gradually being abandoned and replaced by synthetic dyes. The use of synthetic dyes can pose health and environmental problems. Synthetic dyes such as Rhodamine B, Methanyl Yellow, and Amaranth in food and beverages are very dangerous to health, as they can trigger cancer and cause damage to the kidneys and liver [1].

Natural dyes are a non-toxic, renewable, and environmentally friendly alternative. Most natural coloring agents are derived from plants. Some natural dyes found around us include chlorophyll, carotenoids, tannins, and anthocyanins [2]. Miana (Coleus scutellarioides (L) Benth) is a wild tropical plant from Indonesia. The miana variants have diverse leaf colors, with the crispa variant featuring reddish-purple leaves, indicating the presence of anthocyanins. Research conducted [3], found that the total anthocyanin content in miana is 0.149542 mg/200 g. Therefore, the anthocyanin content in miana leaves has the potential to be used as a natural coloring agent.

Anthocyanins are a group of pigments that range in color from red to blue and are widely distributed in plants. The use of natural coloring agents such as anthocyanins is one solution to the limitations of natural dyes that can be used in various fields [4]. Based on the analysis conducted in the research [3], it was found that the pigment extract from miana leaves has a visible purple color, with maximum absorbance at a wavelength of 529 nm. The pigment is suspected to be an anthocyanin derivative, specifically cyanidin-3-rutinoside.

This research was conducted to obtain total anthocyanin levels from natural dye powder made from miana leaves using the foam mat drying method with varying maceration times. The filler and foaming materials used are maltodextrin and chicken egg white. The drying process is carried out using an oven.

2. MATERIALS AND METHODS

The raw material used is miana leaves obtained from Jl. Pattimura, Mangkupalas Village, Samarinda Sebrang District, Samarinda City, while the chemicals used are maltodextrin, citric acid, NaOH, HCL and Aquadest. This research was carried out at the Laboratory of the Chemical Engineering Department, Samarinda State Polytechnic. The research procedure is as follows:

2.1 Miana Leaf Preparation

Miana leaves are cleaned with water to remove dirt from the leaves. Next, drain the miana leaves and dry them at room temperature for 24 hours. After that, cut the miana leaves into small pieces.

Miana Leaves are taken | Miana leaves are dried for 24 hours | Miana leaves are cut

Figure 1. Miana Leaf Preparation

2.2 *Making Miana Leaf Natural Coloring Extract*

Miana leaves were weighed as much as 25 grams which had been cut into small pieces. Furthermore, it was macerated using 250 mL of aquadestc solvent and adding 10 mL of citric acid with a concentration of 10% (w/v) of the amount of solvent used. The extraction process was carried out for 6, 12, 18, 24, 30 and 36 hours. After that, the results of the miana leaf color extract were filtered, then continued with the centrifugation process at a speed of 4000 RPM for 10 minutes.

Miana Leaf Weighed | Miana Leaves are Macerate | Maceration Results

Filtered Extract | Centrifuge Process

Figure 2. Process for Making Miana Leaf Dye Extraction

2.3 Process of Making Natural Dye Powder Using the Foam Mat Drying Method

The initial stage of the process of making natural dye powder, namely maltodextrin is added as much as 8% (w/v) and chicken egg white with a concentration of 5% (w/v) into the filtrate that has been centrifuged. Then stirred with a mixer at a speed of 450 RPM until homogeneous for 15 minutes and forms foam. Furthermore, the extract that has become foam is transferred to baking paper, then in the oven at a temperature of 45 °C until constant weight. After that, the extract is ground until smooth and sieved with a 60 mesh sieve. The next stage is to test the yield, water content, solubility. Color intensity and total anthocyanin concentration.

Figure 1. Process for Making Natural Dye Powder

3. RESULTS AND DISCUSSION

The purpose of this study was to determine the effect of maceration time on the total concentration of anthocyanins in the manufacture of natural dye powder from miana leaf extract using the foam mat drying method. The difference in maceration time on miana leaf extract will have different effects on the yield value, water content, solubility, and total concentration of anthocyanins from miana leaf dye powder. The maceration process was carried out using aquadest solvent, then the extract obtained was added with foaming agents and thickeners to obtain miana leaf dye in the form of dye powder.

3.1 Effect of Maceration Time on Yield

The difference in maceration time has an influence on the resulting yield. The longer the maceration treatment time will increase the yield. The increase in the yield value of dye powder is influenced by anthocyanins and the use of polar solvents. So that in the extraction process the anthocyanin substances will dissolve completely.

Based on Figure 4, the highest yield value can be obtained at a maceration time of 36 hours, amounting to 57.643%. This is because the longer the contact time, the greater the number of cells that rupture and the compounds dissolved in them. It is very likely that this condition will continue until it reaches a condition of equilibrium between the concentration of miana leaf compounds and the concentration of the solvent [5].

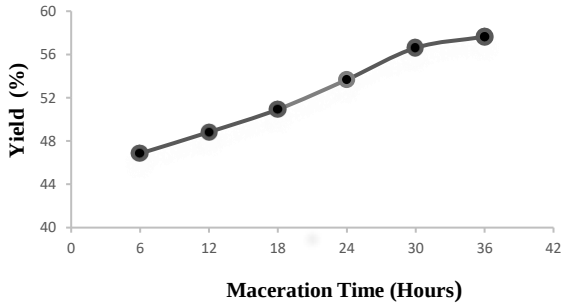

Figure 2. Effect of Maceration Time on Yield

3.2 Effect of Maceration Time on Water Content

The solid product produced from the foam mat drying process was analyzed for water content using the gravimetric method to determine the water content produced in the dye product from miana leaves.

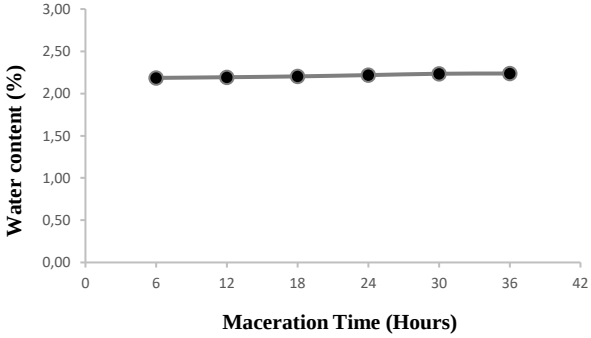

Figure 3 Effect of Maceration Time on Water Content

Based on the results obtained in Figure 5, it shows that the water content produced from miana leaf coloring powder products tends to be stable, ranging between 2.185-2.237%. This is due to the effect of adding citric acid to the extraction process for making miana leaf powder dye. Citric acid is hygroscopic which causes maximum absorption of water content during the maceration time.

According to chemical specifications, natural dyes on the global market have a water content in natural dyes of 7%. However, based on the results of research that has been conducted, the water content produced in natural dye products using the foam mat drying method is below the maximum threshold. So that the resulting products can be sold on the global market.

3.3 Effect of Maceration Time on Total Anthocyanin Concentration

The solid product resulting from the foam mat drying process was tested using UV-vis spectrophotometry with the pH differential method to estimate the total concentration of anthocyanins. Based on the results obtained in Figure 6, it shows that maceration time influences the increase in total anthocyanin concentration in miana leaf coloring powder. This is because the longer the contact time between the raw material and the solvent will have an impact on the amount of compound extracted. The highest total anthocinin concentration in miana leaf coloring powder with a maceration time of 36 hours was 2.171 mg/200 g.

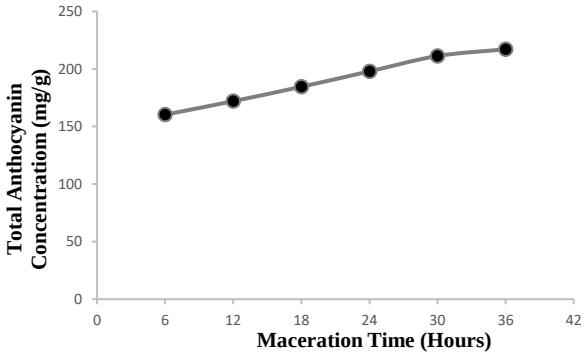

Figure 4. Effect of Maceration Time on Total Anthocyanin Concentration

The results of other research on miana leaves were carried out by [6], the total concentration of anthocyanins in C. scutellariodes var. crispa was 1.03 mg/100 g. In research [3], the total concentration of anthocyanins from miana leaves was 149,542 mg/200 g. The total anthocyanin concentration obtained in miana leaves from each study showed different results. This is due to several factors such as the number of samples to be extracted, the use of different solvents, the extraction methods used and the planting locations which are not necessarily the same. Apart from that, soil conditions, environmental temperature and light intensity can also cause these differences.

3.4 Effect of Maceration Time on Color Intensity

Based on the results of the qualitative total anthocyanin color test, it was carried out by taking 7 mL of the extraction results obtained, adding 2 drops of 10% NaOH so that the color changed to brown, then adding 2 drops of concentrated HCl so that the color returned to red [7]. From the results of color testing, it shows that the longer the maceration time, the color intensity of miana leaf powder increases. This is in line with the increase in total anthocyanin concentration in miana leaf powder extract.

Table 1. Effect of Maceration Time on Color Intensity

Maceration Time (hours)	Color	Picture
6	Faded pink	
12	Pink	
18	Pink	
24	Bright pink	
30	Bright pink	
36	Bright pink	

3.5 Effect of Maceration Time on Solubility

The solid product produced from the foam mat drying process was subjected to solubility analysis using the gravimetric method to determine the physical analysis of a dye product from miana leaves. Based on the results obtained in Figure 7, it shows that the solubility value of the Miana leaf dye powder produced tends to decrease. This is due to the non-uniformity of particle size because the sieving process uses a 60 mesh size. This results in powder of various sizes. Various particle sizes will affect the solubility value of a product.

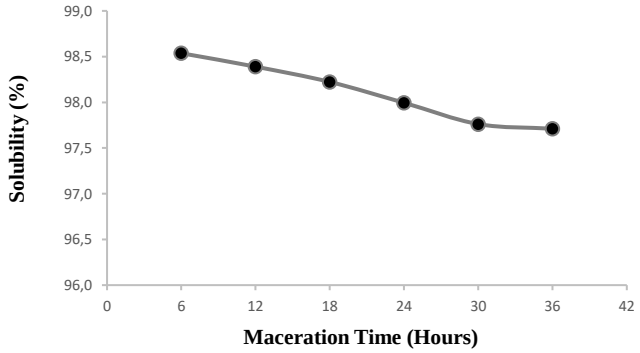

Figure 5. Effect of Maceration Time on Solubility

4. CONCLUSION

In research on making natural coloring powder from miana leaves using the foam mat drying method with different maceration times, it can be concluded that the difference in maceration time has an influence on the yield value, water content, solubility, color intensity and total anthocyanins of natural coloring powder made from miana leaves. . This is because the contact time between the material and the solvent becomes longer so that the extraction process will be more optimal. Based on the analysis test results of maceration times of 6, 12, 18, 24, 30 and 36 hours, it shows that the dye powder with the best value at 36 hours of maceration produces a yield value of 57.643%, water content of 2.237%, solubility of 98.711% and total anthocyanin concentration of 2.171 mg/25 g.

REFERENCES

[1] Pujilestari, T, "Review: Sources and Utilization of Natural Dyes for Industrial Needs," Journal of Craft and Batik Dynamics, Vol. 32, no. , 93-106 (2015).

[2] Bahri, S., Jalaluddin, J., & Rosnita, R, "Making Natural Dyes from Jamblang Bark (Syzygium Cumini) as a Basic Material for Textile Dyes," Unimal Journal of Chemical Technology, 6(1), p. 10 (2017). Available at: https://doi.org/10.29103/jtku.v6i1.465.

[3] Puspita, D., Tjahyono, YD, Samalukang, Y., & Im, B. A, "Anthocyanin Production from Moana (Plectranthus scutellarioides) Leaves as a Natural Colorant," Journal of Food Science and Technology, 4(1), 298–30 (2018).

[4] Priska, M., Peni, N., Carvallo, L., & Ngapa, Y. D, "Review: Anthocyanins and their Use," Indonesian E-journal of Applied Chemistry. Vol. 6, 79–97 (2018).

[5] Chairunnisa, S., Wartini, NM, & Suhendra, L, "The Effect of Temperature and Maceration Time on the Characteristics of Bidara Leaf Extract (Ziziphus mauritiana L.) as a Source of Saponin," Journal of Agro-Industrial Engineering and Management, Vol. 7 No. 4), 551–560 (2019).

[6] Cisilya, T., Lestario, LN, Cahyanti, M. N, "Degredation Kinetics of Miana Leaf Anthocyanin Powder (Colleus scutellariodes L. Benth) Var. Crispa Result of Microencapulation"\," Journal of Chimica et Natura Acta. Vol. 5 No. 3, 146–152 (2017). DOI: https://doi.org/10.24.198/cna.v5.n3.16063.

[7] Agustin, D., & Ismiyati, "The Effect of Solvents on the Anthocyanin Extraction Process from Hibiscus Skin," Journal of Chemical Engineering, Volume 4 No 2 (2015).