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The Physical Properties of By-Product Proportion in Rice Flour-Based Facial Scrub

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***Abstract*—Sustainable development of under-utilized by-product commodities such as rice, potato, and orange which has high productivity in Indonesia is necessary. Rice has been known to be used in the traditional cosmetic application and can be valued-added by several by-products such as potato and orange peel incorporation. The peel which rich in antioxidants was formed into flour to make it easier to blend into rice flour-based face scrub. This study was to analyze the effect of added potato and orange peel flour proportion on rice flour-based face scrub's physical properties. The experiment was conducted on four proportion levels to determine aroma, texture, stickiness, color, and preference of rice flour-based face scrub. Data were obtained from 30 panels observation and analyzed with one-way ANOVA and Duncan test on a significant level < 0,05. The result showed that: 1) potato and orange peel flour proportion affected on aroma, texture, stickiness, color, and preference of rice flour-based face scrub; 2) the best product was rice flour face scrub with the proportion of potato and orange peel flour (PPF: OPF) on 4:3. This study will compile current findings on by-product utilization as a new cosmetic innovation with an economic and environmentally friendly approach.**

Keywords: by-product, potato peel flour, orange peel flour, cosmetic ethnology

I. INTRODUCTION

Rice is the second most important cereal crop for more than half of the world's population, no exception Indonesia has high productivity because of its role as a staple food. The production of rice is increasing from 2013 to 2017 with the production reaches 81 million tons [1]. The number of research has studied rice benefits namely good nutritional value, resistance to high blood pressure, dysentery, heart diseases used in skincare. In the Indian subcontinent, rice water is duly prescribed by ayurvedic practitioners as an effective ointment to cool off inflamed skin surfaces [5]. Rice also processed into flour and has been implicated since ancient times by Egyptians and Greeks, [2] while Malaysian and Indonesian women used rice in a form of cooling face mask where the rice is soaked for three months or until the rice grains fully dissolved [3] [4]. The application of dried powdered rice is recommended for skin ailments [5].

Besides the use of rice, the women in several regions in the world have developed a rich ethnomedical tradition. The traditional herbal preparations that they passed down from generation to generation to cure skin infections and other diseases by utilized plants leave, root, and discharged parts such as peel. The several plants they used includes dried fruit peel of banana (Musa spp.) for lips blackness and leprosy infected skin, dried lemon peel (Citrus Limon) to remove the tartar of tooth, and soapberry (Sapindus Saponaria) for hair growth and shine [7] [8] [10]. Apart from traditional ethnic-cosmetic applications of local herbs, Afzal et al stated that efforts are in progress to formulate and develop skincare products based on these natural resources by-products, termed as herbal cosmetics [9]. Other natural resources that can be used in herbal cosmetics are potato and orange, with the correlation of its high productivity level in Indonesia and can be caused by environmental concern due to its microbial spoilage [14] [11] [12].

Potato and orange is a horticulture commodity which significantly increases in productivity level in these past 6 years.

The productivity of potato has increased significantly from 2013 to 2018 from 160,18 Ku/Ha to 187,06 Ku/Ha [14] and orange is higher than potato, it is 309,20 Ku/Ha to 404,41 Ku/Ha. According to the Indonesian Ministry of agriculture, orange is the third-highest fruit

commodities production at the national level with reach 20 million tons each year [14]. As it is also stated by Wu that sweet orange (Citrus Sinensis) is the major fruit in the citrus group constituting up to 70% of the total citrus production and consumption [11]. Several studies have reported the potential of these by-products application in terms of the herbal cosmetic and pharmaceutical field. The potential use of essential oils from citrus waste as anti-inflammatory and antimicrobial agents in cosmetics has been reported by Yang et al [13]. While lactic acid that generally used in the cosmetic and pharmaceutical applications can be extracted from potato peel [12]. Therefore, there will be a necessary utilization of this large amount of by-product derived from its annual high productivity level into a cosmetic appliance such as face scrub. The face scrub is granules that are not foaming which serves to remove dead skin cells and further optimize the facial cleansing process [15]. Various brands of beauty products have issued products in the form of face scrubs with a variety of different scents and functions. However, most of these products are made from chemicals that can cause irritation or allergic skin on some people's faces. The demand for herbal and natural based cosmetic is increasing rapidly nowadays due to ease of availability, good results as well as minimum side effects [16] [17].

Potato and orange peel scrubs require to be transformed into powder or flour base to make it easier to use and apply. The authors chose rice flour as the basis for a face scrub to be made. This study aimed at evaluating the effect of several added proportion of potato peel flour (PPF) and orange peel flour (OPF) on the physical properties of rice flour-based face scrubs. The following physical properties which evaluate include aroma, color, texture, stickiness, and preference. This study carried out to sustain environmental management due to the reuse of consumption and industrial discharged by-product. This study will compile current findings on by-product utilization as a new cosmetic innovation with an economic and environmentally friendly approach.

II. MATERIALS AND METHODS

2.1. Ingredients and equipment

The materials used in this study obtained from the local market in Surabaya, Indonesia. Rice flour used in this study is commercial rice flour with the brand 'Rose brand' which directly bought in the local market. Potato used is Solanum Tuberosum L and orange type used is sweet orange (Citrus Sinensis), both ingredients are peeled and discharged from its flesh.

The equipment used in this study provided in the Laboratory Cosmetology department of Universitas Negeri Surabaya. To make facial scrub the equipment is needed includes kitchen scale, knife/cutter, small bowl, stainless steel spoon, tray, chopper/blender, rubber spatula, jar, and sieve.

2.2. The Production of PPF and OPF

By product raw material in this study was produced through a series of procedures that begin with the peeled potato and wash thoroughly. Cut potato peel into small pieces then dried potato peel under the sun for 7 days. Potato peel that has dried and then ground using a blender. If there is still a rough in it, repeat the ground step and sifted using a sieve no. 80. The same procedures also applied to orange peel. After doing all of the procedures, keep the flour in a plastic container in dry and tightly closed conditions.

2.3. The Production of Facial Scrub

Facial scrub was produced with rice flour-based and through a series of procedures that begin with add 8 g rice flour in a plastic bowl. Mix rice flour with PPF and OPF with the several proportion values. Mix thoroughly and put the mixture in a plastic container. Keep it in a cool and dry place for the longer shelf-life. Before use, the mixture must be added with 9 g aqua dest and stir it until mix well. Make sure face is in clean condition and washed with a facial wash before using the facial scrub

2.4. Experiment design

The independent variable in this study was the proportion of PPF and OPF in several values X1= (6:1), X2= (5:2), X3= (4:3), X4= (3:4). The dependent variable in this study was the physical properties of facial scrub are aroma, color, texture, stickiness, and panels preferences. The experiment design carried out in this study is a single factor design. The four proportion of PPF and OPF as shown in Table 1 below

Table 1. Experiment Design

PPF and OPF proportion	Physical properties of rice flour-based face scrub				
	(Y1)	**(Y2)**	**(Y3)**	**(Y4)**	**(Y5)**

X1	Y1X1	Y2X1	Y3X1	Y4X1	Y5X1
X2	Y1X2	Y2X2	Y3X2	Y4X2	Y5X2
X3	Y1X3	Y2X3	Y3X3	Y4X3	Y5X3
X4	Y1X4	Y2X4	Y3X4	Y4X4	Y5X4

Abbreviation:

X1 : 6 g PPF, 1 g OPF

X2 : 5 g PPF, 2 g OPF

X3 : 4 g PPF, 3 g OPF

X4 : 3 g PPF, 4 g OPF

Y1 : Aroma of rice flour-based face scrub

Y2 : Color of rice flour-based face scrub

Y3 : Texture of rice flour-based face scrub

Y4 : Stickiness of rice flour-based face scrub

Y5 : Panels preferences of rice flour-based face scrub

2.5. Data Collection and Analyzation

The data collection technique was carried out with observation by 30 panels, consisted of 5 lecturers and 25 students majoring in the Cosmetology study program of Universitas Negeri Surabaya. The observation instrument used was a questionnaire with several observed aspects in the final result of the facial scrub product includes aroma, texture, stickiness, color, and preferences. Data collection was conducted in the Home Economics Department, Engineering Faculty, Universitas Negeri Surabaya in June 2019. Data which has collected then analyzed with one way ANOVA in significant value < 0.05. If the results show that there was a significant influence, a further test will be performed with the Duncan test.

III. RESULTS AND DISCUSSION

3.1. Descriptive Analysis of Mean Value of Rice Flour-Based Facial Scrub's Physical Properties

The mean value obtained from data collection presented in Figure 1. The result showed the range mean value from 1.6 to 3.63 which the lowest mean value obtained from X1 final product in the aspect of panel's preference and the highest mean value obtained from X3 final product's texture.

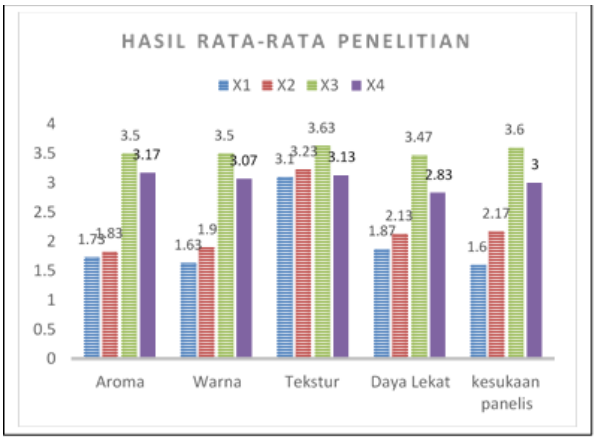

Fig 1. Mean Value of Facial Scrub Physical Properties

According to Figure 1., the proportion of PPF and OPF resulted in rice flour-based facial scrub's best aroma in X3 (4 g PPF: 3 g OPF) which obtained the highest mean value 3.5. Meanwhile, the lowest mean value was 1.73 which obtained from X1 (6 g PPF: 1 g OPF). Based on the result, it is showed that the orange peel flour amount in the proportion with potato peel flour contributed to facial scrub's aroma and the slight amount of OPF will result in the lowest mean value of facial scrub's aroma. The proportion of PPF and OPF resulted in rice flour-based facial scrub's best color in X3 (4 g PPF: 3 g OPF) which obtained the highest mean value 3.5. Meanwhile, the lowest mean value was 1.63 which obtained from X1 (6 g PPF: 1 g OPF). Based on the result, it is showed that the orange peel flour amount in the proportion with PPF contributed to facial scrub's color and the slight amount of OPF will result in the lowest mean value of facial scrub's color. Besides, the highest mean value of rice flour-based facial scrub's texture was 3,63 which derived from X3 (4 g PPF: 3 g OPF) proportion and the lowest mean value of rice flour-based facial scrub's texture was 3.1 and derived from X1 (6 g PPF: 1 g OPF) proportion. Based on the result, it is showed that the orange peel flour amount in the proportion with potato peel flour contributed to facial scrub's texture and the slight amount of OPF will result in the lowest mean value of facial scrub's texture.

According to Figure 1., the proportion of PPF and OPF resulted in rice flour-based facial scrub's best stickiness aspect from X3 (4 g PPF: 3 g OPF) proportion which obtained the highest mean value 3.47. Meanwhile, the lowest mean value was 1.87 which derived from X1 (6 g PPF: 1 g OPF) proportion. Based on the result, it is showed that the orange peel flour amount in the

proportion with potato peel flour contributed to facial scrub's stickiness and the higher amount of PPF will result in the lowest mean value of facial scrub's stickiness. In addition, the highest mean value of rice flour-based facial scrub's preferences was 3,6 which derived from X3 (4 g PPF: 3 g OPF) proportion and the lowest mean value of rice flour-based facial scrub's preference was 1.6 and derived from X1 (6 g PPF: 1 g OPF) proportion. Based on the result, it is showed that the orange peel flour amount in the proportion with potato peel flour contributed to facial scrub's preference and the slight amount of OPF will result in the lowest mean value of facial scrub's preference.

3.2. The effect of PPF and OPF Proportion on Rice Flour-Based Facial Scrub's Physical Properties

The analytical result with one-way ANOVA to determine the effect of PPF and OPF proportion on rice flour-based facial scrub's physical properties includes color, texture, aroma, stickiness, and panel's preferences displayed in Table 2. The results showed that the proportion of PPF and OPF in different amounts affected all of the rice flour-based facial scrub's physical properties. Therefore, further Duncan test is performed to determine the mean value differences between the proportion amounts present in Table 3.

Table 2. One-way ANOVA result of the effect of PPF and OPF proportion on rice flour facial scrub's physical properties

Physical properties		Sum of Squares	Df	Mean Square	F	Sig.
Aroma	Between Groups	73,892	3	24,631	53,206	,000
	Within Groups	53,700	116	,463		
Color	Between Groups	72,892	3	24,297	53,145	,000
	Within Groups	53,033	116	,457		
Texture	Between Groups	5,758	3	1,919	4,111	,008
	Within Groups	54,167	116	,467		
Stickiness	Between Groups	46,758	3	15,586	28,002	,000
	Within Groups	64,567	116	,557		
Preference	Between Groups	70,425	3	23,475	61,102	,000
	Within Groups	44,567	116	,384		

Table 3. Duncan Test Result of Rice Flour Based Facial Scrub

Physical properties	Substitution	Subset for alpha = 0.05			
		1	2	3	4
Aroma	X1	1,73			
	X2	1,83			
	X4		3,17		
	X3		3,50		
Color	X1	1,63			
	X2	1,90			
	X4		3,07		
	X3			3,50	

Table 3. Duncan Test Result of Rice Flour Based Facial Scrub

Physical properties	Substitution	Subset for alpha = 0.05			
		1	2	3	4
Texture	X2	3,23			
	X4	3,13			
	X1	3,10			
	X3		3,63		
Stickiness	X1	1,87			
	X2	2,13			
	X4		2,83		
	X3			3,50	
Preference	X1	1,60			
	X2		2,17		
	X4			3,00	
	X3				3,60

3.2.1. Rice Flour-Based Facial Scrub's Aroma

The analytical result with one-way ANOVA to determine the effect of PPF and OPF proportion on rice flour-based facial scrub's aroma has performed. It showed that F value = 53.206 and significant value of 0.000 which results <0.05 so it can be concluded that there is an influence between the PPF and OPF proportion on rice flour-based facial scrub's aroma. Orange peel has an important role in giving a fresh aroma, but if the proportion is too much it will produce a pungent aroma. According to the results of research by Safaatul, et al [18] orange peel can produce essential oils that provide aroma. Essential oil is a term used for volatile oil, which consists of a mixture of several substances with different compositions and boiling points.

Essential oils are widely used in industries, such as the soap and cosmetics industry as givers of aroma and taste. While the potato peel has a distinctive aroma that tends not to smell. Characteristics of PPF are yellowish-white color, smooth texture, slightly sweet taste, and has a distinctive fragrant aroma of potato that is not scented [19]. So that when combined with the strong aroma of orange peel, it can produce a balanced, fresh but not pungent aroma. Duncan test result showed that X3 and X4 proportion produce a stronger orange peel aroma, there was a fresh potato peel which distinctively not strong compared with other proportion level X1, X2.

3.2.2. Rice Flour-Based Facial Scrub's Color

The analytical result with one-way ANOVA to determine the effect of PPF and OPF proportion on rice flour-based facial scrub's color has performed. It showed that F value = 53,145 and significant value of 0.000 which results <0.05 so it can be concluded that there is an influence between the PPF and OPF proportion on rice flour-based facial scrub's color. Yustina and Dena [20] stated that essential oils produced from orange peels have a yellowish color and smell like oranges. Therefore, yellowish color comes from the orange peel, but if the proportion of orange peel is higher, it is likely the yellow color will dominate more so that the resulting color is not appropriate. While, PPF has a younger (not concentrated) yellowish-brown color because the potato peel used in this study is butter potato skin. As Angela [21] stated that butter potato tubers have a light brownish yellow skin color with a sweet and tastier tuber flavor than other potatoes. Duncan's test result showed that X3 proportion produces yellowish-brown color compared with other proportion level X1, X2, and X4.

3.2.3. Rice Flour-Based Facial Scrub's Texture

The analytical result with one-way ANOVA to determine the effect of PPF and OPF proportion on rice flour-based facial scrub's texture showed that F value = 4,111 and significant value of 0.008 or < 0.05. Therefore, it can be concluded that there is an influence of the proportion between the PPF and OPF on rice flour-based facial scrub's texture. The proportion of X3 gets the highest mean value because it produces a facial scrub with a good texture. In line with that, Fauzi [22] stated that the main function of facial scrub is to remove dead skin cells, a good texture that is rough-textured where if held and smeared there are granules. The texture of OPF tends to be rougher than PPF because it contains a lot of fiber, which if mashed into flour then tends to form granules.

Orange peel consists of flavedo and albedo. Flavedo is part of the outer peel which is located at the bottom of the epidermis layer and contains chromoplast and oil sacs, while the inner skin called albedo is a layer of foam tissue from fibers [23]. While the texture of PPF can be in the form of granules if it is heated because the potato skin contains starch. Starch-modified starches are resistant to high temperatures, stirring, and acidic conditions and have characteristics of granules that are not too swell [24]. The proportion of PPF and OPF that is almost equal (4 g PPF, 3 g OPF) produces a better texture than the other proportions because the two ingredients have almost the same texture which is rough texture. If the orange peel flour is more then the texture tends to be very rough, but if the proportion of potato skin is more / dominates, the texture is smoother. Therefore, Duncan test result showed that X3 proportion produces rougher texture compared with other proportion level X1, X2, and X4.

3.2.4. Rice Flour-Based Facial Scrub's Stickiness

The analytical result with one-way ANOVA to determine the effect of PPF and OPF proportion on rice flour-based facial scrub's stickiness showed that F value = 28,002 and significant value of 0.000 or < 0.05. Therefore, it can be concluded that there is an influence of the proportion between PPF and OPF on rice flour-based facial scrub's stickiness. This is due to potato peel contains starch which has very high adhesion, while orange peel has a low adhesion. Thus, if combined, it will produce good adhesion that can stick well and is easy to remove. Starch adhesiveness on the resulting potato skin is very easy to stick and easy to rub. Starch serves as an adhesive and provides thickness to the physical properties of face scrubs made from potato peels and orange peels.

Besides potato starch derived from potatoes has physical properties that are able to attach objects that contain fat. Including various kinds of microscopic feces and microorganisms [25]. While the adhesiveness of orange peel flour is indeed low according to Li, et al [26] stated that the higher the concentration of orange peel essential oil, the smaller the adhesion. As it is known that orange peel contains lots of essential oils. Duncan test result showed that X3 proportion produces stickiest facial scrub compared with other proportion level X1, X2, and X4.

3.2.5. Rice Flour-Based Facial Scrub's Preference

The analytical result with one-way ANOVA to determine the effect of PPF and OPF proportion on rice flour-based facial scrub's preferences showed that F value = 61,102 and significant value of 0.000 or < 0.05. Therefore, it can be concluded that there is an influence of the proportion between PPF and OPF on rice flour-based facial scrub's preferences. This is due to the highest mean value of preference level was 3,6 which can be integrated to 4. Score 4 has meant a very like which means the proportion of X3 is the proportion most preferred by panelists because of the aroma of the final product. yellowish-brown. The final product of facial scrub easily adhered to facial skin easily peels off when rubbed has a rough texture and can remove dirt on the surface of facial skin. Duncan test result showed that X3 proportion produces most preferred facial scrub compared with other proportion level X1, X2, and X4.

IV. CONCLUSION

According to the experiment and data analysis that carried out on the proportion of PPF and OPF in the rice flour-based facial scrub, we can conclude that potato and orange peel flour proportion affected on aroma, texture, stickiness, color, and preference of rice flour-based face scrub. Overall, the best final product was rice flour face scrub with a proportion of potato and orange peel flour (PPF: OPF) on 4 g PPF and 3 g OPF. This study indicated that discharges peel from potato and orange can be transformed into flour, reduce consumed, and industrial waste which has a bad impact on the environment. PPF and OPF can be added in rice flour-based facial scrub in several amounts. Therefore, further research is needed to determine the shelf life of face scrubs.

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