FORMULATION OF BODY SCRUB COMBINATION OF ARABICA COFFEE AND VANNAMEI SHRIMP SHELLS

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Abstract. Body Scrub is a cosmetic treatment that works to help lift dead skin cells. Coffee can serve as a scrubbing ingredient, while shrimp shells contain chitosan that is useful for smoothing the skin. This study aims to determine the effect of differences in the concentration of Tween 60-Span 60 as an emulgator on Arabica coffee powder body scrub formulation with vannamei shrimp shells (Litopenaeus vannamei). The body scrub formulation uses 15% Arabica coffee bean powder and 3% vannamei shrimp shells and a variation in the concentration of Tween 60-Span 60. namely F1 (1.5: 0.5%), F2 (1%:1%), and F3 (0.5%: 1.5%). Formula evaluation tests include organoleptics tests, homogeneity tests, pH tests, dispersion tests, adhesion tests and cream type tests. Furthermore, a stability test was carried out using the cycling test method for 6 cycles. The data was analyzed using the One Way Anova test followed by the Tukey HSD test. The results of statistical analysis in the spreadability and stickiness tests showed that there was an influence of variations in the concentration of Tween 60-Span 60 in F2 and F3 with the significance value for both formulas being 0.985 for the positive control. The stability test shows a stable formula at changes in storage temperature. It can be concluded that the best emulgator concentration for the body scrub formula in this study is the ratio of Tween 60-Span 60 1%:1% and 0.5%:1.5%.
Keywords: *Arabika coffee, vannamei shrimp shell, body scrub, Tween 60, Span 60*

Introduction

The skin is an essential organ that covers the surface of the body and has the main function as a protector from various kinds of interference and stimuli from outside. The skin also has the ability to regenerate, replacing dead skin cells with new skin cells (Kolekar et al., 2021). One of the cosmetic preparations that can be used for skin care from the outside is body scrub. This cosmetic preparation serves to smooth the skin and help remove damaged skin cells with the help of scrubs. Scrub ingredients are made from rice, coffee, yam and other natural ingredients (Barel et al., 2014). Coffee has coarse grains so it is expected to be formulated in body scrub preparations to remove dead skin cells so that the skin will look brighter and cleaner. Coffee contains alkaloid compounds, saponins, tannins, terpenoids, flavonoids and has antioxidant activity (Kellou and Nabti, 2023). Vanami shrimp shell (*Litopenaeus vannamei*) is marine waste containing chitin which is useful for making chitosan. Chitosan has benefits for moisturizing and smoothing the skin (Aranaz et al., 2018).

Cosmetic is dosage forms that one of the goals is to improve skin health. One of the dosage forms of cosmetics used as a treatment is scrub preparations. The use of scrub preparations can produce healthy and fresh skin. The scrubbing effect comes from the solid particles in the formula. The combination of coffee beans and chitosan from vannamei shrimp shells can be formulated in scrub form as a solids phase dispersed in a cream base. Emulgator is needed in cream formulations to disperse oil globules in water or water globules in oil so that a stable and elegant formula is obtained. This study has observed the formula of scub preparation cream by varying the concentration of

surfactants, namely Tween 60 and Span 60, both are non-ionic emulsifying agent that have a hydrophilic and lipophilic balance that can produce cream types O/W, Tween 60 and Span 60 are non-toxic, non-irritative, stable in acidic and weakly alkaline atmospheres, and have a low potential for hypersensitivity (Nafiah et al., 2023).

Materials and Methods

Coffee powder making

Arabika coffee, vannamei shrimp shell, NaOH (Merck, Jerman), HCL (Merck, Jerman), Mayeir, Wagneir, and Drageindorff reagent, eithanol 95%, Tweiein 60, Span 60, meityl parabein (Bratachem, Indonesia), propyleine glycol (Bratachem, Indonesia), ceityl alcohol (Bratachem, Indonesia), vaseiline albuim (Bratachem, Indonesia), ninhidrine (Merck, Jerman), iodine (Merck, Jerman), sulphate acid (Merck, Jerman), and distilled water. Arabica coffee beans are roasted and then made using homogenizer (Phillips, Japan). Coffee grounds are sifted using sieve mesh number 40 (Uman et al., 2016).

Making chitosan from shrimp shells

The wet shells is rinsed for 1 day, then powdered using homogenizer (Phillips, Japan). The deacetylation process of shrimp shells becomes chitosan through 3 stages, namely deproteination, demineralization and deacetylation (Saha et al., 2023). Deproteinization was carried out by mixing shrimp shell powder with 1M NaOH 1:10 (w/v), stirring at 700 rpm at 60°C for 2 hours (Nesco). Demineralization using 1M HCL with a ratio of 1:10 (w/v) stirred at a speed of 700 rpm while heated at a temperature of 30°C for 60 minutes, then dried, so that chitin is recovered. Furthermore, deacetylation of chitin becomes chitosan by adding NaOH 1M with a ratio of 1:15 (w/v) while heated at of 90°C for 60 minutes, stirred 700 rpm, diluted by HCl and accompanied at a height of 80°C for 30 minutes (Vallejo-Domínguez et al., 2021).

Secondary metabolites identification coffee beans, chitin and chitosan

Coffee beans is observed by identifying alkaloid using Wagner, Mayer and Dragendorff reagents (Mangiwa and Maryuni, 2019). Chitin identification using Lugol's reagent gives it a brown color and adds sulfur acid. Chitosan identification is carried out by spraying the material using ninhidrine reagent and let stand for 5 minutes (Aranaz et al., 2018).

Formulation body scrub

The oil phase consists of vaseline, cetyl alcohol and Span 60 melted at 70°C, then propyl paraben was added. The water phase consists of propylene glycol, Tween 60 and water heated at 70°C. The oil phase and the water phase are mixed and homogenized to form a cream. Chitosan shrimps vannamei and coffee powder are put into the cream mass (Chopra et al., 2022).

Stability test

The formula is tested for stability using cycling test methods. One cycle in this test is carried out by storing the formula at 4°C for 24 hours and transferring it to a container

with 40°C for 24 hours. The testing was carried out in a total of 6 cycles (Sinko, 2006). Test parameters observed in this stability test include: organoleptic test, pH, homogeneity, spreadability test, adhesion strength, and cream type. The organoleptic test is a physical parameter of the performance at the consistency, colour and smell. The characteristics of the body scrub formula is having a rough character, homogenous of the colour and implying the smell. The pH value is done by raising the pH meter (pH meter, Hanna USA) by dipping the pH meter probe into the sample. Cream homogeneity is done by applying a sample on glass object then observation is made where it is said to be homogenous if not rough particulate (Musdalipah et al., 2016). The spreading power test was carried out by applying 0.5 grams of sample to the middle of the watch glass surface, then given a load of 50 grams for 1 minute. Furthermore, the diameter of the spreading power of the sample was measured.The adhesive strength test was carried out by weighing 0.5 grams of the formula, then the formula was smeared on the glass plate. The glass plate was placed on the test tool, then the plate was given a load of 500 grams for 1 minute. After the load was released, record the time until the two layers of the glass plate were removed (Chopra et al., 2022).

Cream type test is done by using the methylene blue staining method in the formula viewed using a microscope. If the methylene blue is evenly distributed, it indicates the formula is an oil-in-water (O/W) type, but if it gives blue spots, it indicates the formula is an oil-in-oil (W/O) type.

Results and Discussion

Extraction results

The manufacture of coffee bean powder and extraction of chitosan from vanami shrimp shells can be seen in *Table 1*. The making of a single Arabica coffee bean uses 200 grams of raw coffee beans which are roasted for 10 minutes with a small fire until the weight becomes 179.28 grams. The coffee beans are ground using a blender and sieved using a sieve with a mesh no. 40. The production of chitosan from vannamei shrimp shells uses three stages of the process, namely: deproteinization, demineralization and deproteinization. The deproteinization stage is intended to loosen the protein bonds in the shrimp shell. At this stage, a shrimp shell is given a NaOH solution to remove the protein contained in the shrimp shell assisted by heating and stirring, so that it can accelerate the binding of the protein chain with NaOH so that the degradation and precipitation of protein take place perfectly (Xu et al., 2022). The demineralization stage aims to remove inorganic salts or minerals present in the shrimp shell. This stage uses HCl solution, so that the separation of minerals from the shrimp shell occurs. The separation process is indicated by the formation of CO_2 gas in the form of air bubbles when the HCl solution is added to the sample. The demineralization stage obtained a chitin pellet of vannamei shrimp shell with a yield of 49.46%. This result is in accordance with the extraction requirements, which state that the chitin content is above 20%. The deacetylation stage aims to remove the acetyl groups in chitin using an alkali solution to convert them into amine groups called chitosan. Chitosan powder from vannamei shrimp shell is light pink and odorless. The deacetylation process produces 29.82 grams of chitosan powder, resulting in a yield of 60.29%.

Table 1. *Yield of coffee bean powder and vanami shrimp shell chitosan.*

Sample	Yield value (in percentage, %)
Arabika coffee bean (*Coffeia arabica*)	89.64
Chitosan from Vaname Shrimp Shell (*Litopeinaeiuis vannameii*)	60.29

Secondary metabolites identification

The results of secondary metabolites identifications show that testing for the presence of alkaloids in coffee bean samples is indicated by the Wagner, Mayer and Dragendorf tests. The observation results showed that coffee contains flavonoids. Meanwhile, the test on chitin and chitosan showed that qualitatively shrimp skin contains chitin and chitosan. The results can be seen in *Table 2*.

***Table 2**. Results of identification of secondary metabolites and content in coffee and shrimp.*

Materials	Test	Parameters	Result
Coffee	Wagner	Brown sediment	+ alkaloid
	Mayer	Yellow sediment	+ alkaloid
	Dragendorff	Orange sediment	+ alkaloid
	HCl 2N	orange red	+ flavonoid
Chitin	Lugol-sulphate acid	Brown, violet	+ chitin
Chitosan	Ninhidrine	Violet	+ chitosan

Formulation body scrub

This study aims to obtain the best formula by varying the concentration of emulsifier materials, namely Tween 60 and Span 60. The formulation can be seen in *Table 3*, while the formula results can be seen in *Figure 1*. The formula that has been made, then tested for stability with the cycling test method for 6 cycles. The results of the stability test can be seen in *Table 4*, which results show that all formulas stable in organoleptic observations, pH, homogeneity and cream type. In the spread power stability test which can be seen in *Figure 2*. It appears that F1 dan F3 tend to have decrease in spreading power, meanwhile F2 tends to be stable up to the 6th cycle with a spread power of 5.1 cm. These results indicate that the consistency of the material can affect the spreadability of the formula. Formulas with high Tween concentrations tend to have better spreadability compared to formulas with higher Span concentrations (Chauhan and Gupta, 2020). It is known that Tween 60 is a nonionic surfactant that has a gel consistency, while Span 60 is in the form of pellets.

***Table 3**. Body scrub formula combination of Arabica coffee beans and vanami shrimp skin against variations in Tween 60 and Span 60 concentrations.*

Materials (% w/w)	F1	F2	F3
Coffee powder	15	15	15
Chitosan	3	3	3
Tween 60	1,5	1,0	0,5
Span 60	0,5	1,0	1,5
Methyl paraben	0,18	0,18	0,18
Propylene glycol	5	5	5
Cetyl alcohol	2	2	2
Vaseline album	10	10	10
Distilled water up to	100	100	100

***Table 4**. Results of the cycling test stability test of the body scrub formula.*

Cycle	Formula	Organoleptic			pH	Homogeneity	Cream type
		Consistency	Color	Order			
1	F1	SS	B	coffee	6	H	O/W
	F2	SS	B	coffee	6	H	O/W
	F3	SS	B	coffee	6	H	O/W
	K+	SS	DB	coffee	6	H	O/W
2	F1	SS	B	coffee	6	H	O/W

	F2	SS	B	coffee	6	H	O/W
	F3	SS	B	coffee	6	H	O/W
	K+	SS	DB	coffee	6	H	O/W
3	F1	SS	B	coffee	6	H	O/W
	F2	SS	B	coffee	6	H	O/W
	F3	SS	B	coffee	6	H	O/W
	K+	SS	DB	coffee	6	H	O/W
4	F1	SS	B	coffee	6	H	O/W
	F2	SS	B	coffee	6	H	O/W
	F3	SS	B	coffee	6	H	O/W
	K+	SS	DB	coffee	6	H	O/W
5	F1	SS	B	coffee	6	H	O/W
	F2	SS	B	coffee	6	H	O/W
	F3	SS	B	coffee	6	H	O/W
	K+	SS	DB	coffee	6	H	O/W
6	F1	SS	B	coffee	6	H	O/W
	F2	SS	B	coffee	6	H	O/W
	F3	SS	B	coffee	6	H	O/W
	K+	SS	DB	coffee	6	H	O/W

Note: SS=Semi Solid, B=Brown, DB=Dark-Brown, H=Homogeneous.

Figure 1. *Body scrub formula combining Arabica coffee beans and vannamei shrimp shells against variations of Tween 60 and Span 60.*

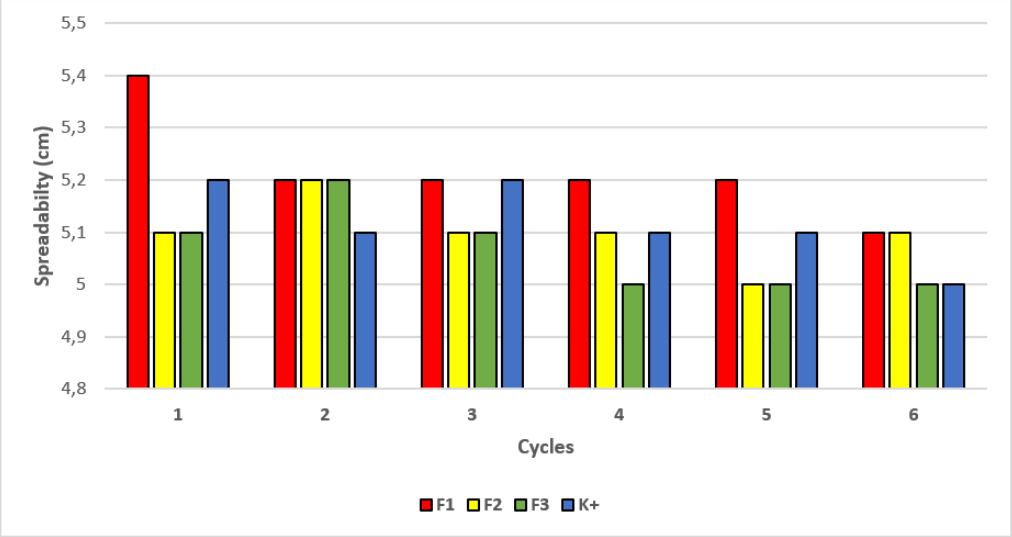

Figure 2. *Spreadability of body scrub formula in stability test.*

Based on the analysis of the spreadability data using One Way Anova, the significant value of 0.012, with a value α=0,05. It shows that there is an influence of the difference in the concentration of Tween 60- Span 60 on the spreadability of the formula body scrub of Arabica coffee beans with shrimp skin.The results of analysis using Tukey HSD with a value of α=0.05 obtained a significant value of the comparison of F1 to K+ giving a sig value=0.098, F2 to K+ giving a sig value=0.985 and F3 to K+ giving a sig value of 0.720. It can be stated that there is no significant difference in the spreadability of each formula against the K+, and F2 shows the greatest significance value against K+. The adhesion test that can be seen in *Figure 3*, it appears that all formulas tend to increase their adhesive power up to the 6th cycle. Changes in temperature in the stability test affect the consistency of the formula to become thicker, thereby increasing the adhesive power of the formula (Ganji et al., 2022). The results show that F1 has the lowest adhesive power compared to F2 and F3. In the formula, F1 has the highest concentration of Tween 60 compared to the other formulas, which is 1.5%. Tween 60 has a gel consistency while Span 60 is in the form of pellets, so increasing the concentration of Tween 60 can reduce the adhesive power of the formula, conversely increasing the concentration of Span 60 can increase the adhesive power. In Figure 3 it can be seen that F3 has the highest adhesive power because it has the highest concentration of Span 60, which is 1.5%.

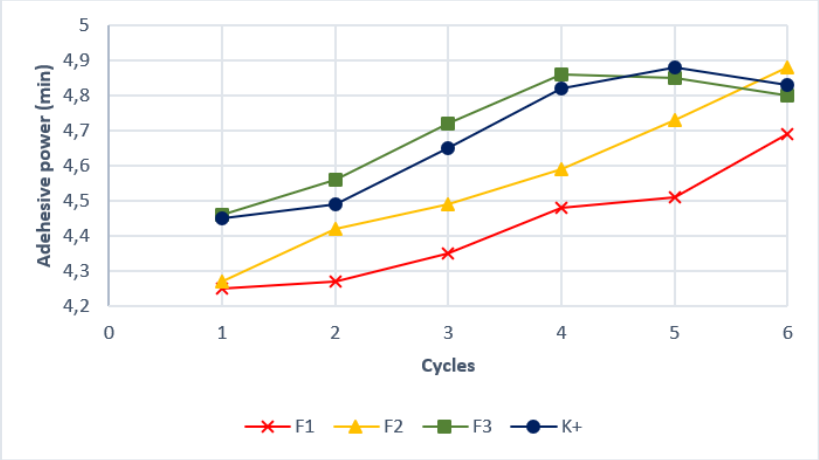

Figure 3. *Adhesive power of body scrub formula in stability test.*

Based on the results of One Way Anova in the adhesion test, it shows that the significance value of 0.034 with value of α=0.05. It shows that there is a difference in the variation of the concentration of the emulsifier Tween 60-Span 60 in the body scrub formula of Arabica coffee beans with vannamei shrimp shell on the adhesion of the formula to the skin. Based on the results of the post hoc test, the significant value of the comparison of F1 to K+ gave a sig value=0.077, F2 to K+ gave a sig value=0.643, and F3 to K + sig=0.985. From the results of data analysis using Anova, it shows that F1, F2 and F3 have no significant different binding power to the K+. Based on the significance value, it shows that F3 has the largest value, namely sig=0.985, which means it has similarities to K+ compared to other formulas. The cream type test in this study used the coloring method and the dilution method. The formula coloring method used the Methylene blue reaction and observed under a microscope, the preparation was seen to have an even color so it was said to be an oil-in-water type. The results of the oil type test observations can be seen in *Figure 4*. In the cream type test, the dilution method was carried out by mixing the formula with aquadest in a reaction tube and then shaking it. The observation results showed that the three formulas contained oil at the top of the tube, this indicated that the formula had an O/W cream type. In the 6 cycle stability test, all formulas showed no color change in the methylene blue staining test, indicating that there was no change in the type of cream, thus stating that all body scrub formulas were stable. The combination of Tween 60 and Span 60 in the body scrub formula can increase the stability of the body scrub cream formula. Tween 60 and Span 60 have the same fatty acid bound to the nonionic surfactant monomer, namely the monostearate group (Rowe et al., 2009). The monolayer membrane on the formed O/W globules can tightly wrap the oil globules, so that there is no membrane leakage, so that phase separation didn't occur (Adejokun and Dodou, 2020). Due to this, the formula can be declared stable in the stability test. A similar thing happens to body scrub creams that use surfactants with the same lipophilic group as in the use of Tween 80 and Span 80 (Lv et al., 2014).

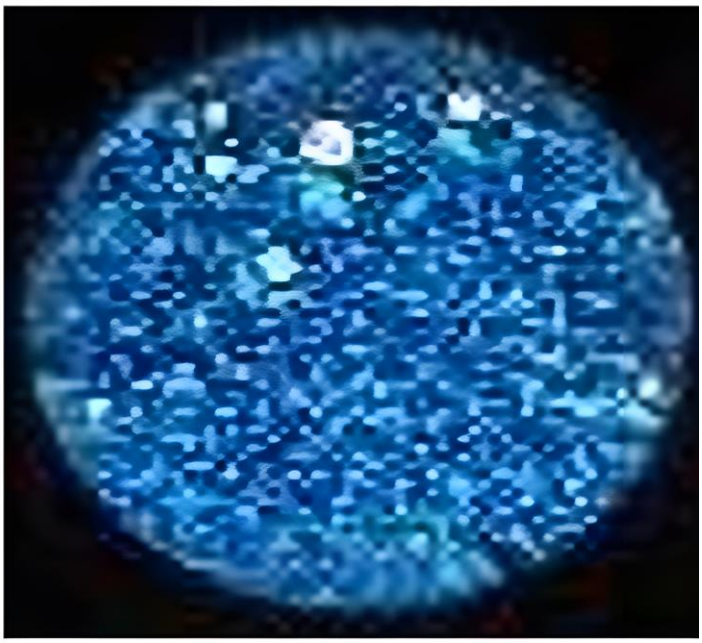

Figure 4. *Cream type testing.*

Conclusion

Based on the results of observations on the formulation test of body scrub preparations, a combination of Arabica coffee beans and vannamei shrimp shell that have been carried out, it can be concluded that there is an influence of variations in the concentration of Tween 60-Span 60 on the spreading power and adhesive power. The best variation of Tween 60-Span 60 concentration used as an emulsifier in the body scrub formula of Arabica coffee beans with shrimp shell is in F2 the ratio of Tween 60-Span 60 with a ratio of 1%:1%. The results of the stability test showed that all body scrub formulas were stable in the accelerated stability test using the cycle method.

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Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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