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TEST ANTI-AGING ACTIVITY IN A FACE SCRUB PREPARATION THAT CONTAINS COFFEE-GRADE ACTIVE CHARCOAL (*COFFEA ARABICA L.*) WITH THE ADDITION OF VITAMIN E

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Ageing can be caused by accumulating excess dead skin cells on the skin's surface. Coffee grounds are a by-product of the coffee brewing process. Coffee grounds can be used as activated charcoal in face scrub preparations.

The purpose of this study was to formulate and test the effectiveness of anti-ageing face scrub preparations of coffee grounds activated charcoal (*Coffea arabica L.*) with the addition of vitamin E.

Material and methods: the research method includes processing coffee grounds in the form of drying and making activated charcoal, then formulating into face scrub preparations with a concentration of 1 %, 2 %, 3 % with vitamin E, 5 % and without vitamin E and blanc (without activated charcoal). Evaluation of face scrub preparations includes homogeneity test, stability test (odour, colour, pH and consistency), cycling test, dispersion test, viscosity test, centrifugation test, hedonic test, irritation test, and effectiveness test (moisture, pores, stains, wrinkles) on facial skin using a skin analyser on 24 volunteers with application to the face once a week for 4 weeks. The experimental data were analysed using the SPSS 22 program.

Results: they showed that all face scrub preparations were in the form of cream with grey-black granules, coffee-scented, homogeneous, stable for 12 weeks of storage at room temperature (20–25 °C), pH value (5.0–6.0), had a spreading power of 5–7 cm, viscosity (3760–3996 mPa·s), no separation occurs in the centrifugation test and does not irritate facial skin. The results of the hedonic test, the most preferred formulation, was the F3 preparation. The effectiveness test results were an increase in humidity of 27 %, a decrease in pore size of 35.8 %, stains of 40 % and wrinkles of 37.6 %.

Conclusion: from the results of the study, it can be concluded that the face scrub preparation of activated charcoal coffee grounds (*Coffea arabica L.*) with a concentration of 3 % and vitamin E 5 % is a formula that meets the evaluation of the preparation and measures the effectiveness of anti-ageing

Keywords: activated coffee charcoal (charcoal), face scrub formulation, anti-ageing, vitamin E

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1. Introduction

Skin is an important part of the human body which has the largest area, is located at the outermost, helps cover the entire human body and has protective power against external influences. Ageing is the process of slowly losing the ability of tissues to repair themselves and maintain their normal structure and function so that the skin cannot withstand damage. Ageing can be seen from seven main signs such as fine lines and wrinkles, skin colour and texture changes, dull skin surface, visible pores, blotches, age spots and dryness [1]. Ageing can also be caused by excessive accumulation of dead skin cells on the skin's surface. These dead skin cells must be removed so that skin regeneration can occur properly. One way to do this is by exfoliating [2]. Several previous studies have proven that many studies have been carried out on the use of coffee grounds in the cosmetic field, such as research on the formulation of making body scrubs from coffee grounds because of their high antioxidant content. Another study was carried out to formulate scrub preparations from coffee grounds, which were

proven to have good physical stability when formulating and did not show any creaming during storage. pH testing gave a pH value range of 4.7–5.4, which was still in the range according to the pH criteria of cosmetic preparations [3, 4].

Antioxidant testing is one of the most widely used tests for testing the effectiveness of cosmetic preparations. For example, antioxidant testing is one of the tests carried out using coffee bean dregs. The results of antioxidant testing using coffee samples gave an IC_{50} value of 89.48 ± 37.65 ppm with a medium category [5].

According to Caetano et al. (2020), coffee grounds still contain beneficial compounds. Coffee grounds contain a high total carbon content of 47.8–58.9 %. Carbon is a substance that can be used as an active adsorbent or often known as activated charcoal or charcoal. Based on the absorption function, activated charcoal has the potential to be further developed as an active substance in skin cleansing preparations [6]. Activated charcoal with a concentration of 2 % in soap preparations can provide results that meet SNI requirements

and have better skin cleansing power than preparations without activated charcoal [7]. Activated charcoal as an adsorbent is very good if used in an exfoliant preparation such as scrubs and scrubs so that the skin regeneration process will also be better and can avoid the effects of premature ageing [8].

Another factor that affects skin ageing is excessive sun exposure [9]. The use of cosmetic preparations containing anti-ageing agents such as vitamin E functions very well as an antioxidant, and anti-ageing can also overcome the effects of ageing. Face mask 5 % concentration of vitamin E in gel preparations provides good effectiveness as an anti-ageing. The amount of vitamin E is limited in the body and can be reduced by UV radiation and other oxidative stress [10]. Antioxidant activity using the Inhibitory Concentration (IC_{50}) parameter. Vitamin E has an IC_{50} of 8.27 g/ml. The smaller the IC_{50} value, the higher the antioxidant activity [11, 12].

In the clinical study, vitamin E was safely used in topical formulations as an antioxidant that helps the regeneration process and maintains skin elasticity. In addition, activated charcoal is often found in skin cleansing preparations such as soap, masks, toothpaste, micellar water, body scrubs, shampoos and scrubs. Therefore, activated charcoal containing vitamin E has the potential to be developed into a face scrub formulation [13, 14].

2. Planning (methodology) of research

Coffee grounds, regarded as trash, are used to formulate face scrub preparations. By utilising waste, this face scrub formulation helps to reduce waste in people's daily lives. The processing of coffee grounds through the steps of drying samples for use as activated charcoal is a part of this study. With the inclusion of vitamin E, the face scrub recipe is manufactured in five concentrations: 1 %, 2 %, 3 %, and 5 %. The preparation is next tested for homogeneity, stability (odour, colour, pH, and consistency), cycling, dispersion, viscosity, centrifugation, hedonistic, irritation, and effectiveness (moisture, pores, blemishes, wrinkles) on facial skin using a skin analyser.

3. Methodology of the research

Apparatus.

The tools used in this study include a muffle furnace, an oven (Memmert), a desiccator, filter paper, burettes, hot plates, stirrer rods, porcelain dishes, glass funnels, mortar and pestle, analytical balance, NDJ 8-s viscometer, pH meter, centrifuge (Eppendorf 5424R), skin analyser (Aramo Huvis), and laboratory glassware.

Materials.

Arabica coffee grounds (*Coffea arabica*. L) gathered from a coffee shop in the Banda Aceh area, HCl (Merck), sodium thiosulfate (Merck), activated charcoal (Nature's Way), cetyl alcohol (Bratachem), glycerin (Scorlife), triethanolamine (TEA) (Merck), propylene glycol (Merck), methylparaben (Neutron), and propylparaben (Merck) are the materials to be used in this study.

Activated charcoal making: 40 grams of Arabica coffee grounds were dried in the sun, then put in a fur-

nace at a temperature of 450 °C for ±45 minutes until the pulp turned into charcoal, and cooled in a desiccator. Then the charcoal activation process is carried out chemically by soaking the charcoal in 0.1 M HCl solution for 48 hours, checking the initial pH. Then washed with distilled water and measured the pH of the activated charcoal again to a neutral pH, then put in an oven at 100 °C for 4 hours. Then characterisation of the finished activated charcoal was carried out by calculating the yield, volatile matter content, water content, ash content, pure activated carbon content and iodine absorption. The characteristics of the formulated activated charcoal are yield, volatile substance level, water level, ash level, pure activated carbon content and iodine absorption [15].

Formulation of Arabica coffee scrub.

Arabica coffee is converted into activated charcoal, which is used as raw material to manufacture face scrub preparations. The ingredients used are cetyl alcohol which is used as an emulsifier, which can increase the stability of the preparation; stearic acid used as an emulsifier, glycerin acts as a humectant; triethanolamine (TEA), used as solvent and humectant, propylene glycol acts as a humectant, methylparaben used as a preservative, propylparaben used as a preservative and aqua dest used as a solvent. The amount of activated charcoal used in this study was 1 %, 2 %, and 3 %.

The preparation process begins with weighing the ingredients that will be used in making face scrubs. The preparation process is divided into two phases, namely, the oil phase and the water phase. The oil phase, which includes stearic acid and cetyl alcohol, is heated to 70–75 °C and stirred for about 10 minutes or until homogeneous. The aqueous phase ingredients include propylene glycol, glycerin, triethanolamine (TEA), and distilled water, heated to 75–80 °C and stirred for about 15 minutes. Furthermore, the material in the water phase is poured little by little into the oil phase with constant manual stirring speed to a temperature of about 40 °C for about 15 minutes. Added 5 % Vitamin E and mixing of coffee grounds activated charcoal scrub granules (1 %; 2 %; 3 %) to the preparation after the thickened cream base was formed.

Following evaluation, parameters were performed to ensure the superiority of prepared face scrub organoleptic, pH, spreadability, viscosity, centrifugation, stability, cycling test, irritation, Hedonic and Anti-ageing test [7, 16]

pH Test.

The test is done by calibrating the pH meter first. Then 1 gram of the preparation to be examined is diluted with distilled water to 100 ml, the pH meter electrode is dipped into the solution, and the measured pH of the preparation is recorded [17].

Spreadability test.

Weighing 0.5 grams of the cream mixture and laying it on a glass with a 15 cm diameter served as the spreadability test. Next, add weights of 50 grams, 100 grams, and 150 grams to the preparation and place the glass on top. After one minute of testing, the cream preparation's diameter was determined [18].

Viscosity test.

Measurement of the viscosity of the preparation was carried out by placing the preparation in a 100 ml glass beaker and selecting the appropriate spindle number. This measurement was carried out with three repetitions using the NDJ-8S viscometer. In addition, the determination of the viscosity of the preparation was carried out at room temperature for 12 weeks [18].

Centrifugation test.

This test was carried out by inserting the cream preparation into a centrifugation tube, then rotating it at 3750 rpm for 5 hours, and then observing the physical changes to determine whether there was a separation. This measurement is carried out once before the preparation is made [19].

Cycling test.

The sample is put in a container, stored in an oven at 45 ± 2 °C for 24 hours, then transferred to a freezer at 5 ± 2 °C for 24 hours (one cycle). The test is continued for up to 6 cycles or 12 days. Furthermore, organoleptic evaluation, pH, syneresis, and viscosity were carried out [19].

Irritation test.

The irritation test was carried out using a patch test technique, namely a preventive patch, which was carried out by attaching the preparation with the highest concentration of the active substance (F3) to the back of the right ear and the left ear for a blank (F0) as a comparison. A safety test was conducted for 24 hours for each volunteer. Symptoms that arise are observed. Generally, irritation will be immediately indicated by a skin reaction shortly after sticking or touching the skin. Such irritation is called primary irritation. But if this reaction occurs several hours after touching and sticking to the skin, then this irritation is called secondary irritation [20].

Based on inclusion criteria, women between the ages of 28 and 35 who displayed evidence of early ageing, had no prior history of skin allergies, and had been trained to refrain from using other anti-inflammatory medications for 4 weeks were chosen as volunteers. Volunteers are willing to participate in the research all the way through, test the preparation's effectiveness as an anti-ageing measure, and be assessed for discomfort [20].

4. Result

*Activated charcoal characterisation.**Yield.*

The yield value of activated charcoal of Arabica coffee grounds in this study was 79.975 %. Therefore, the criteria for the yield value of activated charcoal of Arabica coffee grounds in this study have met the requirements of SNI [21].

Volatile substance level.

The test of volatile substances level of activated charcoal of Arabica coffee grounds in this study was 12.7 %. According to SNI, the value of volatile substances that must be met by activated charcoal is 25 %. The levels of volatile substances obtained from the activated charcoal of Arabica coffee grounds in this study have met the requirements of SNI [22].

Moisture content.

The results of testing the water content of activated charcoal of Arabica coffee grounds in this study were 5 %. According to SNI, the value of water content that must be met by activated charcoal is a maximum of 15 %. The water content obtained from activated charcoal in this study has met the requirements of SNI [23].

Ash level.

The test results of the ash content of activated charcoal Arabica coffee grounds in this study were 2.333 %. According to SNI, the value of ash content that must be met by activated charcoal is 10 %. Therefore, the value of ash content obtained from activated charcoal of Arabica coffee grounds in this study has met the requirements of SNI [24].

The pure activated carbon level.

The results of pure activated carbon levels of activated charcoal from Arabica coffee grounds in this study were 79.967 %. According to SNI, the value of pure activated carbon that must be met by activated charcoal is at least 65 %. The pure activated carbon content obtained in this study has met the requirements of SNI [15].

Iodine Absorption.

The results of the iodine absorption test for activated charcoal of Arabica coffee grounds in this study were 1522.8 mg/g. According to SNI, the value of iodine absorption that must be fulfilled by activated charcoal is at least 750 mg/g. Therefore, the value of iodine absorption of activated charcoal of Arabica coffee grounds in this study has met the requirements of SNI [24].

*Preparation Evaluation.**Organoleptic Examination Results.*

The results of the organoleptic examination carried out on all formulations were evaluated immediately after completion. In addition, evaluation of the preparation at week 0 was carried out to compare the state of the preparation before and after the stability test was carried out using physical quality parameters [25].

Homogeneity Examination Results.

The results of the homogeneity examination of blanks (F0) and F7 showed that the preparation did not show any coarse grains when applied to transparent glass. Examination of the homogeneity of the formulas F1 to F6 showed that the activated charcoal particles of coffee grounds mixed evenly when the preparation was smeared on a transparent glass [14]. The particle size of activated carbon has varied pore sizes from a micro size below 20 Ao, meso size between 20 to 50 Ao, and macro size exceeding 500 Ao.

pH Test.

Results of pH measurements are shown in Table 1. In examining the pH of the face scrub preparation, it was found that the pH obtained increased compared to the pH after it was made but was still within the range of requirements. Therefore, although there is an increase in pH, the preparation is still safe to use, where the pH of this preparation is still within the physiological pH of the skin, which is 4.5–6.5 [19].

Results of pH measurements for face scrub preparations

No.	Formula	pH value				Mean ±SD
		Time (noun)				
		0	4	8	12	
1	Blanc (without active ingredients)	5.2	5.3	5.3	5.4	5.28±0.08
2	F1 (activated charcoal 1 % and Vit. E)	5.3	5.4	5.4	5.5	5.36±0.06
3	F2 (activated charcoal 2 % and Vit. E)	5.4	5.5	5.6	5.7	5.56±0.11
4	F3 (activated charcoal 3 % and Vit. E)	5.5	5.6	5.7	5.7	5.66±0.06
5	F4 (activated charcoal 1 % without Vit. E)	5.2	5.3	5.3	5.4	5.28±0.08
6	F5 (activated charcoal 2 % without Vit. E)	5.4	5.5	5.5	5.6	5.48±0.08
7	F6 (activated charcoal 3 % without Vit. E)	5.3	5.4	5.4	5.5	5.38±0.08
8	F7 (Vit. E 5 %)	5.2	5.3	5.3	5.4	5.28±0.08

Table 1 Centrifugation test results.

The stability of the mask preparation is one of the parameters that show the stability of the mask. The results of centrifugation show the ability of the preparation to remain homogeneous and stable during storage [30] (Table 4).

Spreadability Test.

The spreadability test is one of the evaluation procedures used to assess a cosmetic preparation's spreadability when used for its intended purpose [26]. For preparations applied to the face, a good dispersion value is between 5 and 7 cm [27]. Table 2 below shows the outcomes of testing the spreadability of face scrub formulations.

The information above shows that every formula that was tested complied with the conditions for the preparation's dispersion test.

Results of Preparation of Viscosity Measurement.

Viscosity testing was carried out using a Brookfield Viscometer. Viscosity testing is carried out to determine the viscosity of the preparation, the ability to spread the preparation, and the readiness of the preparation to flow or be removed from the container [28, 29]. A viscosity that is too high can cause uneven distribution of the preparation on the skin. In contrast, a low viscosity causes the preparation to be too runny so that it is difficult to apply to the skin and difficult to attach the preparation to the skin [7]. Table 3 below shows the results of testing the viscosity of facial scrub formulations.

Centrifugation test results

Formulation	Centrifugation test results				
	Co-lour	Smell	Appearance	Sediment	Phase separation
Blanc (without active ingredients)	White	Coffee	Good	-	-
F1 (activated charcoal 1 % and Vit. E)	Gray White	Coffee	Good	-	-
F2 (activated charcoal 2 % and Vit. E)	Gray	Coffee	Good	-	-
F3 (activated charcoal 3 % and Vit. E)	Black	Coffee	Good	-	-
F4 (activated charcoal 1 % without Vit. E)	Grey White	Coffee	Good	-	-
F5 (activated charcoal 2 % without Vit. E)	Grey	Coffee	Good	-	-
F6 (activated charcoal 3 % without Vit. E)	Black	Coffee	Good	-	-
F7 (Vit. E 5 %)	White	Coffee	Good	-	-

Table 4

Note: no phase separation (consistency)

The results of the evaluation of the spreadability of face scrub preparations

No.	Object weight (g)	Spread Diameter (cm)							
		Formulation							
		F0	F1	F2	F3	F4	F5	F6	F7
1.	0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	3.5
2.	50	3.8	4.3	4.5	5.0	4.4	4.7	4.8	3.7
3.	100	4.5	4.8	5.2	5.5	4.8	5.3	5.4	4.5
4.	150	5.0	5.5	5.7	5.8	5.5	5.8	6.0	5.0
Mean ±SD		4.2±0.67	4.7±0.65	4.9±0.75	5.1±0.78	4.7±0.63	5.0±0.77	5.1±0.85	4.2±0.69

Table 2

Storage results at high temperatures.

The results of observations of face scrub preparations can be seen that the preparation is physically stable (organoleptically) during storage at high temperatures.

Cycling test results.

The results of the cycling test for face scrub preparations did not change colour, odour and shape.

Irritation Test.

An irritation test is done to see how the preparation reacts to the skin. Evaluation test to prevent side effects of the preparation on the skin. The test results indicate that the preparation does not cause adverse effects on the panellists [31] (Table 5).

The results of the measurement of the viscosity of the preparation

No.	Time (Week)	Viscosity Value (mPa's)							
		Formulation							
		F0	F1	F2	F3	F4	F5	F6	F7
1.	0	3996	3996	3996	3996	3996	3996	3996	3996
2.	4	3986	3996	3896	3996	3986	3996	3995	3976
3.	8	3960	3896	3896	3896	3796	3876	3968	3860
4.	12	3896	3796	3795	3865	3688	3796	3786	3768
Mean±SD		3959.5± ±44.97	3921± ±95.74	3895.7± ±82.05	3938.2± ±67.87	3866.5± ±150.42	3916± ±97.9	3936.2± ±101.0	3900± ±106.48

Table 3

Table 5

Irritation test

Formulation	Volunteer											
	Redness			Itching			Swelling			The roughness of the skin		
	1	2	3	4	5	6	7	8	9	10	11	12
Blanc (without active ingredients)	-	-	-	-	-	-	-	-	-	-	-	-
F1 (activated charcoal 1 % and Vit. E)	-	-	-	-	-	-	-	-	-	-	-	-
F2 (activated charcoal 2 % and Vit. E)	-	-	-	-	-	-	-	-	-	-	-	-
F3 (activated charcoal 3 % and Vit. E)	-	-	-	-	-	-	-	-	-	-	-	-
F4 (activated charcoal 1 % without Vit. E)	-	-	-	-	-	-	-	-	-	-	-	-
F5 (activated charcoal 2 % without Vit. E)	-	-	-	-	-	-	-	-	-	-	-	-
F6 (activated charcoal 3 % without Vit. E)	-	-	-	-	-	-	-	-	-	-	-	-
F7 (Vit. E 5 %)	-	-	-	-	-	-	-	-	-	-	-	-

Note: no irritation

Hedonic Test.

Based on the results of the study, it was shown that the formulation of activated charcoal 2 % and vitamin E was the most preferred formula compared to other formulations.

Anti-ageing testing.

Moisture.

The Aramo skin analyser gadget was used to assess moisture levels. According to the measurement results in the table above, using face scrub preparations for four weeks caused the water content to rise from dehydrated to normal (30–50), whereas the humidity of the control formula remained dehydrated (0–29). This demonstrates that the amount of activated charcoal coupled with Vitamin E in the face scrub preparation determines how effective it is in boosting skin hydration [32, 33] (Fig. 1).

Pore.

Based on the measurement results shown in Fig. 2 shows that after using face scrub preparations for 4 weeks, all formulas experienced a decrease in pores. In accordance with the graphic data above, it shows that the more activated charcoal content in the face scrub preparation, the greater its role in reducing the number of pores on the skin [32]. Pore measurement using a skin analyser device.

Spot.

When the skin is being exfoliated, the activated charcoal in face scrub formulations can get rid of imperfections. When using the product frequently, stains on the skin will also be lifted during the exfoliation process, and vitamin E will aid in the process of skin regeneration by balancing the production of melanin in the skin so that the skin colour returns to normal and the skin appears healthier. Active charcoal face scrub preparations remove skin imperfections so that, over time, the stains will be covered up and gradually fade on their own [34] (Fig. 3).

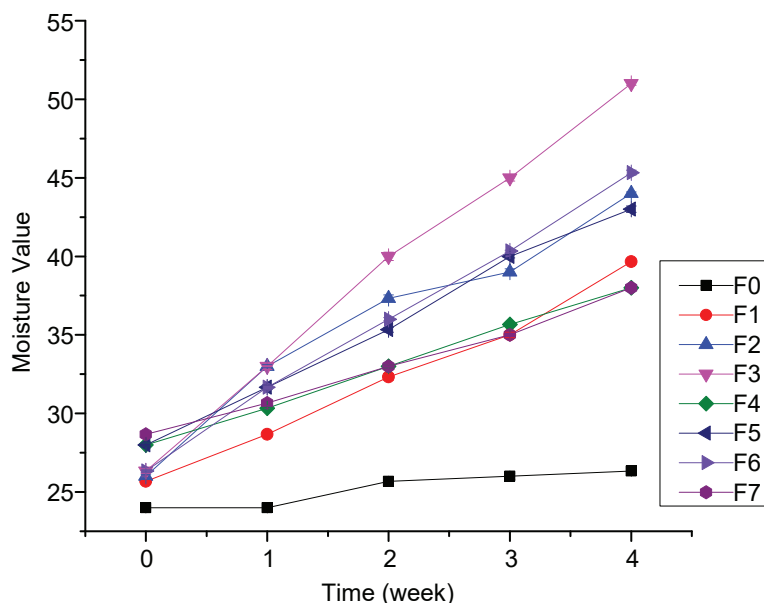


Fig. 1. The moisture (moisture) of the volunteers' skin before and after using the entire formula face scrub for 4 weeks

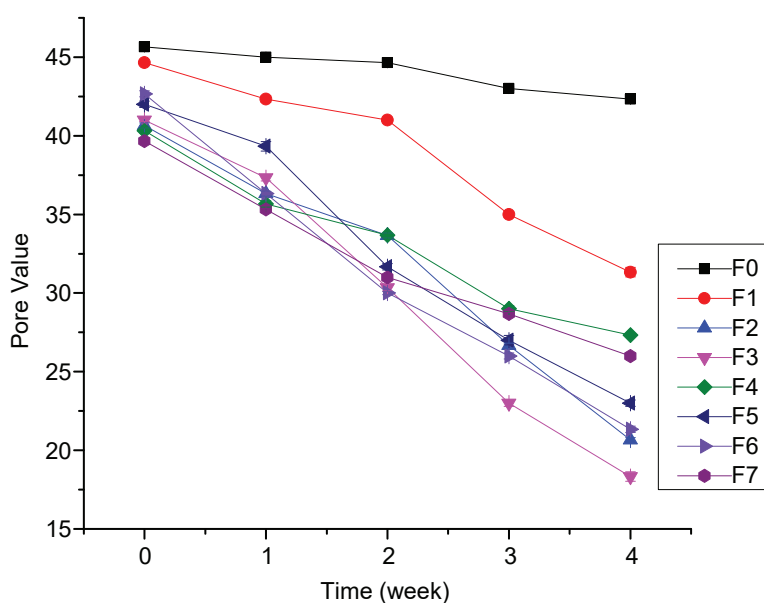


Fig. 2. Volunteer skin pores before and after using the whole formula face scrub for 4 weeks

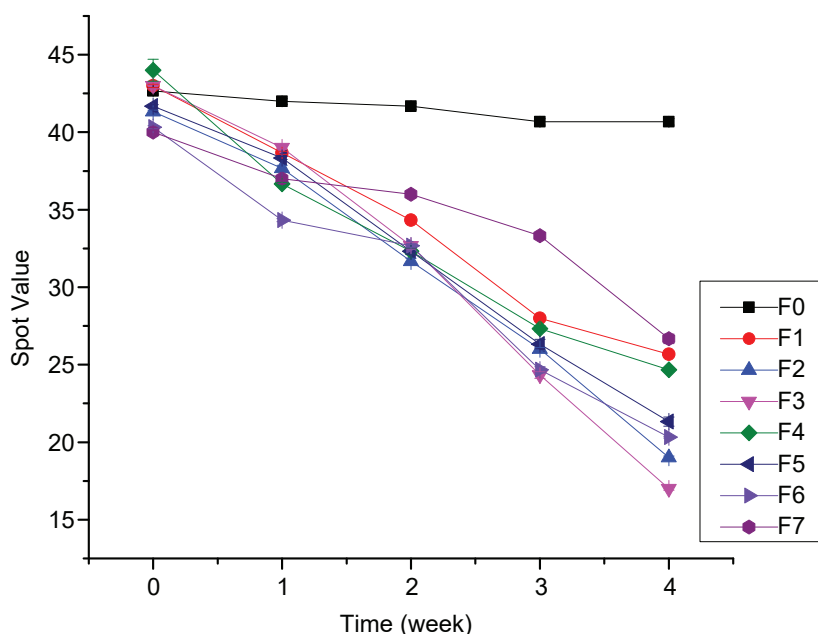


Fig 3. The results of the reduction of skin spots on the volunteers' skin after using face scrub preparations for 4 weeks

Wrinkle.

Measuring wrinkles with a skin analyser Results of a test for wrinkles using facial scrubs. It is evident from graph 4 that panellists who use this mask preparation had less facial wrinkling. This demonstrates that, when combined with Vitamin E, activated charcoal plays a bigger effect in reducing the number of wrinkles on the skin than solutions without using vitamin E [35] (Fig. 4).

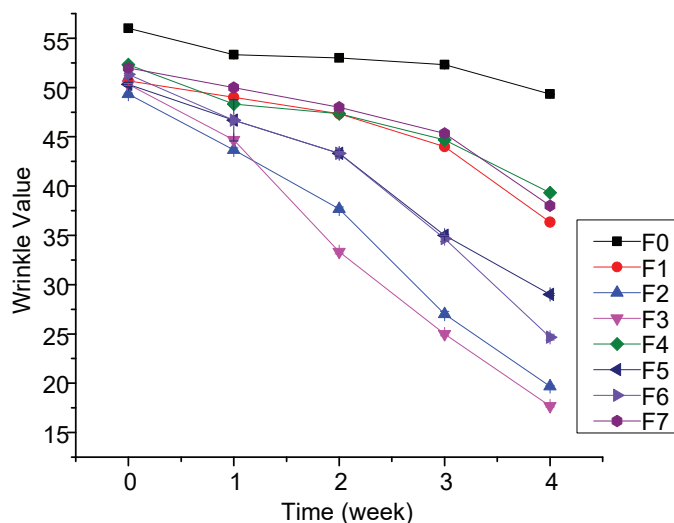


Fig 4. Wrinkles on the volunteers' skin before and after using the entire formula for 4 weeks

5. Discussion

Based on the results of research on the characterisation of activated charcoal on yield, it was found that all preparations had met the requirements of SNI. The yield of activated charcoal is highly dependent on raw materials and activation treatment factors, namely temperature and time of carbonisation and activation [16]. Generally, activated charcoal is made with a combustion temperature above

300 °C [36]. Increasing the temperature too high for too long in the carbonisation process will reduce the yield of activated charcoal is very important to pay attention to the raw materials in the manufacture of activated charcoal because not all materials can be completely carbonised to become activated charcoal [21].

From the results of the organoleptic test of the formulas of all gel formulations with a comparison of concentrations and each existing base, it was shown that there was no significant change in the observations before and after storage [2]. That is, it has a characteristic coffee smell, is black in colour and has a fine grain texture, indicating that the observations on this parameter are stable before and after storage or the formulation material does not experience a reaction between one ingredient and another during storage, so there are no signs of change [37].

Based on the results of research on the characterisation of activated charcoal on the levels of volatile substances, it was found that all preparations have met the requirements of SNI. According to Junari et al. (2015), the appropriate temperature and time of carbonisation will also affect the levels of volatile substances. The levels of volatile substances will be lower at high temperatures, and the activation time will be longer because the levels of volatile substances can no longer stick to the pores, so more and more carbon pores are free from volatile molecules [38].

Based on the results of research on the characterisation of activated charcoal on water content, it was found that all preparations had met the requirements of SNI. The water content test aims to determine the number of remaining water molecules that are still bound to the activated charcoal. The high or low water content will indicate how much of the activated charcoal pores are covered by water molecules. The lower the water content, the better the quality of the activated charcoal produced; this also indicates that fewer carbon pores are covered by water molecules [39].

Based on the results of the research on the characterisation of activated charcoal on the ash content, it was found that all preparations had met the requirements of SNI. Testing the ash content of activated charcoal aims to determine the content of metal oxides or inorganic materials remaining in activated carbon [36]. The value of ash content will increase as the temperature and time of carbonisation increase during the activated charcoal manufacturing process. The high content of ash contained in activated charcoal will reduce the quality and absorption of activated carbon. Conversely, the lower the ash content of activated charcoal, the better the quality of the activated charcoal produced [40].

Based on the research results on the characterisation of activated charcoal on pure activated carbon content,

it was found that all preparations had met the requirements of SNI. Tests of pure activated carbon levels were carried out to determine the amount of pure activated carbon produced by activated charcoal. The size of the pure activated carbon content produced is highly dependent on the value of volatile substances, water content, and ash content. The value of pure activated charcoal content is the total difference with the value of the total water content, ash content and volatile matter content. The lower the value of volatile substances, water content, and ash content, the higher the purity of the activated carbon produced [15].

Based on the results of research on the characterisation of activated charcoal on iodine absorption, it was found that all preparations had met the requirements of SNI. The iodine absorption test aims to determine the ability of activated charcoal to absorb molecules with a size of 10 or 1 nm [41]. The adsorption capacity of activated carbon to iodine is correlated with the surface area of activated carbon. The greater the value of iodine absorption, the greater the surface area of the activated carbon, the better the ability of the activated charcoal to absorb impurity particles and the better the quality of activated charcoal [42].

Evaluation of the quality of physical preparations.

There are several research factors for the physical quality of the preparation, one of which is pH. Measurement of pH is carried out to determine the pH of the face scrub preparation according to the skin because the preparation will be in direct contact with the skin and affect the skin's condition. The pH of the preparation that meets the skin pH criteria is in the range of 4.5–6.5 [43]. In addition, spreadability is an important characteristic of the formulation that ensures ease when the preparation is applied to the consumer's skin. Viscosity testing is another important factor influencing the dispersion and release of active substances from face scrub preparations. Less impermeable packaging can cause the preparation to absorb water from the outside, thereby increasing the volume of water in the preparation [7].

Irritation test results.

The results of the irritation test conducted on 12 volunteers showed that all volunteers gave negative results to the irritation reaction parameters. The parameters observed were the presence of red skin, itching or swelling and skin roughening [44]. The results of the irritation test concluded that the face scrub preparation is safe to use.

Hedonic test results.

The preference or hedonic test is an important parameter to see consumer preferences and acceptance of a product [45]. This is the most widely used test to measure the level of liking for production on a hedonic scale, for example, very like, like, neutral, slightly dislike, dislike, very dislike and so on. This test is used to test consumer

reactions to material or determine consumer reactions to samples [46]. From the results of the study, it was found that the preparations with the 2 % formulation and vitamin E as the dosage formulations were the most preferred by the volunteers.

Anti-ageing Test Results.

The anti-ageing test was carried out first to measure the initial condition of the skin on the back of the hands of all volunteers, with test parameters including moisture, pores, spots and wrinkles. Then, the preparation was smeared evenly on the volunteer's skin until exfoliation or every two times a day, night and morning for 4 weeks. Changes in skin condition were measured every week for 4 weeks with a skin analyser. The study's results found that the increase in humidity was 27 %, the pore reduction was 35.8 %, blemishes were 40 %, and wrinkles were 37.6 %. According to its physiological function, the skin needs fat and water. The fat layer on the surface of the skin and the material in the stratum corneum is hygroscopic, can absorb water and is in a functional relationship called the Natural Moisturizing Factor. The ability of the stratum corneum to bind water is very important for the flexibility and elasticity of the skin [47].

Research limitations. During the research, limitations exist during the homogenisation of mask preparations. Due to the unstable homogenisation process, the use of stored vitamin E must be maintained so that it is not easily degraded.

Prospects for further research. For further research, it is expected to examine the use of mask preparations that are tested in vitro on the skin so that they can be marketed as anti-ageing preparations.

6. Conclusion

Coffee grounds activated charcoal can be formulated in face scrub preparations.

Differences in the concentration of coffee grounds activated charcoal formulated in face scrub preparations provide different anti-ageing effectiveness.

The use of face scrub preparations containing 3 % coffee grounds activated charcoal with the addition of 5 % vitamin E for 4 weeks showed changes in skin condition for the better.

Conflict of interest

The authors declare that they have no conflict of interest concerning this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this article.

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