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RESEARCH ARTICLE

Optimisation of seed oil and powder of *Momordica charantia* in the formulation of body scrub cream

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Abstract

Background: *Momordica charantia* seed oil and powder are potential ingredients for a body scrub. The seeds contain fatty acids to moisturise the skin, and the mineral content to remove dead skin cells and nourish the skin. **Objective:** To determine the optimal efficiency of *Momordica charantia* seed oil and powder on body scrub cream produce. **Methods:** The body scrub used W/O (water-in-Oil) cream base. Simplex Lattice Design was used to determine five formulas. The irritation test with the Draize Skin Test method was carried out on rats (n = three, in each formula), and the Primary Dermal Irritation Index (PDII) was calculated. Informed consent from the female participants has been obtained for the hedonic test. **Results:** The body scrub cream produced appropriate organoleptic, was not irritating, and was stable after centrifugation and cycling test. The optimum formula contained five grams of oil and one gram of powder with a pH of 5.21; viscosity of 205.33 dPa.s; spreading of 6.12cm; adhesion time of 19.86 seconds; rate of washing of 20.60 seconds; a colour value of 4.04; scent value of 2.90; and texture value of 2.98. **Conclusion:** The optimised body scrub cream yielded a good formula which can be developed as a body scrub preparation.

Introduction

The use of cosmetics with natural ingredients is more in demand today because they are safer, have lower side effects, are inexpensive and do not pollute the environment (Istiqomah *et al*., 2021). One of the natural ingredients that can be used for skin cosmetics is *Momordica charantia* (*M. charantia*) seed. *M. charantia* seeds contain 18.1% -37.6% oil, protein, minerals, flavonoids, and phenolic compounds (Saeed *et al*., 2018). The seed oil contains several fatty acids, one of which is alpha oleo stearic acid which functions as an antioxidant, increases skin firmness, and helps increase the skin's natural collagen production so that the skin looks brighter (Yoshime *et al*., 2016).

The body scrub removes dead skin cells, clears the skin surface, and brightens skin colour (Wirasuta *et al*., 2018). Several dosage forms of body scrubs market include creams, powders, and suspensions (Nisa, 2019). Body scrubs in the market are generally creams because they are easy to apply to the skin. Previous studies carried out include the characterisation of body scrubs using marine algae *Halimeda macroloba*, chitosan, and konjac flour (Ervina *et al*., 2020) and body scrub formulations containing virgin coconut oil, coffee powder (*Coffea arabica* Linn) and carbon active coconut shell (Activated carbon *Cocos nucifera* L). Putri *et al*. (2021) determined the parameters for a good body scrub test including organoleptic, pH, homogeneity, viscosity, spreadability, hedonic and skin irritation tests.

This research was conducted to produce a body scrub formulated in W/O cream that is not irritating and meets the criteria to be applied to the skin so that optimisation is carried out using the simplex lattice design. Simplex lattice design is a method for determining the optimal formula of a mixture of materials and is the simplest and most effective optimisation method among various other methods such as trial and error and can determine

which factors are more dominant and which significantly influence a response (Bolton and Bon, 2013). The optimisation was carried out on two factors, *M. charantia* seed oil and seed powder, to make a mixed design to be observed.

Methods

Preparation of the body scrub

The composition of the five formulas (Table I) was adopted from the cold cream formula.

Table I: Formula composition of the body scrub

Composition	Amount (grams)				
	F1	F2	F3	F4	F5
M. charantia seed oil	5.0	1.0	3.0	4.0	2.0
Seed powder	1.0	5.0	3.0	2.0	4.0
Stearic acid	4.0	4.0	4.0	4.0	4.0
Span 80	3.0	3.0	3.0	3.0	3.0
Cetyl alcohol	1.0	1.0	1.0	1.0	1.0
Glyceryl monostearate	2.0	2.0	2 2	2.0	2.0
Vaseline album	8.0	8.0	8.0	8.0	8.0
Adeps lanae	5.0	5.0	5.0	5.0	5.0
Tween 80	0.5	0.5	0.5	0, 5	0.5
Nipagin	0.18	0.18	0.18	0.18	0.18
Nipasol	0.02	0.02	0.02	0.02	0.02
Propylene glycol	2.5	2.5	2.5	2.5	2.5
Glycerin	5.0	5.0	5.0	5.0	5.0
Distilled water	12.8	12.8	12.8	12.8	12.8

Evaluation of body scrub cream

Organoleptic

Organoleptic was carried out by observing the body scrub's texture, scent, and colour.

Viscosity

The cream preparation was evaluated using a viscometer Rion VT-04F using spindle number two.

pH

One gram of the cream was dissolved in 100 ml of distilled water. Then the electrode tip was dipped to measure the pH value.

Spreadability

A cream of 0.5 grams was put into an extensometer, placed weights of 50, 100, 150, 200, and 250 grams above, then measured the spread diameter (Saryanti *et al*., 2019).

Irritation test

The Draize Skin Test was carried out using rats smeared with the cream (Hendrawati *et al*., 2019). The ethical clearance for the irritation test is No. 1395/UN25.8/KEPK/DL/2021, June 6th 2021, issued by the Faculty of Dentistry University of Jember. The assessment of the results of the irritation test follows (Hayes *et al*., 2001), and the score is assessed based on the category according to Lu, (1995).

Cream type test

The cream was dripped with methylene blue. It was observed under an optical microscope (Swastika *et al*., 2013).

Adhesiveness

The adhesiveness test examines the time it takes for the two glass objects filled with the cream to separate after a load of 80 grams (Saryanti *et al*., 2019).

Water washability time

The test measures the time required for the cream to wash off under running water while rinsing hands (Legifani, 2018).

Hedonic

The ethical clearance for the hedonic test is No.1554/UN25.8/KEPK/DL/2022, June 3rd, 2022, issued by the Faculty of Dentistry Jember University. The hedonic test was carried out on 30 respondents obtained from the Slovin formula with the criteria of being female and aged 17-30. The parameters used were the preparations' colour, scent, and texture. The quantitative method is a questionnaire using a measurement scale (Pratiwi *et al*., 2017). The following is the questionnaire test scale used:

a) Likes very much: 5

b) Likes: 4

c) Neutral: 3

d) Dislikes: 2

e) Really Dislikes: 1

Stability test

The cream is stored at 4°C for 24 hours and then at 40°C for 24 hours for six cycles (Diana *et al*., 2020) and centrifuged for 30 min at 3500 rpm (Priyadarsini *et al*., 2018).

Determination of optimum formulation

The optimum formula was determined using the Design Expert 11 software. The selected optimum formula is a dosage formula that matches the criteria (Table II).

Table II: The criteria for the optimum formula

Response	Desired
pH	4.5-8 (in range)
Viscosity	20 – 5,000 dPa.s (in range)
Diameter of spreading	5 – 7 cm (in range)
Hedonic ● Colour ● Aroma ● Texture	Highest score (maximise)
Adhesion	Highest score (maximise)
Washing time	1-60 seconds (in range)

Results

The cream (Figure 1) shows the broken white to brown body scrub cream, a semisolid texture, and has an *M. charantia* scent. The results of the physicochemical evaluation of the body scrub creams were analysed using Software Design Expert version 11.0.0.4. are described in the equation below, with A denoting the proportion of seed oil and B referring to the seed powder.

1) Viscosity = +205.33 (A), +351.99 (B)

2) pH = +5.21 (A), +5.75 (B)

3) Spreadability = +6.13 (A), +5.13 (B), –0.4114 (AB)

4) Adhesion = +19.86 (A), +10.18 (B)

5) Water washability = +20.60 (A), +7.96 (B)

6) Colour = +4.04 (A), +2.40 (B)

7) Scent = +2.90 (A), +2.46 (B)

8) Texture = +2.98(A), +3.54 (B)

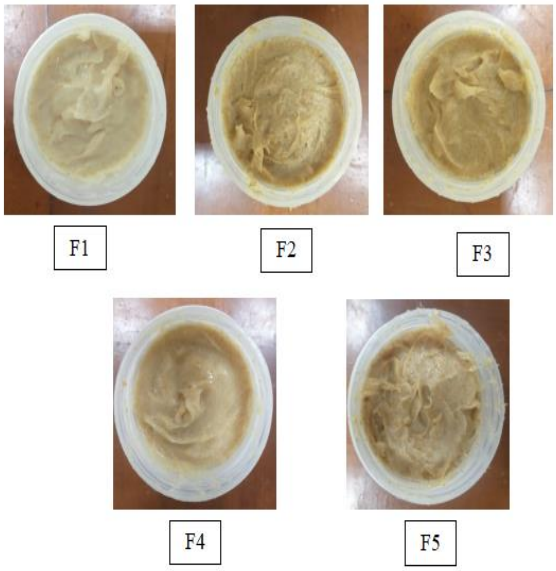

Figure 1: The body scrub cream

The proportion of seed powder affected the viscosity, pH, and texture on the other hand, the proportion of seed oil influenced the spreadability, adhesion, water washability, colour, and scent. The pH test determines the safety of the preparation when applied to the skin. The spreadability test determined whether the cream is easy to smear on the skin. The irritation index generated for each formulation is zero or non-irritating to the skin, as shown in Figure 2. The cream type test showed that the cream preparation has a W/O type after staining with methylene blue. The adhesion test measured the attached length of the cream. All formulas fulfilled the adhesion requirement (more than four seconds) (Prolapita & Safitri, 2021). All the cream formula was easily washed off with water after 30-60 seconds (Legifani, 2018). The higher the *M. charantia* seed oil concentration, the greater the scent preference.

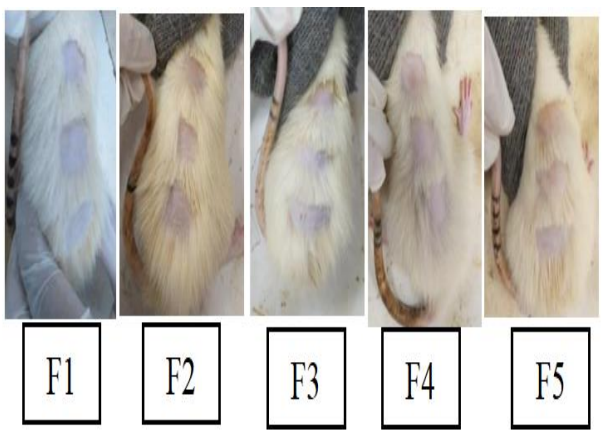

Figure 2: Irritation test on animal

Results after the stability test did not undergo phase separation, cracking, creaming, colour, scent, and texture change. Then, the optimum formula selection was according to the highest desirability index (0.86), which consists of five grams of oil and one gram of powder.

Discussion

The *M. charantia* seed powder dominantly affected the cream's viscosity, pH, and texture, while the *M. charantia* seed oil dominantly influenced the spreadability, adhesion, washing time, colour, and scent of the cream. Better consistency and texture make for better cream-smearing ability (Sampebarra, 2016), but a very low viscosity intensifies the scrubbing effect (Hasan *et al*., 2012). The body scrub produced in this study had a good consistency and thickness, which made it comfortable and easy to spread on the skin.

The increased concentration of oil and powder did not irritate experimental animals, which indicated its safety for human use. The cream type after staining with a methylene blue is W/O. It showed blue droplets dispersed in a transparent continuous phase. The oil-in-water (O/W) cream was reportedly used due to its ease of rinse with water (Ervina *et al*., 2020; Hilda *et al*., 2020). However, in this study, the W/O type chosen as the lipidic phase presented no irritation because of the powder's friction to the skin. Besides, the W/O cream type moistened the skin because scrubbing removed the skin oil content, avoiding dryness after a body scrub.

Centrifugation is a stability study to accelerate separation under centrifugal force. Hence the test could predict the stability of the cream (Morais *et al*., 2005). Each cream formula was stable, with no phase separation, cracking, or creaming. The colour, scent, and texture also did not change. The stable preparation might be because of less density difference between the oil and aqueous phase or solid interfacial film at the interface (Jumaa *et al*., 2002). Therefore, the dispersion system was even due to temperature cycling and gravitational effect. The optimisation is conducted by superimposing all the responses, resulting in an optimum area. One selected formula for desirability is the cream made from five grams of oil and one gram of powder. This study showed that the composition of *M. charantia* seed oil and powder dramatically influences the characteristics of the body scrub cream produced, preference responsiveness, and skin irritation. The optimum formula showed physical characteristics that meet the criteria for body scrub preparations, are preferred by respondents and are not irritating. The results of this study can be used as a reference for body scrub cream formulations for further research, including *in vivo* studies on the effectiveness of body scrubs in removing dead skin cells and moisturising the skin.

Conclusion

The *M. charantia* seed powder affects the cream's viscosity, pH, and texture, while *M. charantia* seed oil affects the spreadability, adhesion, washing time, colour, and scent of the cream. Optimisation resulted in one optimum formula consisting of five grams of oil and one gram of powder. The optimum formula is not irritating, so it can be developed as a body scrub preparation from a natural source.

Conflict of interest

The authors certify there is no actual or potential conflict of interest to declare regarding the subject matter discussed in this manuscript.

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