Vol. 13, No. 2: 13 — 20
December 2024
DOI: https://doi.org/10.22487/25411969.2024.v13.i1.17144

Natural Science
Journal of Science and Technology

Original article

Comparison of Physical Properties of Face Scrub Gel Containing Moringa Seed Powder (*Moringa oleifera* Lamk.) as Natural Exfoliant and Polyethylene Beads as Synthetic Exfoliant

Asriana Sultan*, Mar'atul Azizah S.Nawai and Nurlina Ibrahim

Department of Pharmacy, Faculty of Mathematics and Natural Sciences, Tadulako University, Palu, 94118, Indonesia.

Keywords: *Moringa seeds, polyethylene beads, natural exfoliants, synthetic exfoliants, face scrub gel*

Article history:
Received 08 June 2024
Accepted 30 August 2024
Published 31 December 2024

*Corresponding Author :
asriana.sultan@gmail.com

Abstract

Face scrub is a facial skin care product used to remove dead skin cells on the face, containing small particles of polymer as a synthetic exfoliant and natural ingredients of *Moringa oleifera* Lamk. as a natural exfoliant. The aim of this study was to compare the physical characteristics of face scrub gel using Moringa seed powder as a natural exfoliant and polyethylene beads as a synthetic exfoliant. The research method was laboratory experimental with varying concentrations of exfoliants in 1%, 1.5% and 2% in F1, F2 and F3 (containing Moringa seed powder) and F4, F5 and F6 (containing polyethylene beads). Evaluation of the preparation were included organoleptic, homogeneity, pH, spreadability, viscosity, stability, and irritation test. The results of the stability test showed that the Moringa seed face scrub gel preparation as a natural exfoliant affected its physical characteristics, but all formulas still met the requirement range for the physical properties of gel. The results of the irritation test for a face scrub gel preparation containing both of the exfoliant did not cause irritation in all volunteers. From this research, it can be concluded that Moringa seed powder as a natural exfoliant which is formulated into a face scrub gel preparation can be a natural alternative as exfoliating facial cleansing agents. The optimal formulation is formula 1 with a concentration of 1% Moringa seed powder and formula 5 with a concentration of 1.5% polyethylene beads.

INTRODUCTION

Abrasive cosmetics or scrubs can be obtained from synthetic or natural ingredients. Natural scrubs include fruit seeds, walnut shells, almond shells, and synthetic scrubs using artificial particles, such as microplastics or polyethylene beads (Draeloz, 2016). Face scrub is very important in facial skin care to ensure that the skin remains healthy, clean and radiant. Various beauty product brands have released face scrubs using natural and synthetic ingredients.

One of the commonly used synthetic scrub ingredients or synthetic exfoliants is polyethylene beads. Polyethylene beads are a type of microplastic, the granules are small, tend to be soft and have better physical stability (Malviya *et al.,*

How to Cite: Sultan, *et al*. "Comparison of Physical Properties of Face Scrub Gel Containing Moringa Seed Powder (*Moringa oleifera* Lamk.) as Natural Exfoliant and Polyethylene Beads as Synthetic Exfoliant" Natural Science: Journal of Science and Technology. Vol. 13, No. 2: 13–20, December 2024.

2013). Polyethylene beads function to remove dead skin cells and make them smoother and cleaner, which encourages epidermis regeneration and helps skin soften, uniform texture and elasticity. Although polyethylene beads are effective in removing dead skin cells, the problem lies in their inability to decompose naturally, causing serious environmental impacts (Nadiratuzzahra and Tristantini, 2020).

Moringa seed contains various ingredients that are beneficial for the skin, including oil which is rich in antioxidants (Unuigbe *et al*., 2015). In the other studies, Moringa seed is known as containing active substances such as alkaloids, phenol hydroquinone, flavonoids, and saponins (Umar, 2019), which have the potential as a skin care. Moringa seeds also contain a number of important nutrients such as proteins, vitamins, minerals, beta-carotene, amino acids, and phenolic compounds that are good for skin health. The content of vitamin C, minerals, protein and folic acid in Moringa seeds can help to reduce skin damage and to increase healthy skin cell regeneration and also to remove dead skin cells (Koch *et al*., 2010). These natural contents make Moringa seeds an attractive candidate as a natural exfoliating agent in skin care products (Meireles *et al*., 2020).

Previous research by Savitri, (2019) also showed that Moringa seeds can be used as a scrubbing agent in skin care products, with results that are safe for the skin. Therefore, this study aims to determine the use of *Moringa oleifera* Lamk. seeds as a natural exfoliant in the formulation of face scrub gel preparations and to compare the physical characteristics to face scrub gel that was made from polyethylene beads as a synthetic exfoliant.

MATERIALS AND METHODS

The materials used are Moringa seed powder obtained from cultivating Moringa plants at Sibedi Village in Sigi Regency, Central Sulawesi, polyethylene beads, carbopol, propyl paraben, methyl paraben, propylene glycol, triethanolamine (TEA), no.1 filter paper, hypoallergenic plaster, gauze. The tools used include viscometer (Brookfield RVDV-III+Pro), Ohaus PA214 analytical balance, cooling cabinet (Polytron®), oven (Memmert®), homogenizer (EYELA N2-100), ointment pot, optical microscope (Vision DX21), and glass tools (Pyrex®).

Preparation of Simplicia

Blackish brown Moringa fruit was selected, then the seeds were taken. The skin of the Moringa seeds was peeled and dry sorted with good quality Moringa seeds (round in shape and dry whole). The inside of the Moringa seeds was dried using an oven at 60°C for 2 hours. After drying, the contents of the seeds were grounded using a blender and produced coarse Moringa seed powder (Savitri, 2019).

Determination of Seed Powder Particle Size

Exfoliant particle size was determinate with the sieving method. Coarse Moringa seed powder was sieved from filter mesh sizes of 100, 80, 60, 40, and 30 for 15 minutes with rotating speed at 20 rpm (Sahlan *et al*. 2020).

Formulation of The Face Scrub Gel

Face scrub gel with varying concentrations of Moringa seed powder as a natural exfoliant and polyethylene beads as a synthetic exfoliant was produced in 6 formulas that were performed in triplicate as a F1, F2, F3, F4, F5, and F6. The preparation was produced in 100 ml. The formulas can be seen in table 1.

Production of The Formulation

The formula based on the composition was listed in Table 1. Firstly, 20 ml of distilled water was heated with carbopol and developed in boiling water for 30 minutes until a required gel mass was formed. TEA was then homogenated as a mixture A. Subsequently, propylene glycol, methyl paraben and propyl paraben were blended and stirred until homogeneous as a mixture B. Mixture B was incorporated with mixture A gradually while distilled water was poured up to 100 ml using a homogenizer. Finally, Moringa seed powder was added as a natural exfoliant to F1 – F3 and polyethylene beads as a synthetic exfoliant to F4 – F6 (Rahayu *et al.,* 2016).

Evaluation of The Preparation

The parameters were evaluated including organoleptic, homogeneity, pH, spreadability, viscosity, and stability. Organoleptic tests included color, smell and shape of the gel preparation (Agustina *et al*. 2022). The homogeneity test was carried out by smearing 0.1 gram of the gel preparation on a glass object and covered it with another glass object, The homogeneity of the preparation was observed (Dwi *et al.,* 2022).

The pH value was determined by weighing 1 gram of the gel and diluted with 10 ml of distilled water. The electrode was dipped in the container and waited until the needle moving to a constant position (Agustina *et al*., 2022). The results was obtained (the numbers printed on the pH meter). Cosmetic products must have a pH that appropriates to the value standard of the physiological pH of the skin (4.5-7.5) (Faradiba *et al*., 2013).

Table 1. Formulation of face scrub gel with Moringa seed powder as a natural exfoliant and polyethylene beads as a synthetic exfoliant

Materials	Concentration (%)					
	F1	F2	F3	F4	F5	F6
Moringa seed powder	1	1,5	2	-	-	-
Polyethylene beads	-	-	-	1	1,5	2
Carbopol 940	0,5	0,5	0,5	0,5	0,5	0,5
TEA	1	1	1	1	1	1
Propyl paraben	0,02	0,02	0,02	0,02	0,02	0,02
Methyl paraben	0,18	0,18	0,18	0,18	0,18	0,18
Propylene glycol	5	5	5	5	5	5
Aquades	100	100	100	100	100	100

Table 2. Erythema and Edema Evaluation Scale (Amasa *et al*. 2012)

Type of erythema	Scale	Type of edema	Scale
No erythema	0	No edema	0
Very slight erythema (barely visible)	1	Very slight edema (barely visible)	1
Mild erythema	2	Mild edema	2
Moderate to severe erythema	3	Moderate edema	3
Severe erythema	4	Severe edema	4

The spreading power was measured using 2 pieces of transparent glass measuring 30 x 30 cm. 0.5 grams of the gel preparation were weighed and applied to covered glass. Thereafter, 125 grams were put on and left for a minute until the diameter of spreaded area was formed. The provision for spreadability is 5-7 cm (Dwi *et al.,* 2022).

Viscosity test was performed by using a Brookfield Viscometer. 100 grams of gel preparation were weighed, adjusted the spindle and speed and operated the viscometer. The result was obtained immediately. According to Indonesian standard of SNI 16-4380-1996, the viscosity value of skin cleansing gel preparations is 3,000-50,000 Cp (Nakhil *et al.,* 2019).

The stability test was evaluated by the cycling test method. The gel preparations were placed at refrigerator temperature of 4°± 2°C for 24 hours, then moved to temperature of 40°C for 24 hours (1 cycle). This process was carried out for 12 days or 6 cycles. The physical characteristics of the scrub gel that consisted of organoleptic, homogeneity, pH, spreadability, and viscosity during the cyling test were compared to previous results (Putri, Nawangsari, and Sunarti 2021).

Irritation Test

The closed patch test or patch test method on human skin was prepared using 0.25 grams of the preparation where applied to the inside of the forearm and covered with Watthman paper. After 24 hours, the filter paper and plaster were removed and rinsed with water. Then after 40 minutes, the area was observed for erythema and edema. Following changes which were occurred again in 48 hour after treatment, were confirmed (Wasitaadmadja, 1997; Kamkaen *et al*., 2007; Lestari *et al.,* 2020).

The volunteers for the skin irritation test was selected on 20 students randomly which based on the criteria for test panelists (Ditjen POM, 1985):

1. Woman
2. Age between 20-30 years
3. Physically and mentally healthy
4. No history of allergic disease
5. Agreement on statement letter

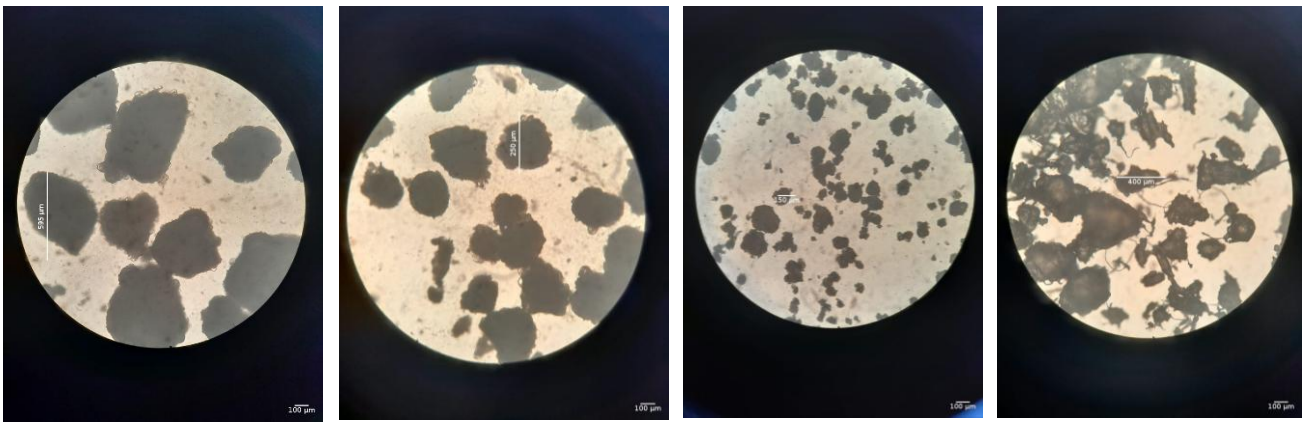
Table 3. Response Categories and Primary Iritation Index (PII) (Amasa, et al., 2012)

Category	PII Value
Ignored	0-0,4
Slight irritation	0,5-1,9
Moderate irritation	2,0-4,9
Severe irritation	5,0-8,0

RESULTS AND DISCUSSION

Morfology of Moringa Seed Powder

The morfology of the seeds powder was showed microscopically that taken at x10 magnification in Figure 1 (a,b,c) and the size was measured around the filter mesh from 30 mesh to 100 mesh at 595 µm to 150 µm. The polyethylene beads was presented in Figure d and the size was approximately 400 µm. Determination of the exfoliant particle size ensures that Moringa seed powder can fulfill the characteristics of a scrub that is good for the skin. The best particle size for removing dead skin cells is between 30/40 mesh size (Yulianti, 2010). Biodegradable scrubs can replace synthetic polyethylene with some characteristics, i.e. they must have the same visual effect, the feel on the skin, and the same abrasion capacity, also available in large quantities and affordable prices (Nadiratuzzahra and Tristantini, 2020).



(a) (b) (c) (d)

Figure 1. (a), (b), (c) The Moringa seeds powder; (d) The polyethylene beads

Table 4. Results of preparations before cycling test

Parameters	The results (in average value ± SD (n=3))						Literary standard
	F1	F2	F3	F4	F5	F6	
Organoleptic	Brownish white color, distinctive smell, thick	Brownish white color, distinctive smell, thick	Light brown color, distinctive smell, thick	Clear white color, odorless, thick	Clear white color, odorless, thick	Clear white color, odorless, thick	No changes in color, odor and texture (Kementerian Kesehatan Republik Indonesia, 1979)
Homogeneity	Homo-geneous	Homo-geneous	Homo-geneous	Homo-geneous	Homo-geneous	Homo-geneous	No visible coarse grains (Lalita & Shalini, 2020)
pH	6.783 ± 0.033	6.860 ± 0.016	6.963 ± 0.065	6.407 ± 0.061	6.587 ± 0.049	6.773 ± 0.029	The pH value of 4.5 – 7.5 (SNI, 1996)
Spreadability	5.923 ± 0.209	5.810 ± 0.172	5.937 ± 0.225	5.467 ± 0.105	6.000 ± 0.219	5.167 ± 0.179	5-7 cm (Daswi, et al., 2021)
Viscosity	8950.000 ± 129.972	10061.000 ± 1220.668	8038.667 ± 918.056	11611.000 ± 2663.443	16416.670 ± 7467.125	16611.000 ± 7661.849	3.000-50.000 Cps (Nakhil et al., 2019)

Table 5. Results of preparations after cycling test

Parameters	The results (in average value ± SD (n=3))					
	F1	F2	F3	F4	F5	F6
Organoleptic	Light brown color, distinctive smell, slightly liquid	Dark brown color, typical smell, slightly liquid	Dark brown color, typical smell, slightly liquid	Clear white color, odorless, thick	Clear white color, odorless, thick	Clear white color, odorless, thick
Homogeneity	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous
pH	6.853 ± 0.017	6.970 ± 0.008	7.050 ± 0.022	6.467 ± 0.033	6.630 ± 0.065	6.840 ± 0.016
Spreadability	6.077 ± 0.343	6.267 ± 0.099	6.110 ± 0.446	5.553 ± 0.054	5.923 ± 0.062	4.923 ± 0.225
Viscosity	5016.667 ± 54.298	3694.333 ± 1324.461	4328.000 ± 698.048	15438.670 ± 422.884	16150.000 ± 1080.411	16422.000 ± 989.926

Furthermore the size, the Moringa seed powder had irregular particle forms and slightly sharp edges. This shape almost has the same shape as the polyethylene sample which has an irregular shape discussed by Godoy *et al*., (2019). The observation results of the polyethylene beads sample also had an irregular shapes and an uneven surface. In accordance with Fendall and Sewell, (2009), polyethylene beads contained in one of the facial cleansing products has an irregular shape and a rough and uneven surface. In the environment too, for the most microparticles are not spherical, many more are shaped elongated, cylindrical, irregular or rough (Hidalgo-Ruz *et al*., 2012). The particle shape which is almost similar to synthetic polyethylene proves that the characteristics and physical and chemical properties of Moringa seeds can be used as a scrub ingredient in skin care cosmetics.

Physical Properties of Face Scrub Gel

The preparation evaluation results were compared the physical properties of the preparation before and after the cycling test. All datas analyzed were evaluated considering to the standard values. The inspection results can be seen in Table 4 and Table 5.

After the cycling test, the results showed that F1, F2 and F3 had changes in color to became more dark and in consistency became slightly liquid.

Table 6. Irritation Index

Volunteer	Formula	Scale in Observation Time			
		24 Hours		48 Hours	
		Erythema	Edema	Erythema	Edema
1	F1-F6	0	0	0	0
2	F1-F6	0	0	0	0
3	F1-F6	0	0	0	0
4	F1-F6	0	0	0	0
5	F1-F6	0	0	0	0
6	F1-F6	0	0	0	0
7	F1-F6	0	0	0	0
8	F1-F6	0	0	0	0
9	F1-F6	0	0	0	0
10	F1-F6	0	0	0	0
11	F1-F6	0	0	0	0
12	F1-F6	0	0	0	0
13	F1-F6	0	0	0	0
14	F1-F6	0	0	0	0
15	F1-F6	0	0	0	0
16	F1-F6	0	0	0	0
17	F1-F6	0	0	0	0
18	F1-F6	0	0	0	0
19	F1-F6	0	0	0	0
20	F1-F6	0	0	0	0

Note: (0) = no erythema and no edema

Table 7. Irritation test results

Volunteer	Irritation test results					
	F1	F2	F3	F4	F5	F6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	-	-	-	-	-	-

Note: (+) = irritation; (-) = no irritation

The organoleptic changes occurred were not significantly different. According to Savitri, (2019), Moringa seed was mainly provided color to the product. The more added, the browner formed. The other results of F1, F2 and F3 were compared statistically to F4, F5 and F6. The results from ANOVA analysis of the pH values of F1 and F4 on days 0 to 12 showed a significant difference ($p<0.05$), which interpretated that the Moringa seed powder and polyethylene beads had a significant effect on increasing the pH value. The differences in pH value were affected by Moringa seed that has alkaline properties with pH value of 7.5-8.5. The more added, the higher pH value obtained (Savitri, 2019).

The homogeneity test results showed that all formulas were homogeneous and in accordance with specifications. The preparation is claimed to be homogeneous because each formula shows a homogeneous composition and no visible coarse grains (Chauhan and Gupta 2020). Homogeneity evaluation related to feel the skin and affected to no irritation on application.

The result changes in spreadability test were represented statistically between F2 and F5 after the cycling test that were significantly different ($p<0.05$). Due to the composition and storage condition affecting the texture, the seed powder and polyethylene beads have a significant effect on increasing spreadability. This spreadability is inversely related to the viscosity of the gel preparation. When the viscosity of the gel decreases, the gel will spread more easily over the surface and the spreadability of the gel increases

(Rahayu, Fudholi, and Fitria 2016). The viscosity results between F1 and F5 on days 0 to 12 were significantly different ($p<0.05$), which means that the seed powder and polyethylene beads had a significant effect on the viscosity value of the preparation. This was also stated by Hasan *et al*., (2023) that the higher the temperature, the smaller the viscosity value produced will be because temperature and viscosity are inversely proportional. Decreasing in viscosity value occurs during storage time of 24 hours respectively at temperatures of 4°C and 40°C because the longer the storage time, the longer the preparation will be affected by the environment condition, such as air and heat. Packaging that is less tight can also cause the preparation to absorb water from the outside, thereby increasing the volume of water in the preparation (Shanti Septiani & Nasrul Wathoni, 2011).

Irritation Test Results

Skin irritation test results were only descriptive and can not be considered as a standard for the purity of the material. The results showed that all volunteers stated no reaction occurred after the irritation test was carried out on the face scrub preparation. The results were based on PII. Irritation test results can be seen in Table 7 as a result of assessment from the irritation index values that showed in Table 6. The irritation index was measured from erythema and edema scale.

According to Amasa *et al*., (2012), types of erythema and edema were an initial parameter that evaluated to determine the irritation result. The alteration in severity level of the parameters was indicated in the observation period from normal condition to severe changes. Furthermore, the values were calculated using the following equation of Primary Irrittation Index (PII):

$$\text{PII Score} = \frac{\sum \text{erythema grades at 24/48/72/ h} + \sum \text{edema grades at 24/48/72/ h}}{3 \times \text{number of animals}}$$

Previous study has been proved that the body scrub cream containing various Moringa seeds concentrations (3.5%; 4.5%; 5.5%) did not cause irritation to the test in white mice, with the primary skin irritation index value or Primary Dermal Irritation Index (PDII) was 0. This showed that the body scrub cream are safe to use for skin care. Moringa seeds being an excellent choice as a basic ingredient in skin care cosmetic products that can provide multiple benefits, such as gentle exfoliation and additional nutrition for the skin (Savitri, 2019).

CONCLUSION

The result that have been obtained represents the characteristics of Moringa seed powder comparing to polyethylene beads which have fulfilled the requirements as an exfoliant. The application in face gel showed the required evaluation test. The stability test results of all formulas were in range value of physical properties of gel that based on literature standard. Statistically, all Moringa's gel formulas (F1, F2 and F3) comparing to the polyethylene gels (F4, F5 and F6) indicated that the statistical test result between F1 and F4 showed a significant differences ($p<0.05$), equally in the comparison between F2 and F5 and also in F3 and F6. Therefore, statistical tests were carried out for each formula group and it was found that there were no significant differences between F1, F2 and F3.

However, there was a significant difference between F4, F5 and F6, while there was no significant difference between F5 and F6. Based on this data, the most optimal Moringa gel formula was concluded at the lowest concentration because it met the requirements for a good gel and did not change with increasing Moringa powder concentration. Then for the polyethylene gel formula, F5 is considered to be the most optimal formula since it had no changes compared to F6. Therefore, F1 (1% of moringa seed powder) was the optimal formula that assumed as a natural exfoliant equalized to a synthetic exfoliant in F5 (1.5% polyethylene beads) that offered all requirement characteristics in the range of standard and in statistic analysis, and no irrtitation on the skin.

REFERENCES

Agustina, Lia, Vindy Sheila, Amilia Muharjito, and Ninis Yuliati. (2022). "Formulasi Dan Uji Mutu Fisik Sediaan Face Scrub Kulit Ari Kedelai (Glycine Max)." *Jurnal Pharma Bhakta* 2 (1): 10–17.

Amasa, Wayessa, Dante Santiago, Seblework Mekonen, and Argaw Ambelu. (2012). "Are Cosmetics Used in Developing Countries Safe? Use and Dermal Irritation of Body Care Products in Jimma Town, Southwestern Ethiopia." *Journal of Toxicology* 2012.

Chauhan, Lalita, and Shalini Gupta. (2020). "Creams: A Review on Classification, Preparation Methods, Evaluation and Its Applications." *Journal of Drug Delivery and Therapeutics* 10 (5-s): 281–89.

Ditjen POM. (1985). Formularium Kosmetika Indonesia. Departemen Kesehatan RI, Jakarta. 83(85), 106 – 132.

Dwi, Rachmawaty Daswi, St Mutmainnah Dewi

Reski, Alfrida Monica, and StRatnah Politeknik Kesehatan Makassar. (2022). “Formulation And Physical Quality Stability Of Facial Gel Preparations Containing African Leaf Extract (Vernonia Amygdalina Dell.) With Variations In Carbopol Concentration.” *Media Farmasi p.Issn* 18 (No.1): 42–48.

Draeloz, Z. D. (2016). “Cosmetic Dermatology.” *Cosmetic Dermatology*, 1–170.

Faradiba, Faisal, A., & Ruhama, M. (2013). Formulasi Krim Wajah dari Sari Buah Jeruk Lemon (*Vitis vinifera* L.) dengan Variasi Konsentrasi Elmugator. Majalah Farmasi dan Farmakologi. 17(1), 17 – 20.

Fendall, Lisa S., and Mary A. Sewell. (2009). “Contributing to Marine Pollution by Washing Your Face: Microplastics in Facial Cleansers.” *Marine Pollution Bulletin* 58 (8): 1225–28.

Godoy, V., M. A. Martín-Lara, M. Calero, and G. Blázquez. (2019). “Physical-Chemical Characterization of Microplastics Present in Some Exfoliating Products from Spain.” *Marine Pollution Bulletin* 139 (December 2018): 91–99.

Hasan, Hamsinah, Nurmaya Effendi, and Sulfiani. (2023). “Formulasi Sediaan Krim Body Scrub Berbahan Dasar Tepung Cangkang Telur Bebek.” *Jurnal Kesehatan Tambusai* 4 (2): 330–330.

Hidalgo-Ruz, Valeria, Lars Gutow, Richard C. Thompson, and Martin Thiel. (2012). “Microplastics in the Marine Environment: A Review of the Methods Used for Identification and Quantification.” *Environmental Science and Technology* 46 (6): 3060–75.

Kamkaen, Narisa, Wimon Phuntuwate, Weerasak Samee, Artitaya Boonrod, and Charoen Treesak. (2007). “The Investigation of the Rabbit and Human Skin Irritation of Herbal Anti-Wrinkle Cream.” *Thai Pharmaceutical and Health Science Journal* 2 (1): 20–25.

Koch, Lothar, Stefanie Kuhn, Heiko Sorg, Martin Gruene, Sabrina Schlie, Ralf Gaebel, Bianca Polchow, *et al*. (2010). “Laser Printing of Skin Cells and Human Stem Cells.” *Tissue Engineering - Part C: Methods* 16 (5): 847–54.

Lestari, Uce, Syamsurizal Syamsurizal, and Wulan Tri Handayani. (2020). “Formulasi Dan Uji Efektivitas Daya Bersih Sabun Padat Kombinasi Arang Aktif Cangkang Sawit Dan Sodium Lauril Sulfat.” *JPSCR: Journal of Pharmaceutical Science and Clinical Research* 5 (2): 136.

Malviya, Smriti, Jitendra Pandepy, and Sumeet Dwivedi. (2013). “INTERNATIONAL JOURNAL OF PHARMACY & LIFE SCIENCES Formulation and Evaluation of Floating Microbeads of Ciprofloxacin HCl by Emulsion Gelation Method.” *Int. J. of Pharm. & Life Sci. (IJPLS)* 4 (8): 2876–84.

Meireles, Diana, João Gomes, Lara Lopes, Mariana Hinzmann, and Jorge Machado. (2020). “A Review of Properties, Nutritional and Pharmaceutical Applications of Moringa Oleifera: Integrative Approach on Conventional and Traditional Asian Medicine.” *Advances in Traditional Medicine* 20 (4): 495–515.

Nadiratuzzahra, Syarifah, and Dewi Tristantini. (2020). “Cellulose Acetate from Oil Palm Empty Fruit Bunches Waste as Biodegradable Microbeads for Making Scrubs.” *AIP Conference Proceedings* 2223.

Nakhil, Umaimatun, Isabella Meliawati Sikumbang, Nugrahani Hendra Putri, and Heni Lutfiyati. (2019). “Wuluh Starfruit (Averrhoa Bilimbi) Extract Gel For Recurrent Aftosa Stomatitis.” *Jurnal Farmasi Sains Dan Praktis* 5 (2): 2579–4558.

Putri, Natasha Faruqi Andrian, Desy Nawangsari, and Sunarti Sunarti. (2021). “FORMULASI SEDIAAN GEL SCRUB WAJAH SERBUK BIJI KOPI ARABIKA (Coffee Arabica) DENGAN KONSENTRASI KARBOPOL 940 SEBAGAI GELLING AGENT.” *Jurnal Farmasi & Sains Indonesia* 4 (2): 68–73.

Rahayu, Titis, Achmad Fudholi, and Annisa Fitria. (2016). “Optimasi Formulasi Gel Ekstrak Daun Tembakau (Nicotiana Tabacum) Dengan Variasi Kadar Karbopol940 Dan Tea Menggunakan Metode Simplex Lattice Design (Sld).” *Jurnal Ilmiah Farmasi* 12 (1): 22–34.

Sahlan, Muhamad, Hafizh Fadhullah, Diah Kartika Pratami, and Kenny Lischer. (2020). “Physical and Chemical Characterization of Dry Mud Propolis for Natural Scrub Cosmetic.” *AIP Conference Proceedings* 2230.

Savitri, A. K. (2019). Formula dan Tingkat Iritasi Akut Dermal Serbuk Biji Kelor (*Moringa oleifera*) pada Sediaan Lulur Krim dengan Metode Draize Test [Bachelor's Thesis]. Jakarta: Fakultas Sains dan Teknologi, Universitas Islam Negeri Syarif Hidayatullah.

Shanti Septiani, Nasrul Wathoni, Soraya R. Mita. (2011). “Formulasi Sediaan Masker Gel Antioksidan Dari Ekstrak Etanol Biji Belinjo.” *Fakultas Farmasi Universitas Padjajaran*, 2–4.

Sharath Golla, Sundar Madihally, Robert L. Robinson Jr., Khaled A.M. Gasem. (2009). "Quantitative structure–property relationships modeling of skin irritation." *Toxicology in Vitro* 23: 176–184.

Umar, G. R. (2019). Standarisasi Parameter Spesifik Ekstrak Biji Kelor (*Moringa oleifera* L) [Skripsi]. Palu: Fakultas Matematika Universitas Tadulako.

Unuigbe, CA, HA Okeri, O Erharuyi, EE Oghenero, and DA Obamedo. (2015). "Phytochemical and Antioxidant Evaluation of *Moringa Oleifera* (Moringaceae) Leaf and Seed." *Journal of Pharmacy & Bioresources* 11 (2): 51.

Wasitaatmadja S, M. (1997). Penuntun Ilmu Kosmetik Medik. UI – Press, Jakarta.

Yulianti, Erma dan Binardjo Anna. (2010). "Prosiding_konggres_IAI_2010-1.Pdf."