



Formulation and Stability Test of Physical Quality of Lotion Preparations from Moringa Oleifera L. Leaf Extract with Various Concentrations of Emulsifier TEA

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ABSTRACT

The tendency to use herbal ingredients has entered the world of beauty leading to increased research on cosmetic and plant formulations used to be cosmetic active substances. There are many plants that can be used, one of which is the Moringa plant which is considered sacred because it has many benefits. This study aims to determine whether Moringa leaf extract with variations in TEA concentrations of 2.5%, 3%, and 3.5% is formulated into lotions to produce an effective, stable, and safe cream. This type of research is experimental; physical quality testing is carried out before and after the storage conditions are accelerated (Freeze-thaw), including organoleptic tests, homogeneity tests, viscosity tests, pH tests, dispersion tests, and emulsion type tests. Moringa Leaf Extract can be formulated into lotion preparations with variations in TEA concentrations of 2.5%, 3%, and 3.5%. The results of the physical quality test show that all formulas meet the requirements of physical qualification. Third, the dosage formulation of Moringa leaf extract lotion (*Moringa oleifera L.*) with variations in TEA emulsifying concentrations of 2.5%, 3%, and 3.5% based on physical quality stability tests all meet the requirements.

Keywords: lotion, physical quality, moringa leaves, TEA.

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INTRODUCTION

The high level of public awareness of the importance of caring for the skin is one of the triggers for increased invitations for cosmetic skin care products (Craddock et al., 2022). Using cosmetics on the skin is one of the efforts to protect the skin (Megantara et al., 2017). Cosmetics are materials or preparations used on the body's exterior, which function as cleansers and deodorizers, which can change the body's appearance, which can protect the body and maintain the body in good condition (Meilani, 2021).

The trend of using herbal ingredients has entered the beauty world, which has led to increased research on cosmetic formulations and plants used to become active cosmetic substances (Araujo et al., 2022). The analysis is carried out on plants whose use has been passed down for generations or research that aims to find innovations and variations of new plant active ingredients (Faccio, 2020). Many plants can be used, one of which is the Moringa plant, which is considered sacred because it has many benefits (Oktariani S, 2018).

Based on the phytochemical tests that have been carried out, many compounds have been found that are useful as antioxidants, including saponins, tannins, alkaloids, steroids, anthraquinones, triterpenoids, and flavonoids. Moringa leaves contain the compound Quercetin, a group of flavonoids 4 to 5 times stronger than vitamins E and C (Hardiyanthi, 2015).

Testing Moringa Leaf Extract with the DPPH activity technique (1,1-Diphenyl-2-picryl Hydrazil), which is expressed by IC50 (50% Inhibitor Concentration), namely 92.5283 ppm This means that antioxidants from Moringa leaves are active in inhibiting free radicals (Hardiyanthi, 2015). Free radicals can be caused by Pollution and weather (Feng et al., 2022). Free radicals can damage collagen

fibers and the dermis layer, which causes scaly, dry, wrinkled skin and accelerates the aging process. Therefore, the skin needs antioxidants to ward off free radicals (Ramos-Tovar & Muriel, 2023). Compounds that can prevent and inhibit the occurrence of easily oxidized compounds are called antioxidants (Santoso, 2021). Antioxidants can slow down and avoid damage caused by free radicals (Yuslianti, 2018). To facilitate the use of antioxidants, lotion preparations are made to make them easier to apply, especially to the hands and body parts (Dominica & Handayani, 2019).

Lotion is part of skin care cosmetics that can moisturize the skin while protecting the skin (Anggraeni, 2020). Cream includes an aqueous phase and an oil phase. To counteract separation between the two steps, TEA (Triethanolamine) is administered as an emulsifier to stabilize the lotion. Lotion formulations are made with varying TEA concentrations which function as alkalinizers and emulsifiers (Rahman et al., 2013). However, the purpose of this study was to formulate lotion preparations from *Moringa oleifera L.* leaf extract with variations in TEA emulsifier concentrations and to determine the stability of the physical quality of lotion preparations from *Moringa oleifera L.* leaf extracts with variations in TEA emulsifier concentrations. The benefits of research are as a place to apply the knowledge that has been obtained and add insight in conducting research, as a reference for further research related to *Moringa Leaf extract* on skin health, providing scientific information to the public regarding the efficacy of *Moringa Leaf extract* as one of the uses for making lotions, as well as providing information on how to make good and correct *Moringa Leaf extract* lotion.

Based on the above background, the researchers wanted to examine the formulation and stability test of the physical quality of lotion preparations from *Moringa leaf extract* with variations in TEA emulsifier concentrations. This study aims to formulate lotion preparations from *Moringa oleifera L.* leaf extract with variations in the concentration of TEA emulsifier and to determine the stability of the physical quality of lotion preparations from *Moringa oleifera L.* leaf extract with variations in TEA emulsifiers. Concentration.

METHODS

Research Design

This type of research is experimental and aims to formulate lotion preparations from *Moringa oleifera L.* Leaf extract with variations in TEA emulsifier concentrations.

Tools and Materials

The tools used in this study were a mortar and stamper, stir bar, spatula, porcelain cup, water bath, measuring cup, watch glass, analytical balance, dropping pipette, horn spoon, pH meter, incubator, refrigerator, and lotion container. The materials used in this study were *Moringa leaves (Moringa oleifera L.)*, cetyl alcohol, stearic acid, lanolin, TEA, glycerin, propylparaben, methylparaben, Tocopherol, distilled water, and fragrance.

Formula Designz

Table 1. Formulation of *Moringa Leaf extract* lotion (*Moringa oleifera L.*)

Materials	Concentration (%)			Function	Concentration (%)
	F1	F2	F3		
Moringa Leaf Extract	5	5	5	Active Substance	3-5 (Onainor, 2019)
Cetyl Alcohol	5	5	5	Emollient	2-5 (Excipient 5, 2006)
Stearic Acid	6	6	6	Emulsifier	1-20 (Excipient 5, 2006)
Lanolin	3	3	3	Moisturizer	≤ 3 (Excipient 5, 2006)
TEA	2,5	3	3,5	Emulsifier	2-4 (Excipient 5, 2006)

Materials	Concentration (%)			Function	Concentration (%)
	F1	F2	F3		
Gliserin	5	5	5	Humektan	≤ 30 (Excipient 5, 2006)
Propil Paraben	0,01	0,01	0,01	Preservative	0,01-0,6 (Excipient 5, 2006)
Metil Paraben	0,02	0,02	0,02	Preservative	0,02-0,3 (Excipient 5, 2006)
Tokoferol	0,05	0,05	0,05	Anti-Oxidant	(Kharisma, dkk 2019)
Pewangi	0,1	0,1	0,1	Odor Enhancer	0,1-0,5 (Hardiyanthi, 2015)
Aquadest	ad 100	ad 100	ad 100	Solvent	

How to Make Lotions

The first step in making Moringa Leaf lotion is to melt the oil phase, namely propylparaben, cetyl alcohol, stearic acid, and lanolin. Dissolve Nipagin using hot water, then melt the water phase, which consists of Nipagin and TEA, which has been dissolved with Aquadest. Then, prepare a hot mortar. After the two steps melted, they were put together in a hot mortar and stirred until a lotion base was produced. After that, glycerin was added to the Moringa Leaf Extract. Then, the mixture was mixed into the lotion base and crushed until homogeneous. After being homogeneous, the Tocopherol is added and crushed until homogeneous, and then fragrance is added. After that, it is put into the lotion preparation container.

Stability Test

The stability test of lotion preparations is carried out to determine the physical stability of the lotion using the Freeze-thaw technique. This test was carried out based on the effect of changing the temperature of the Cycling test at 4oC and 40oC, which was carried out in 6 cycles, and one process lasted 24 hours (Wildaniah & Ganda, 2019).

Physical Quality Evaluation

1. Organoleptic observation k

An organoleptic test of Moringa Leaf extract lotion preparations was detected visually, including changes in shape, color, and aroma.

2. Homogeneity test

The preparation of Moringa Leaf extract lotion is taken sufficiently and placed on a transparent material. Then observe whether the preparation is homogeneous or whether there are parts that are not mixed.

3. Viscosity Test

The preparation of Moringa Leaf extract lotion is put into the container. Spindle number 6 is installed, ensuring the rotor is immersed in the practice. Then, turn on the viscometer and make sure that the spindle rotates. This test uses a viscometer at a reading of 100 rpm. Observations were made on the viscometer needle, leading to the viscosity scale number, and documentation was carried out. The requirement for suitable viscosity for topical preparations in the form of lotions is 2000 – 50000 cP (SNI 16-4399-1996).

4. pH measurement

The pH test is carried out by preparing the lotion; then, the pH meter is inserted into the cream. After that, the results of the scale readings were recorded. Stable pH is in the range of 4.5 – 6.5.

5. Spreadability Test

The preparation is weighed as much as 0.5 grams, placed on top of the watch glass, put another watch glass, given a weight of 150 g, and left for 60 seconds. After that, the diameter was measured, and the lotion distribution was recorded. Standard Power spread ranges from 5 – 7 cm.

6. Emulsion Type Test

Coloring is given to the lotion by adding methylene blue. If the preparation is homogeneous with methylene blue, the cream is an oil-in-water emulsion type (Ulfa, Maria., Himawan, Achmad., Kalni, Sri, 2019).

RESULTS AND DISCUSSION

Table 2. The accelerated stability method with three replications was used to perform organoleptic test results for Moringa leaf extract lotion (*Moringa oleifera* L.) before and after storage.

Formulas	Organoleptic					
	Before storage accelerated			After storage accelerated		
	Consistency	Color	Aroma	Consistency	Color	Aroma
F1 2.5%	Semi-solid	Green	Melons special	Semi-solid	Green	Melons special
F2 3%	Semi-solid	Green	Melons special	Semi-solid	Green	Melons special
F3 3.5%	Semi-solid	Green	Melons special	Semi-solid	Green	Melons special

Table 3. The accelerated stability method with three replications was used for the homogeneous test results for Moringa leaf extract lotion (*Moringa oleifera* L.) before and after storage.

Formulas	Before Accelerated Storage	After Expedited Storage	Condition	Results
F1 2.5%	Homogeneous	Homogeneous	There are no parts that do not mix	Qualify
F2 3%	Homogeneous	Homogeneous		Qualify
F3 3.5%	Homogeneous	Homogeneous		Qualify

Table 4. The viscosity test results for preparing Moringa Leaf extract lotion (*Moringa oleifera* L.) before and after storage using the accelerated stability method with three replications.

Formulas	Before storage		After storage		Condition	Results
	I	II	I	II		
F1 2.5 %	I	7119	I	4675	2000-50000 cP	Qualify
	II	7118	II	4658		
	III	7102	III	4559		
Average		7113		4630		
F2 3 %	I	6386	I	4724		
	II	6446	II	4647		
	III	6546	III	4791		
Average		6459		4720		
F3 3.5 %	I	11861	I	9584	Qualify	
	II	12201	II	9254		
	III	12041	III	9377		
Average		12034		9405		

Table 5. The results of testing the pH of the Moringa Leaf extract lotion preparation (*Moringa oleifera* L.) before and after storage with the accelerated stability method with three replications

Formulas	Before Accelerated Storage		After Expedited Storage		Condition	Results
	I	II	I	II		
F1 2.5 %	I	6,42	I	6,40	4.5 - 6.5	Qualify
	II	6,42	II	6,37		
	III	6,41	III	6,39		
Average		6,41		6,38		

F2 3 %	I	6,41	I	6,40	
	II	6,39	II	6,34	
	III	6,39	III	6,34	Qualify
Average		6,39		6,36	
F3 3.5 %	I	6,38	I	6,35	
	II	6,39	II	6,35	
	III	6,38	III	6,33	Qualify
Average		6,38		6,34	

Table 6. The results of testing the spreadability of Moringa Leaf extract lotion (*Moringa oleifera L.*) before and after storage using the accelerated stability method with three replications.

Formulas	Before Accelerated Storage	After Expedited Storage	Condition	Results	
F1 2.5 %	I	6,3	I	6,2	
	II	6,4	II	6,1	
	III	6,3	III	6,2	Qualify
Average		6,3		6,1	
F2 3 %	I	6,4	I	6	
	II	6,4	II	6,1	5 – 7 cm
	III	6,1	III	6,1	Qualify
Average		6,3		6	
F3 3.5 %	I	5,9	I	6	
	II	5,8	II	6	
	III	5,4	III	6,1	Qualify
Average		5,7		6	

Table 7. The results of testing the emulsion type of Moringa Leaf extract lotion (*Moringa oleifera L.*) before and after storage with the accelerated stability method with three replications.

Formulas	Before Accelerated Storage	After Expedited Storage	Results
F1 2.5%	Homogeneous	Homogeneous	M/A
F2 3%	Homogeneous	Homogeneous	M/A
F3 3.5%	Homogeneous	Homogeneous	M/A

This research made a lotion with an active extract of Moringa leaves (*Moringa oleifera L.*). This research aimed to determine the effect of different concentrations of TEA in lotion formulations by varying the TEA concentrations of 2.5%, 3%, and 3.5%, which act as emulsifiers.

Simplicia Extraction of Moringa Leaves was done by maceration technique. The choice of the maceration extraction technique is because, in addition to the equipment used being simple, the process is also very profitable if extraction is carried out on natural materials because only by immersion will the solvent break through the walls and cell membranes that contain active ingredients, then the active ingredients will be pushed out due to different concentrations on the functional ingredient solution inside and outside the cell. This incident will continue to repeat until the concentration is balanced between the key inside and outside the cell (Najib, 2018). The simplicial extraction was carried out for 15 days, and the solvent was significantly changed. Maceration uses a sample of 400 grams. Moringa leaf simplicia is soaked using 96% ethanol solvent and left to stand at room temperature, protected from light while occasionally stirring. Furthermore, the soaking results were filtered into the holding container; then, the solvent was replaced up to 3 times. The resulting filtrate is then evaporated using a rotary evaporator.

This lotion formula uses several ingredients, namely Moringa Leaf (*Moringa oleifera L.*) as an active ingredient, Cetyl alcohol as an emollient, Stearic acid and TEA as emulsifiers, Lanolin as a

moisturizer, Glycerin as a humectant, Propylparaben and Methylparaben for preservation, Tocopherol for antioxidants, Aquades as a solvent and fragrance.

After making the lotion, the stability of the preparation's physical quality was tested, including organoleptic testing, homogeneity, pH measurement, viscosity, spreadability, and emulsion type.

Organoleptic testing was carried out by observing the preparation of Moringa Leaf extract lotion (*Moringa oleifera* L.), which includes color, aroma, and dosage form. The results of organoleptic observations for the three TEA concentration formulas of 2.5%, 3%, and 3.5% before storage obtained green color with a distinctive smell of melon fragrance, so the aroma produced was quite attractive. The results obtained after storage were that the color, shape, and smell were the same as before storage, so no changes occurred.

A homogeneity test was carried out to determine whether all the materials were homogeneous. Homogeneous preparations will produce good quality preparations because homogeneous trials indicate that the extract, in this case, the active substance, mixes well with the essential ingredients so that all parts of the practice contain the same amount of active substance (Dominica & Handayani, 2019). A homogeneity test is done by smearing the preparation on transparent glass under the light. Table III, where the three formulations of Moringa Leaf extract lotion before and after accelerated storage, shows that the composition of the dispersed ingredients is homogeneous and meets the requirements.

The viscosity test determines whether the preparation can be applied quickly and stick to the skin. Lotion with a higher viscosity will affect its application. The viscosity test of the cream was carried out using a viscometer at a speed of 30 rpm with spindle number 4. Table IV shows that the highest viscosity is found in F3, 3.5%; the lowest density is in F2, 3% before and after accelerated storage, and the most inferior thickness is located in F1, 2.5%. Based on the Two Way ANOVA test results, $P = 0.000$ ($\alpha < 0.05$) showed a significant difference between the viscosity test before and after storage.

The pH test was carried out to determine whether the lotion preparations met the pH requirements of topical preparations, ranging from 4.5 to 6.5. If the pH is very acidic, it can cause skin irritation, whereas if it is too wet, it can cause dryness and scaly skin (Dominica & Handayani, 2019). In table V, the pH of the lotion preparations from the three formulas before and after storage was accelerated with three replications at F1 2.5%, F2 3%, and F3 3.5%; all met the requirements. Based on the Two Way ANOVA test results, $P = 0.878$ ($\alpha > 0.05$) showed no significant difference between the pH test before and after storage.

The spreadability test determines the lotion's ability to spread when applied to the skin. A good cream is usually easy to spread when used, while the requirements for the lotion are 5-7 cm (Dominica & Handayani, 2019). The easier the cream is to apply to the skin surface, the more the ointment will be in contact with the skin surface, and the active ingredients will be well distributed. Testing the spreadability of each Moringa Leaf extract lotion showed changes before and after accelerated storage. In table VI, the spreadability test before and after accelerated storage shows that the higher the concentration of TEA, the spreading power decreases. In table 4.5, all formulas F1 2.5%, F2 3%, and F3 3.5% before and after storage meet the requirements. Based on the Two Way ANOVA test results, $P = 0.001$ ($\alpha < 0.05$) showed a significant difference between the spreadability test before and after storage.

The emulsion type test on lotion preparations was carried out to determine the emulsion type. In this emulsion-type test, staining was carried out using methylene blue to determine whether the emulsion type for lotion preparations was oil or water in oil. The results of the emulsion type test in table VII for all formulas F1 2.5%, F2 3%, and F3 3.5% before and after storage are oil-in-water (O/A) emulsion types.

CONCLUSION

Based on the results of the research that has been done, it is concluded that Moringa oleifera L. Leaf Extract can be formulated in lotion preparations with variations in TEA emulsifier concentrations of 2.5%, 3%, and 3.5%. The three formulations of Moringa leaf extract lotion (*Moringa oleifera L.*) with various TEA emulsifier concentrations of 2.5%, 3%, and 3.5% based on the stability test of physical quality all met the requirements.

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