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RESEARCH ARTICLE

Formulation and physical properties of lotion Kalakai root ethanol extract (*Stenochlaena palustris Bedd*)

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Abstract

Aim: To determine the physical (organoleptic, homogeneity, pH, dispersibility and adhesion) properties of the ethanol extract of Kalakai root lotion with a concentration of 1%, 2% and 3%. **Methods:** This study used the maceration method that was carried out by testing the physical properties of the lotion preparation with three concentrations, namely 1%, 2% and 3% using one type, namely the M/A type.
Results: It was found that at a concentration of 3% it was a formula for the ethanol extract of Kalakai root that met the quality parameters of the good physical properties of the lotion. **Conclusion:** Kalakai root extract concentration influenced the physical properties of the lotion preparation tested. The higher the kalakai root extract concentration, to a concentration of 3%, did not affect the pH value or homogeneity, but the kalakai root extract lotion preparation had higher results for the spreadability and adhesion.

Introduction

The skin controls body temperature, acts as a protective layer, allows a sense of touch and has melanocytes to filter out some of the potentially harmful ultraviolet (UV) radiation from sunlight (Fauzi & Nurmalina, 2012). The limited protection from UV light means the body needs antioxidants that are able to neutralise free radicals, which are otherwise very dangerous, to prevent damage to the exposed skin cells. This damage can lead to skin cancer; therefore, it is necessary to formulate a cosmetic preparation containing antioxidant compounds. Certain plants are known to have beneficial properties meaning they can be used as natural ingredients to protect the skin from the negative effects of sunlight. These natural substances can be extracted from the plants and serve as a potential source of sunscreen. The use of antioxidants can prevent various diseases caused by UV radiation; there are several active antioxidant compound groups, such as flavonoids, tannins, anthraquinones, cinnamates and other groups, that have been reported to have the ability to protect against UV rays (Indriani, 2018).

The search for these natural compounds is currently a major concern. A natural ingredient widely found in Borneo that grows in peat areas and has traditional medicinal properties is kalakai. Kalakai leaves and roots are widely used in traditional medicines, but it is known that other parts are also used as traditional medicines. Root K*alakai (Stenochlaena palutris)* has not been widely researched; therefore, there is minimal scientific data supporting the effectiveness of kalakai root as an antioxidant. Despite the minimal information for scientific publications, there are articles on the properties of the kalakai root (Adawiyah & Rizki, 2018). Research on antioxidant activity in kalakai roots, from work by Adawiyah and Rizki (2018), states that by using the DPPH and quercetin method as a comparison of the IC value of 50 kalakai roots growing on peat soil of 19.06 ppm and sandy soil of 24.40 ppm have very strong antioxidant activity. Adawiyah's research (2019) for the results of the SPF value of the ethanol extract of Kalakai root at a concentration of 350 ppm, the SPF antioxidant

values are 11 and 14. The accepted range to have an extreme level of ability as an antioxidant SPF is if the range is more than 11.

Antioxidants are important to maintain the quality product of food, health and beauty products. In the health and beauty sector, antioxidants function to prevent cancer, tumours, narrowing of blood vessels, premature ageing and others. In the body, antioxidants also inhibit the oxidation process, where the oxidation process that occurs continuously can cause various degenerative diseases and premature ageing (Sayuti & Yenrina, 2015).

The antioxidant activity and the SPF value from the existing research spurs the development of kalakai root in topical dosage forms that are acceptable to the community. The topical dosage form chosen in this study was lotion preparation. The lotion preparation was chosen because it was the most suitable pharmaceutical preparation for external use as protection. Its liquid consistency allows fast and even application on the skin surface, so it spreads easily and dries quickly after being applied and leaves a thin layer on the skin's surface (Lachman *et al*., 1994). This study aims to determine the physical properties (organoleptic, homogeneity, pH, dispersion and adhesion) of the ethanol extract of kalakai root with a concentration of 1%, 2% and 3%.

Method

The main ingredients used in this study were kalakai roots that grew on peat soil on Mahir Mahar Street, Palangka Raya City; other materials used were 70% ethanol, glyceryl monostearate, glycerine, Cera alba, liquid paraffin, nipagin, nipasol, twen 80, stearic acid, aqua rose and aqua dest.

The tools used in this study were analytic scales, pH universal, a water bath, a rotary evaporator for maceration tools, and a range of glassware.

Simplicia collection and processing

The process carried out in the manufacture of the first Simplicia was done by preparation by collecting Simpilicia, wet sorting, washing with running clean water, draining, chopping and drying. The drying process in this study was carried out by drying in the shade (dry-wind), then dry sorting was carried out, and the dry Simplicia was obtained in the form of a sieved powder using a sieve with a sieve number 14.

Preparation of the extract

Simplisia, containing Kalakai root powder weighing 900 g, was then extracted using the maceration method with 70% ethanol solvent with a ratio of 1: 8 for four days with a change of solvent every 24 hours. The liquid extract obtained was then separated from the residue using Whatman filter paper number 1 until the solution was no longer colourless. The liquid extract obtained was concentrated using a *rotary evaporator* with a temperature of 60°C for approximately eight hours, then evaporated on a water bath with a temperature of 60°C to form a thick extract.

Preparation of Kalakai Root ethanol extract lotion (Stenochlaena palutris Bedd)

Oil phase materials (glyceryl monostearate, stearic acid, liquid paraffin, Cera alba) were mixed by heating the materials at a water bath of 75°C until homogeneous. At the same time, the water phase (glycerin, TEA, twen 80, nipagin, nipasol and distilled water) were mixed. Next, the oil phase was put in a hot mortar then crushed while adding, a little by little, the water phase and crushed until the ingredients were mixed together. Finally, add aqua rose and kalakai root extract and crush it again until it was homogeneous and the lotion preparations are formed. The finished preparation was put in a closed container to avoid sun exposure, then evaluating the lotion preparation. For each variation of the kalakai root extract formula in this study, the concentration was 1% (F1), 2% (F2), 3% (F3).

Evaluation of physical properties of kalakai root extract lotion

The formula of the kalakai root ethanol extract lotion used is as described in Table I. in this study, the physical properties test carried out were an organoleptic test, homogeneity test, pH test, adhesion test and a spreadability test.

Organoleptic test

Organoleptic testing was carried out by observing the smell, color and texture of the lotion preparation (Anief, 1997).

Homogeneity test

The homogeneity test was carried out by weighing 0.1 g of the lotion preparation then placing it in the middle of a glass dish then flattening and covering it with another glass object (Pujiastuti, & Kristianti, 2019).

pH test

The pH test for lotion preparations uses universal pH. The lotion preparation was smeared on universal pH paper and replicated three times for each formula, and

the colour change on the pH paper observed and recorded. The colour that appears on the universal pH paper was then matched with the colour on the pH indicator found on the universal pH package (Pujiastuti, & Kristianti, 2019).

Adhesion test

The preparation was weighed at 0.1 g, placed in the middle of the glass dish and covered with another glass object, pressed using a heavy load (50 g weights) for five minutes. The tip of the cover glass object and the other edge of the glass object is attached to the clamp on the adhesive strength tester; then, the load support is removed. The length of time the two glass objects were separated from the test equipment was recorded as the attachment time for the preparation. This test was carried out for the three formulas (Please rephrase – meaning is unclear) (Pujiastuti & Kristianti, 2019).

Spreadability test

The spreadability test was carried out by weighing the lotion preparation at 0.5 g and then placing it in the middle of a round glass scale. It was then covered using a round glass which has been weighed, and the diameter of the spread was recorded. Weight loads of 50 g, 100 g and 150 g were added alternately for one minute, and the diameter of the spread was recorded. This process was repeated three times, and the same test stages were carried out for the three formulas. Then, another round glass was placed on top of the lotion and a weight of up to 150 g, left to stand for one minute for each additional weight, then the diameter of the spread was recorded. (Pujiastuti & Kristianti, 2019).

Data analysis

The result data of the tests of the physical properties of the lotion preparation formula were replicated three times to increase the accuracy of the experiment. The data obtained were compared with the physical properties of a good lotion preparation.

Result

The Kalakai root extract was made using 70% ethanol by maceration, and a thick extract was obtained weighing 8.00g, with a yield of 0.89% obtained from the kalakai root powder originally weighed at 900g. The lotion preparation formulas with variations in the concentration of kalakai root extract are presented in Table I. Organoleptic and homogeneity test results are presented in Tables II and III, while the results of the pH, adhesion and spreadability tests are presented in Figures 1, 2 and 3.

Table I: Lotion formulations for kalakai root extract with various concentrations of 1% (F1), 2% (F2) and 3% (F3)

Materials	F1 (1%)	F2 (2%)	F3 (3%)
Kalakai ethanol extract	0.50 g	1.00 g	1.50 g
Gliseril monostearate	2.75 g	2.75 g	2.75 g
Cera alba	1.35 g	1.35 g	1.35 g
Tween 80	1.75 g	1.75 g	1.75 g
Gliserin	5.00 g	5.00 g	5.00 g
Parafin liquidum	5.00 g	5.00 g	5.00 g
Nipagin	0.0075 g	0.0075 g	0.0075 g
Nipasol	0.0075 g	0.0075 g	0.0075 g
Acid stearate	2.00 g	2.00 g	2.00 g
TEA	2.00 g	2.00 g	2.00 g
Aqua rosae	3 drops	3 drops	3 drops
Aquadest	ad 50ml	ad 50ml	ad 50 ml

Organoleptic test results

The test was done by observing the smell, colour and texture of the preparation. The results of the three formulas obtained are presented in Table II. Formula 1 produced a brownish colour, had a distinctive smell of Kalakai extract and rose, a soft and smooth texture. Formula 2 produced a brown colour, had a distinctive smell of Kalakai extract and rose, and had a soft and smooth texture. Formula 3 produced a dark brown colour, a distinctive smell of Kalakai extract and rose and had a soft and smooth texture smooth.

Table II: Organoleptic test results

Organoleptic test	F1 (1%)	F2 (2%)	F3 (3%)
Colour	Light brown	Chocolate	Dark brown
Smell	The distinctive smell of Kalakai and Roseroot extracts	The distinctive smell of Kalakai and Roseroot extracts	The distinctive smell of Kalakai and Roseroot extracts
Texture	Soft and smooth	Soft and smooth	Soft and smooth

Homogeneity test

The homogeneity test was carried using 0.1 g of the lotion preparation by placing it on a glass object and observing it by moving it through uneven or coarse particles. Based on the three formulas, a homogeneous formula was obtained in the absence of harshness on the tested lotion, as presented in Table III.

Table III: Homogeneity test results

Replication	F1 (1%)	F2 (2%)	F3 (3%)
1	Homogeneous	Homogeneous	Homogeneous
2	Homogeneous	Homogeneous	Homogeneous
3	Homogeneous	Homogeneous	Homogeneous

pH test result

pH testing on lotion preparations using universal pH. Based on testing the pH value on the lotion preparation, the results obtained in formulas 1, 2 and 3 have a pH value of 7, as shown in Figure 1.

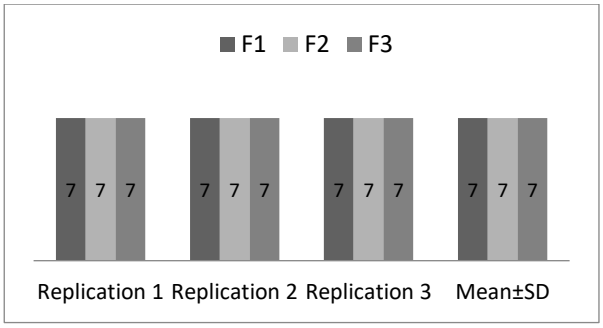

Figure 1: pH test results of Kalakai root extract

Adhesion test results

The adhesion test on lotion preparations obtained results in formula 1 with an average time of 2.4 seconds, formula 2 with an average time of 3.6 seconds and formula 3 with an average time of 4.2 seconds which is presented in Figure 2.

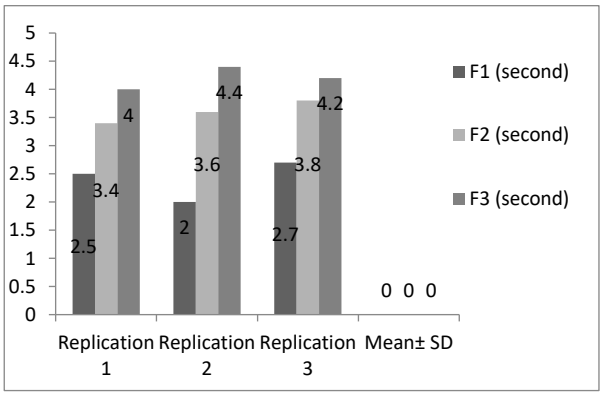

Figure 2: The result of Kalakai root extract adhesion test

Spreadability test result

The spreadability test on lotion preparations had averages of 9.73 cm for formula 1, an average of 9.03 cm for formula 2, and formula 3 with an average of 7.00 cm, which is shown in Figure 3.

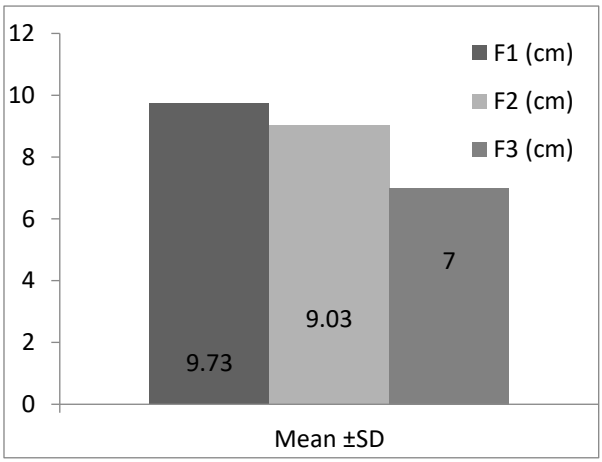

Figure 3: The spreadability test results of kalakai root extract

Discussion

The results of the ethanol extract of Kalakai root in this study used 70% ethanol due to its good penetration power for penetrating the cell wall. This allows the active compounds contained in the sample to be activated. It also has the ability to bind with compounds with a wide polarity range (polar to non-polar compounds); it is non-toxic compared to other organic solvents, and is not easily hydrolysed by microbes (Saifudin *et al*., 2010). The extract was made using the maceration method. Maceration is one of the simplest methods and is widely used, the principle is the diffusion process between the solvent and secondary metabolites due to the immersion of the sample in the solvent. After 24 hours, the solvent was removed and then process was then repeated. The solvent was replaced to speed up the extraction process as the solvents will become saturated. The solvent replacements are stopped when the solvent has shown a former colour or clear colour, which indicates that the compound has completely reacted (Adawiyah, 2018). Then evaporate the mixture until you get a thick extract. 8.00g of thick extract were obtained with a yield of 0.89%, obtained from the original 900g of kalakai root powder. The yield calculation determines the amount of kalakai root used to obtain the amount of extract and will help to improve the next experiment.

The yield of plant roots is generally not large, usually below 5%.

Organoleptic testing carried out on the three formulas of lotion preparations showed an increase in brownish colour with the increasing addition of Kalakai root extract, as well as all samples having a distinctive odour of Kalakai and roseroots. These observation aims to determine the physical characteristics of lotion preparations, so that, apart from being a factor parameter that affects physical and chemical changes, lotion preparations are also a comport parameter (Amatulla *et al.*, 2017).

The homogeneity test of preparation is influenced by the mixing process at the time of preparation (Pujiastuti, & Kristiani, 2019). Based on the research results, it is known that the increase in the concentration of Kalakai root extract in the lotion preparation does not affect the homogeneity of the Kalakai root ethanol extract lotion because all the ingredients are mixed homogeneously.

The pH test carried out on lotion preparations aims to determine the degree of acidity or alkalinity of a preparation, which can affect comport when used so as not to cause irritation to the skin. Based on the pH value testing of the Kalakai root extract lotion, the same pH value was 7, as shown in Figure 1. Based on the pH value, all formulas meet the pH requirements of skin moisturisers, namely 4.5-8.0 (SNI, 1996). The pH value is important to determine the acidity of the preparation, if it is too acidic, it will irritate the skin, and if it is too alkaline, it can cause scaly skin; the ideal pH for the skin is 4.5-7.0 (Wasitaatmadja,1997).

The adhesion test was carried out to determine the length of time the lotion adheres to the skin. If the lotion has low adhesion, then the desired effect is not achieved. In contrast, if the adhesion produced is strong, it will inhibit skin respiration (Megantara *et al*., 2017). Therefore it is important to conduct the adhesion test. The accepted requirement for adhesion time ranging is more than 4 seconds (Mulyani *et al*., 2018), which was only achieved by formula 3 (Figure 2). From this result, it can be concluded that the variation in extract concentration has an influence on the sticking time of the lotion. This is due to the ratio of the concentration of Kalakai root extract; the greater the concentration of Kalakai root extract, resulting in greater adhesion ability and longer adhesion time. This means that the ability of lotion preparations when more Kalakai root extract is added, the lotion adheres more to the skin so that the active substances contained in the lotion preparations will be better able to protect the skin from sun exposure (Ulandari, & Sugihartini, 2020).

The spreadability test was carried out to determine the dispersibility of the preparation when used on the skin. Good preparations are preparations that are easy to spread on the skin without applying great pressure. From the results of the tests carried out, only formula 3 meets the requirements because it has a topical spreadability ranging from five to seven centimetres (Dominica, & Handayani, 2019), as shown in Figure 3. The increase of Kalakai root extract concentration reduces its spreadability as the water content in the preparation decreases, so the lotion gets thicker (Ulandari & Sugihartini, 2020). In addition, the load resistance results in a larger spreading diameter. The wide distribution can show the ease of using the lotion on the skin (Pujiastuti, & Kristiani, 2019)

Conclusion

Kalakai root extract concentration influenced the physical properties of the lotion preparation tested. The higher the kalakai root extract concentration, up to a concentration of 3%, did not affect the pH value, homogeneity, but the increased kalakai root extract lotion preparation showed greater results for the spreadability and adhesion.

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