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Formulation and Evaluation of Face Moisturizing Cream from Katuk Leaf Extract (*Sauropus Androgynus Merr*)

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Abstract

The Katuk plant (*Sauropus androgynus L. Merr*) is a natural substance with proven efficacy in treating diabetes, obesity, and inflammation. It also possesses antioxidant, lactation-inducing, and antibacterial properties. This study aimed to investigate the impact of varying concentrations of katuk leaf extract on characteristics of the moisturizer cream produced. The study involved extracting katuk leaves using the maceration method for 24 hours, utilizing ethanol as the solvent. The extraction process resulted in a yield of 1.86%. The final yield contains alkaloid chemicals, flavonoids, terpenoids, saponins, and tannins. The formulations employed in this investigation utilized the codes F0, F1, F2, and F3, representing the content of katuk leaf extract at 0%, 2%, 4%, and 6%, respectively. The cream generated exhibited an identifiable aroma of katuk and had a hue ranging from light green to blackish brown, as determined by organoleptic testing. The pH values of specimens F0, F1, F2, and F3 were 7, 7, 7, and 8, respectively. The spread ability measurements for specimens F0, F1, F2, and F3 were 5.3 cm, 5.5 cm, 6 cm, and 6.1 cm, respectively. According to the findings of this investigation, specimens F0, F1, F2, and F3 adhered for 5 seconds, 4 seconds, 4 seconds, and 5 seconds, respectively. The formulation F2 is the most superior product generated in this investigation. This is because this specimen exhibits the highest level of respondent satisfaction compared to the other specimens. This formulation exhibits antioxidant activity with a per cent inhibition of 30.51% and an IC50 value of 84.63 ppm. The face moisturizing cream derived from katuk leaf extract possesses a high antioxidant potency, placing it in the active/strong category.

INTRODUCTION

Exposure to sun ultraviolet (UV) radiation is a significant factor in developing skin cancer and other age-related changes. The UV radiation comprises UVA, UVB, and UVC components, which are categorized according to the wavelengths of photons. UVA has the longest wavelength, ranging from 315 to 400 nm, while UVB is in the intermediate range, ranging from 290 to 320 nm.

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UVC has the shortest wavelength, approximately 100 to 280 nm. The majority of the sun's UVC is absorbed by the ozone layer, while ambient sunlight primarily comprises UVA (90%-95%) and UVB (5%-10%) radiation (Amaro-Ortiz et al., 2014). The skin can experience biological impacts from UV radiation, manifesting as either immediate reactions such as erythema or sunburn or long-term reactions involving molecular and metabolic changes associated with skin damage. The initial reaction of the skin to UV light is the beginning of inflammation (Michalak, 2023). The utilization of products that contain sun protection factor (SPF) is extensively promoted as a means of safeguarding the epidermis from the detrimental consequences of ultraviolet radiation exposure. The prevalence of melanoma and non-melanoma skin cancer persists despite efforts to address the issue through public health initiatives. Historically, manufacturers have prioritized the development of personalized SPF formulas that are promoted explicitly as sunscreens. Recently, there has been a rise in the accessibility of alternate SPF formulas, particularly in daily moisturizers. Although the SPF ratings of these formulations were initially lower, numerous widely recognized brands now advertise their products with SPFs in the thirty to fifty per cent range, comparable to the levels advertised for conventional sunscreens (Lourenco et al., 2019).
Modern sunscreens typically consist of two types of materials: organic and inorganic. However, conventional sunscreens are comprised of compounds that have demonstrated harm upon exposure to UV radiation. As a result, other methods have been recently created, such as utilizing natural phytochemicals as the main components in photoprotection products. For centuries, natural materials have been employed in the fields of medicine and cosmetic care. The health impacts of plants have garnered significant interest recently, mostly due to their safety and suitability for use in medicine and cosmetic formulations (Raymond-Lezman & Riskin, 2024; Verma et al., 2024).

Products incorporating plant extracts provide the benefit of being both light and powerful, as well as being secure and harmless, without any adverse reactions. Cosmetics infused with bioactive substances derived from plant extracts are ideal for the skin's requirements and offer greater environmental sustainability than traditional cosmetics. Extracts from plants, abundant in physiologically active compounds, are commonly utilized in cosmetics due to their major impact on human skin (Bujak et al., 2021; Hoang et al., 2021; Michalak, 2023; Ribeiro et al., 2015; Xie et al., 2024).

According to Michalak et al.'s research, extracts from plants like Carthamus tinctorius, Cannabis sativa, Pradosia mutisii, and Hydrangea serrata, have been extensively examined as ingredients for moisturizer productions (Michalak, 2023).

In addition to these plants, katuk (*Sauropus androgynus (L.) Merr*) leaves possess the potential to be employed in the production of moisturizers (Chandra et al., 2021). Several promising properties of katuk leaves have been identified in scientific studies that may be beneficial for the production of moisturizers. Because of the presence of vitamin E and essential fatty acids, katuk leaves may be able to assist in the retention of moisture in the epidermis and the resistance to dryness (Xia et al., 2024). It possesses anti-inflammatory properties which can alleviate irritated or inflamed skin (Andari et al., 2022; Asfi et al., 2022; Bunawan et al., 2015; Selvi & Bhaskar, 2012). Furthermore, katuk leaves exhibit antibacterial properties against Staphylococcus Epidermis and Staphylococcus Aureus, which may be beneficial for individuals with acne-prone skin (Juvita & Wijayanto, 2022; Yunita et al., 2019).

Sauropus androgynus (L.) Merr, commonly known as katuk in Indonesia, is indigenous to hot and humid regions and is extensively cultivated and utilized in Vietnam, Malaysia, Indonesia, Thailand, India, and China. Katuk is a vegetable sometimes called a "multigreen" and "multivitamin" due to its nutritional benefits. It may be eaten raw in salads or cooked in dishes such as curry or stir-fry (Joshi et al., 2023; Zhang et al., 2020). *Sauropus androgynus (L.) Merr.* is a member of the Phyllanthaceae family and is a plant extensively utilized in traditional cuisine and ethnomedicine preparations. S. androgynus is a plant which thrives in hot and humid environments. The branches exhibit a cylindrical or angular shape. The leaves have a pinnate compound structure characterized by an ovoid or lanceolate shape. The plant's flowers have a deep crimson colour, while the fruits possess a spherical shape and a mild yellow shade. *Sauropus androgynus L. Merr*, a perennial shrub belonging to the *Phyllanthaceae* family, is often found in Southeast and South Asia. The plant is extensively

employed for treating fever, foodborne illnesses, gastroenteritis, mouth ulcers, and cancer, in addition to its use as an antiseptic agent. This plant's conventional utilization is rooted in its leaves possessing elevated levels of vitamin C and phenolic compounds (Anju et al., 2022; Hikmawanti et al., 2021; Purba & Paengkoum, 2022). The leaves of the katuk plant contain a variety of vitamins and dietary proteins, as reported by Zhang et al.

This katuk plant produces leaves rich in bioactive phytochemicals, including fatty acids, essential oils, alkaloids, phenols, tannins, terpenoids, and steroids (Zhang et al., 2020).
According to the preceding description, research into using katuk leaf extract as a face moisturizer application is currently limited. Consequently, this investigation will employ katuk leaf extract with various compositions to apply face moisturizers creams. This study aims to determine the effect of katuk leaf extract concentration on the characteristics of the resulting face moisturizing cream. The characteristics of face moisturizing cream that will be evaluated in this study include pH, spread ability, adhesion, respondent satisfaction, antioxidant, and thin layer chromatology. It is anticipated that this research will develop a moisturizing moisturizer that is both safe and effective for hydrating the skin, preventing dryness, and enhancing the skin barrier function. Additionally, it is expected to provide UV protection.

MATERIALS AND METHODS

This investigation implemented maceration instruments, filter paper, homogenizer, water bath, pH meter, analytical balance, rotary evaporator, UV/Vis spectrophotometer, and laboratory glasses. Katuk leaf, distilled water, ethanol, DPPH solution, Mayer reagent, dragendorff reagent, stearic acid, propylene glycol, methyl paraben, propyl paraben, oleum lily, cetyl alcohol, TEA (triethanolamine), hexanes: acetone, hexanes: ethyl acetate, hexanes: chloroform, hexanes: ether, TLC plates (Thin-layer chromatography), methanol, magnesium, concentrated HCl, anhydrous acetate, concentrated H_2SO_4, and $FeCl_3$ 1% are the materials utilized. The production of katuk leaf extract involves the utilization of the sunlight method to dry the katuk leaves. The dehydrated katuk leaves were subsequently pulverized and measured to a weight of 1 kg before being soaked in ethanol solvent for a duration of 24 hours. The macerated mixture was separated by filtration using a Buchner funnel. Following the filtration process, the resulting filtrate and residue are obtained. The filtrate is then concentrated using a rotary evaporator and water bath through the process of evaporation. This allows for the separation of the ethanol solvent, resulting in the production of a thick extract derived from katuk leaves.

In this study, the production of moisturizing cream involves two distinct phases: the liquid phase and the oil phase. The liquid phase comprised propylene glycol, methylparaben, triethanolamine (TEA), and distilled water.

The materials in the liquid phase were placed in a glass beaker and heated to a temperature of 70−80°C until they became homogeneous. The oil phase was formulated using stearic acid, cetyl alcohol, and propylparaben. The oil phase components were placed in a glass beaker and heated to a temperature range of 70−80°C until liquid. The liquid phase was added gradually to the oily phase with continuous stirring using a homogenizer.

Gradually, a specific concentration of Katuk leaf extract was incorporated into the mixture of oil and fluids phases. The stirring process was continued until a solution that is uniform in composition was achieved. The code assigned to each sample of moisturizing cream is displayed in Table 1. The cream was finished by adding strawberry oleum according to preference.

This study conducted various tests, including thin layer chromatography, pH analysis, adhesion testing, spreadability testing, hedonic testing, and antioxidant testing, to evaluate the influence of adding katuk leaf extract on the properties of the moisturizing cream. The pH test is conducted on moisturizing creams to verify their compliance with quality requirements and to ensure consistent quality. Typically, the pH level of face moisturizing creams falls between the range of 4.5 to 8 (BSN (Badan Standarisasi Nasional), 1996). The pH measurement in this investigation was performed using a pH meter.

Face moisturizing cream undergoes the spreadability test to ascertain its simplicity of application and distribution on the skin. Moisturizing creams that possess excellent spreadability can be effortlessly and uniformly

applied without leaving any clumps or white streaks on the skin. The spreadability test involves placing the specimen on a circular glass surface with a diameter scale, covering it with another glass for 1 minute, and subsequently measuring the diameter of the spreading.

Table 1. Formulation and specimen codes of moisturizing cream.

Compositions	Concentration (% w/w)			
	F0	F1	F2	F3
Katuk Leaf Extract	0	2	4	6
Cetyl Alcohol	3	3	3	3
Stearic Acid	15	15	15	15
TEA	3	3	3	3
Glycerin	2	2	2	2
Methyl Paraben	0.9	0.9	0.9	0.9
Propyl Paraben	0.02	0.02	0.02	0.02
Propylenglycol	10	10	10	10
Oleum Strawberry	qs	qs	qs	qs
Aquadest	100	100	100	100

The adhesion of the face moisturizing cream is tested to identify the cream's capacity to stick and stay on the skin. A moisturizing lotion with strong adherence will effectively adhere to the skin. It is crucial to ensure that the active components in the cream are absorbed into the skin optimally to maximize the benefits they give. In this investigation, the adhesion test was conducted by placing the specimen on two pre-determined object glasses, applying a load of 1 kg for 5 minutes, and thereafter measuring the time it took for the specimen to detach from the object glass. The hedonic test used in this study utilized a questionnaire, as specified in the Ethical Feasibility letter No.4096/B/KEPK-UMS/II/2022. This test evaluates preferences and aversions reported using a hedonic scale. The hedonic scale is employed to evaluate the fragrance, hue, consistency, and tactile sensation of moisturizing cream products, with the participation of 20 panellists.

The pH, adhesion, spreadability, and hedonic testing yielded the most favourable results, subsequently used for Thin Layer Chromatography (TLC) and antioxidant testing. Thin Layer Chromatography (TLC) testing is employed to identify chemicals in the final moisturizing cream by comparing the Rf value (relative distance value) of the tested compound with the Rf value of a known reference compound (Kumar et al., 2013). The Thin Layer Chromatography (TLC) testing was conducted using silica plates that were initially activated in an oven at a temperature of 105°C for 30 minutes. Next, the silica plate was created with dimensions of 3.7 × 1.7 cm, including the upper and lower border lines. Using a capillary tube, the katuk leaf extract was dissolved in acetone and applied to the silica plate at the bottom edge.

The eluents employed were mixtures of hexanes and acetone in ratios of 8:2 and 8.5:1.5, as well as mixtures of hexanes and ethyl acetate in ratios of 8:2 and 8.5:1.5. The plate was examined for stains using UV light at a wavelength of 254 nm. Antioxidant tests is conducted on face moisturizing cream to assess its capacity to combat free radicals and safeguard the skin against harm.

Unstable molecules known as free radicals can damage skin cells, resulting in premature ageing, lines, and hyperpigmentation. The moisturizing cream and DPPH (1,1-diphenyl-2-picrylhydrazyl) were combined in a 4:2 ratio for this test. The DPPH concentrations utilized in this investigation were 20, 40, 60, 80, and 100 ppm. Subsequently, the combination was subjected to incubation for 30 minutes. The solution mixture's absorbance was quantified using a UV-Vis spectrophotometer, specifically at a wavelength of 517 nm. The per cent inhibition of the DPPH solution was determined by calculating the absorbance value before and after the addition of katuk leaf extract using Eq. (1) (Putu et al., 2021).

$$\text{DPPH Inhibition (\%)} = \frac{\text{Ab}-\text{As}}{\text{Ab}} \times 100\% \qquad (1)$$

where Ab is the absorbance of the DPPH and As is the absorbance of the face moisturizing cream sample.

RESULTS AND DISCUSSIONS

Figure 1 demonstrates the impact of the concentration of katuk leaf extract on the pH level of the skin moisturizing cream. The facial moisturizing cream derived from katuk leaf extract in this study consistently achieves a pH level that falls within the specified range of 4.5 - 8.0, as determined by the Indonesian National Standard

(SNI) number 16-4399-1996 for cosmetic products (BSN (Badan Standarisasi Nasional), 1996).

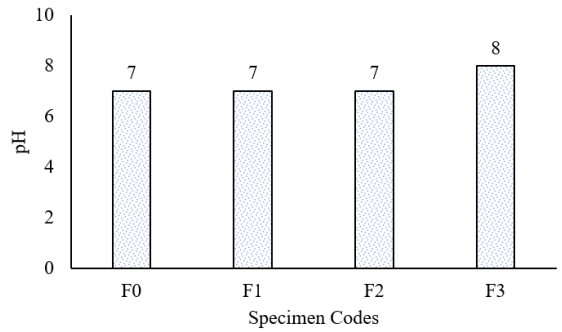

Figure 1. pH of face moisturizing creams with various concentrations of katuk leaf extracts.

The pH value is represented on the vertical axis, ranging from 0 to 10. The horizontal axis displays the concentration of katuk leaf extract (% w/w), with values of 0, 2, 4, and 6. The study findings indicate that the cream pH in specimens F0, F1, and F2 remained stable at 7 when concentrations of katuk leaf extract were 0%, 2%, and 4%. This suggests that including small amounts of katuk leaf extract has no significant impact on the cream's acidity or basicity. Nevertheless, when the concentration of cotton leaf extract in specimen F3 reached 6%, the pH level of the cream rose to 8, suggesting that the skin moisturizing cream became more alkaline. The rise in pH could be caused by certain chemicals in the cotton leaf extract, which, when present in high concentrations, disrupt the ionic balance in the cream and lead to an increase in alkalinity. The pH of normal skin is approximately 6, but specific microdomains may exhibit more excellent acidity (Lukić et al., 2021).

Hence, it is imperative to prioritize the maintenance of a neutral pH in facial moisturizing creams by using a concentration of cotton leaf extract that does not exceed 4%. Maintaining the pH of the skin will have advantageous effects. Incorporating a maximum of 4% extract guarantees the maintenance of a neutral pH in the cream. However, larger quantities could render the cream more alkaline, which may only suit some skin types. Excessive alkalinity in moisturizing creams might harm the skin's natural acidic barrier. This leads to the skin experiencing dehydration, resulting in a lack of moisture and subsequent development of dryness, coarseness, and heightened susceptibility to irritation. The research undertaken by Baker et al. (Baker et al., 2023) indicates that an alkaline pH leads to alterations in the integrity of the stratum corneum (SC), resulting in the breakdown of barrier homeostasis. This disturbance makes the skin susceptible to damage from external chemicals and mechanical forces.

The influence of the concentration of katuk leaf extract on the spreadability of the face moisturizer cream (cm) is illustrated in Figure 2. The study findings reveal that when the concentration of the specimen is 0% (F0), the moisturizing cream produced has a spreadability of 5.3 cm. Adding a 2% concentration of katuk leaf extract in the F1 sample resulted in a slight enhancement in the cream's spreadability, extending it to an area of 5.5 cm. These findings demonstrate that incorporating katuk leaf extract influences the ability of the face moisturizing cream to distribute evenly. A more significant enhancement was observed at a concentration of 4% (F2).

The measurement findings of this specimen indicate that the spreadability of the facial moisturizing cream achieved a distance of 6 cm. This demonstrates that increasing the concentration of the extract by 4% can result in a greater effect on the cream's capacity to spread.

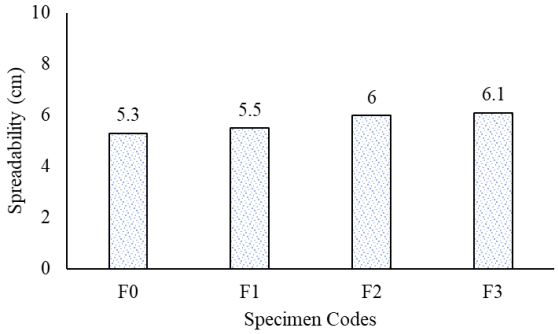

Figure 2. Spreadability of face moisturizing creams with various concentrations of katuk leaf extracts.

As a result, the moisturizing cream becomes more readily applicable to the skin. When 6% katuk leaf extract was added to specimen F3, the spreadability of the cream improved to 6.1 cm. Nevertheless, this increase was less significant than the increase in spreadability at 2% and 4% concentrations. This investigation demonstrated that the spreadability of a facial moisturizing lotion was enhanced by including katuk leaf extract. The most significant amplification impact was observed

in specimen F2, with a concentration of 4%. On the other hand, the higher concentration (6%) resulted in a less significant enhancement in spreadability.

According to the outcomes of this investigation, the face moisturizing cream formulation generated adhesion test results that varied from 4-5 seconds (Figure 3). The findings of this study suggest that incorporating katuk leaf extract into the facial moisturizing lotion leads to fluctuations in adhesion. The absence of katuk leaf extract in the moisturizing cream resulted in an adhesion time of 5 seconds. The adhesion time decreased to 4 seconds when 2% and 4% of cotton leaf extract concentrations were added. Nevertheless, when the concentration reached 6%, the duration of adhesion once again rose to 5 seconds.

According to Ulaen et al.'s research, a satisfactory adhesion time for face cream should be at least 4 seconds (Ulaen et al., 2012).

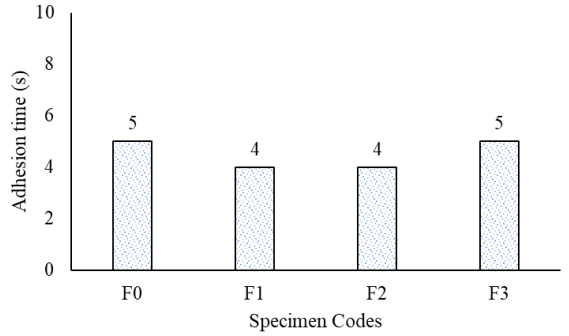

Figure 3. Adhesion of face moisturizing creams with various concentrations of katuk leaf extracts.

The results of the evaluation of the face moisturizing cream's characteristics by 20 respondents are presented in Table 2. Typically, the katuk leaf extract face moisturizing cream has a dense consistency. The cream mixture has a color range from light green to dark green and possesses the fragrance of katuk leaf extract (F1-F3). Specimen F0 produced a white product with the aroma of oleum strawberry. The findings of this investigation revealed that each specimen generated in this study did not induce any skin irritation. The presence of katuk leaf extract has an influence on the preferences of the respondents regarding the texture, color, scent, absorption time, and face moisture of specimens F0, F1, F2, and F3.

Table 2. Physical properties of face moisturizing cream.

Testing Parameters	**Specimen codes**			
	F0	**F1**	**F2**	**F3**
Texture	Thick	Thick	Thick	Thick
Aroma	Strawberry oleum aroma	Typical Katuk Aroma	Typical Katuk Aroma	Typical Katuk Aroma
Color	White	Light green	Green	Dark green
Skin irritation	None	None	None	None

The like levels for these characteristics are 3.84, 3.5, 3.6, and 2.8, respectively. Specimen F0 exhibits a high level of favorability. Specimen F2 had the highest favorability compared to specimens F3 and F1. The findings of this study suggest that incorporating katuk leaf extract into face moisturizing cream significantly influences respondents' satisfaction levels.

According to the results of this study, specimen F2 exhibits superior qualities compared to the other specimens. This is based on the pH and spreadability, which is better than the other specimens. Furthermore, the responders' preference level for specimen F2 was similar to that of specimen F0. Therefore, only specimen F2 underwent antioxidant testing and thin-layer chromatography in this study. Figure 4 displays the outcomes of the antioxidant tests conducted on specimen F2. The relationship between DPPH concentration in ppm and absorbance in per cent (%) is illustrated in Figure 4. The absorbance data, represented by the black line, demonstrates that at a concentration of 20 ppm, the absorbance was 29.70%. It then increased to 30.07% at a concentration of 40 ppm and remained constant at 30.07% at 60 ppm. Subsequently, there was a significant increase to 30.87% at a concentration of 80 ppm, followed by a slight decrease to 30.51% at 100 ppm. The graph includes a blue dashed line representing the linear regression model that most accurately fits the obtained data. The equation for this line is $y = 0.242x + 29.518$. The R^2 coefficient of determination, which is 0.715, suggests that 71.5% of the variability in the absorbance data can be accounted for by this linear model.

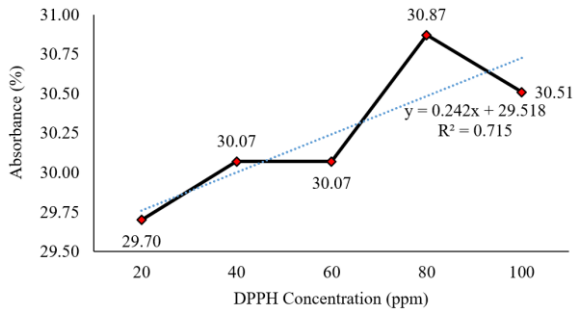

Figure 4. Relationship between concentration and absorbance of DPPH.

The percentage of the dependent variable's variance that the model's independent variables can account for is represented by R^2. A higher R^2 value signifies a stronger correspondence between the model's predictions and the actual data. A value of 1 for R^2 implies a flawless fit, where the model accurately predicts all data points. The range of R^2 values is typically between 0 and 1 (Chicco et al., 2021; Figueiredo Filho et al., 2011). Thus, there is a significant correlation between DPPH content and absorbance, although occasional departures from the established pattern suggest the influence of additional factors on absorbance. This graph demonstrates that absorbance rises as the DPPH concentration increases, although the relationship is not entirely linear. The notable rise in absorbance at 80 ppm suggests the possibility of reaching a saturation point or the occurrence of particular interactions between DPPH molecules and other molecules in the solution. The linear regression equation derived from this study can be utilized to get the IC_{50} quantity. The equation derived in this study represents a straight line with a slope of 0.242 and a y-intercept of 29.518.

The equation indicates that the values of a and b are 0.242 and 29.518, respectively. The antioxidant activity is determined by the IC_{50} value, which represents the concentration of the sample solution required to block 50% of the DPPH free radicals. By selecting the concentration of the sample solution needed for inhibiting 50% of DPPH free radicals, the IC_{50} value can be determined via the following formula: $IC_{50} = (0.5 - b)/a$ (Barkat & Laib, 2012; Budaraga & Putra, 2021). The analysis obtained an IC_{50} value of 84.63 ppm. The IC50, also known as the Half-maximal inhibitory concentration, is a commonly used and very useful metric for assessing the effectiveness of a medicine. The term "half maximal inhibitory concentration" (IC50) refers to the amount of a drug required for inhibiting a biological process by 50%, serving as a quantitative measure of the potency of an antagonist agent in pharmacological research. In other terms, the IC50 is a measure of the quantity of the substance required to obstruct half of the biological or biochemical function (Aykul & Martinez-Hackert, 2016; Borar et al., 2011; Pritchett et al., 2014). A substance's inhibitory action is stronger when its IC50 value is lower (Budaraga & Putra, 2021; Francenia Santos-Sánchez, N., Salas-Coronado, R., Villanueva-Cañongo, C., & Hernández-Carlos, 2019; Olszowy-Tomczyk, 2021).

The results of the thin-layer chromatography tests on the face moisturizer cream in specimen F2 are presented in Table 3. The findings indicate that the facial moisturizing cream developed in this investigation comprises a diverse array of alkaloid, flavonoid, tannin, saponin, and terpenoid chemicals, which possess the potential to offer a range of advantages to the skin (Roy et al., 2022; Shad et al., 2014; Wang et al., 2023). Alkaloid compounds were identified with Rf values of 0.63 and 0.80, respectively, using the solvent mixtures hexanes: ethyl acetate (8:2) and hexanes: acetone (8.5:1.5). The alkaloid stains seen in this investigation had a coloration that ranged from blackish green to pink. Flavonoid compounds were identified with Rf values of 0.66 and 0.78, respectively, using the solvent mixtures hexane:acetone (8.5:1.5) and hexane:ethyl acetate (8.5:1.5). The flavonoid stains had a pink hue with a tinge of grey. Tannin compounds were identified with retention factor (Rf) values of 0.78 and 0.90, respectively, using the hexanes:ethyl acetate solvent mixtures at a ratio of 8.5:1.5. The tannin stains exhibited shades of grey and blackish crimson. The presence of saponin compounds was identified using a hexanes: ethyl acetate (8.5:1.5) ethyl acetate, with an Rf value of 0.44. The saponin stain had a blackish-green hue. Terpenoid compounds were identified with an Rf value of 0.41 using a hexanes: acetone (8.5:1.5) ethyl acetate. The terpenoid stain had a blackish-green color.

CONCLUSIONS

This study examines the development and assessment of a facial moisturizing cream derived from the extract of katuk leaves (*Sauropus androgynus Merr*). This study aims to examine how different concentrations of katuk leaf extract impact the properties of the moisturizing cream that is

produced. The katuk leaves were extracted using the maceration process, employing ethanol as the solvent for 24 hours. The cream formulations utilized in this investigation were labelled as F0, F1, F2, and F3, with each designation corresponding to a different concentration of katuk leaf extract: 0%, 2%, 4%, and 6%, respectively.

The cream was found to have a unique scent of katuk leaves, and its color vary from light green to blackish brown in specimens F1, F2, and F3, as determined by organoleptic tests. The pH test revealed a range of values between 7 and 8, with the highest pH at a 6% extract concentration. The spreadability test findings demonstrated a positive correlation between the extract's concentration and the cream's spreadability. Specifically, the cream exhibited the highest spreadability at a concentration of 4% (measured at 6 cm). The adhesion test revealed 4 to 5 seconds for adhesion time, with the most favorable outcome observed at a concentration of 4%.

Specimen F2 exhibited superior characteristics in terms of moisturization over the other specimens in this study. Specimen F2 exhibited a degree of respondents' preference similar to specimen F0. Specimen F2 exhibited notable antioxidant activity, with a 30.51% inhibition rate and an IC50 value of 84.63 ppm, demonstrating a strong antioxidant potential. The formulation F2 was subjected to thin-layer chromatography (TLC) testing, which revealed the presence of several active components, including alkaloids, flavonoids, tannins, saponins, and terpenoids. These compounds are known to offer beneficial effects on the skin. The study concludes that katuk leaf extract is highly beneficial in formulating facial moisturizing cream. The ideal concentration for achieving good findings in pH, spreadability, adhesion, respondent satisfaction, and antioxidant activity is 4%. This composition not only effectively moisturizes the skin but also has the potential to shield the skin from free radicals and offer other supplementary advantages.

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