PROCEEDING
ICOSSTH 2025
International Conference on Social, Science, Technology and Health

Scope:
Social
Science
Technology
Health

ISSN: 68XX-XX09

Website
https://journal.icossth-politeknikmfh.id/

Formulation of Urtica dioica L. Extract as a Sunscreen Lotion Preparation

Restawara Rizki Palewa[1]*, Nurul Indriani[2], Muhammad Eka Putra Ramandha[3], Lalu Busyairi Muhsin[4]

[1,2,3,4]Universitas Bumigora, Indonesia

Corresponding e-mail: indriani.nrl@universitasbumigora.ac.id

ABSTRACT

Indonesia, as a tropical country, has around 30,000 biodiversity species that have been identified. However, the tropical climate causes people to often face skin problems such as dullness, dark spots, and decreased elasticity that leads to degenerative behavior. Excessive exposure to UV light can accelerate this degenerative process resulting from an imbalance between ROS production. One of the plants that has the potential to be an antioxidant is wild nettle (Urtica dioica L) The purpose of this study is to determine the formulation that provides the best results based on the physical evaluation and SPF value of the sunscreen lotion preparation. The extraction method used is extraction with 70% ethanol solvent with a ratio of 1:10, samples were taken from Aikmel village, East Lombok District, flavonoid and tannin phytochemical screening, ethanol-free test, and physical evaluation and SPF ability of sunscreen lotion preparations. The results explained that all sunscreen lotion preparations were stable on physical evaluation for 28 days, and F3 had an SPF value of 39.74 which is included in the "Ultra" protection category. F3 formulation with an extract concentration of 4.5% ethanol extract Urtica dioica L., is considered the best formulation based on physical evaluation and sun protector activity.

KEYWORDS

Formulation, Urtica dioica L., Sunscreen lotion, SPF.

INTRODUCTION

In recent years, the cosmetics industry in Asia has experienced rapid growth, where consumer preferences tend to lead to products that can brighten the skin, with one of the important factors in the pigmentation process being exposure to ultraviolet rays from the sun (Gao et al., 2018). According to The Food, Drug, and Cosmetic Act (2024) , the use of cosmetics is intended to cleanse, beautify, or increase a person's attractiveness. FD&C Act categorizing these products into drugs, cosmetics, or a combination of the two known as cosmeceutical, i.e. cosmetic products that contain active substances that function like medicines, such as creams Antiaging, baldness treatment, Antiperspirant and sunscreen. Many studies show that Asian herbal ingredients can reduce melanogenesis, provide a protective effect against the sun, and have anti-acne and antioxidant properties (Gao et al., 2018). These findings show the great potential of Asian herbs as active ingredients in cosmetic products. However, further developments and research on this herb are still needed (Hu et al., 2020).

Indonesia, as a country rich in biodiversity, has around 30,000 species that have been identified, with 950 of them serving as medicinal plants, food, and health products (Agus et al., 2022). This diversity gives Indonesia great potential in the food, medicine, and cosmetics industries. On the other hand, natural products are considered more friendly to consumers' skin, so cosmetic products made from herbs tend to be more accepted in the market (Claudia A. Espinosa-Leal, 2019) With global trends leading to 'back to nature' Indonesia has the opportunity to develop the market for natural and organic cosmetics, both in Asia and Europe (Yulina, 2017).

However, Indonesia's tropical climate also causes its own challenges, where people often face skin problems such as dullness, dark spots, and decreased elasticity that leads to premature aging (degenerative). Excessive exposure to ultraviolet (UV) light can accelerate this degenerative process through oxidative stress mechanisms, which occur due to an imbalance between production Reactive Oxygen Species (ROS) and the body's antioxidant defence mechanism. ROS, which is a reactive oxygen compound, can cause oxidative damage to various cellular components, disrupt communication between cells, stimulate apoptosis, and trigger various aging-related diseases. In addition, UV rays can also cause DNA damage, potentially triggering carcinogenesis and accelerating premature aging (Yushariah, 2021).

Excessive exposure to ultraviolet (UV) radiation is a primary factor contributing to premature skin aging, sunburn, and an increased risk of skin cancer. As awareness of the harmful effects of UV radiation grows, the demand for effective and safe sunscreen products continues to rise.

Traditionally, synthetic sunscreens have been widely used; however, concerns about their potential side effects and environmental impact have led to increased interest in natural alternatives.

Urtica dioica L., commonly known as stinging nettle, is a medicinal plant that has been extensively used in traditional medicine for its anti-inflammatory, antioxidant, and antimicrobial properties. Recent studies have revealed that Urtica dioica contains bioactive compounds such as flavonoids, phenolic acids, and vitamins, which may provide protective effects against UV-induced skin damage.

This study aims to formulate a sunscreen lotion using Urtica dioica L. extract and evaluate its physicochemical properties and sun protection factor (SPF) value. By developing a plant-based sunscreen formulation, this research seeks to offer a safer and more sustainable alternative to conventional sunscreen products. The findings are expected to contribute to the growing field of natural cosmetics and promote the utilization of herbal ingredients in dermatological applications

The tradition of beauty care with natural ingredients is part of Indonesia's culture that has been passed down from generation to generation (Iskandar et al., 2021). One of the potential plants is wild nettle (Urtica dioica L.), which has been shown to have antioxidant and antiaging effects in various studies. For example, ethanol extract from nettle leaves shows significant antioxidant activity, making it a potential candidate for antiaging cosmetic products (Maimunah et al., 2020).

East Lombok Regency, West Nusa Tenggara, is known to have many nettle plants, which are often considered a nuisance plant due to their irritating effects. However, this plant has many potential benefits that have not been fully exploited by the local community (Sekar et al., 2022).

Based on this background, this study aims to explore the potential of ethanol extract from nettle leaves in the formulation of sunscreen lotion. The specific purpose of this study is to determine the formulation of Urtica dioica L. extract lotion that provides the best results based on the physical evaluation and SPF value of the sunscreen lotion preparation. This research is expected not only to fill the knowledge gap related to the use of nettle leaves in cosmetic formulations, especially sunscreen, but also to have a positive impact on the use of local resources and support environmental sustainability.

The detrimental effects of ultraviolet (UV) radiation on the skin have been widely documented. Prolonged exposure to UVA and UVB rays can lead to acute conditions such as erythema and sunburn, as well as chronic damage including photoaging, hyperpigmentation, and skin cancer. To mitigate these effects, sunscreens are formulated to absorb, reflect, or scatter UV radiation, thereby protecting the skin. Conventional sunscreens contain synthetic agents such as oxybenzone, avobenzone, and octinoxate; however, these compounds have raised concerns due to their potential for skin irritation, allergic reactions, and environmental toxicity, particularly in aquatic ecosystems.

In recent years, natural and plant-based alternatives have gained popularity due to their perceived safety, biodegradability, and additional therapeutic benefits. Herbal extracts rich in polyphenols, flavonoids, and other antioxidant compounds are of particular interest for sunscreen development. These compounds not only provide UV protection by absorbing UV rays but also neutralize free radicals, thereby reducing oxidative stress and skin inflammation.

Urtica dioica L., commonly known as stinging nettle, is a perennial herbaceous plant traditionally used in herbal medicine for a variety of ailments. It is known for its anti-inflammatory, antioxidant, analgesic, and antimicrobial properties. Phytochemical analysis of Urtica dioica has revealed the presence of phenolic compounds, flavonoids (such as quercetin and kaempferol), carotenoids, vitamins A and C, and minerals like zinc and selenium—all of which contribute to its pharmacological activity. These constituents are believed to play a significant role in protecting the skin against UV-induced damage by absorbing UV radiation and scavenging reactive oxygen species.

Previous studies have explored the potential of plant extracts, including green tea, aloe vera, and turmeric, as active ingredients in sunscreen formulations. However, research on the use of Urtica dioica in topical sunscreen preparations remains limited. Given its rich phytochemical content and established dermatological benefits, Urtica dioica extract represents a promising candidate for incorporation into sunscreen products.

Therefore, the current study focuses on the formulation of a sunscreen lotion using Urtica dioica L. extract and the evaluation of its physical characteristics and sun protection efficacy. This research aims to contribute to the development of natural-based sun care products that are both effective and environmentally friendly.

Materials

The ingredients used are 500 g Urtica dioica L simplicia powder, 70% Ethanol, stearic acid, glycerin monostearate, glycerine, TEA, cetyl alcohol, Methyl paraben, Aquest, concentrated HCl, Mg powder, glacial acetic acid, concentrated sulfuric acid, ascorbic acid, FeCl3 and DPPH.

a. Tools

The tools used in this research were a blender, 40 mesh sieve, rotary evaporators (DLab RE100-PRO), analytical balances (Fujitsu FS-AR 210gram x 0,1), water baths (faithful DK-98-IIA) , oven (memmert UN55), petri dishes, mortars and stampers, lotion containers, pH meters (MQuant pH Indicator Strip), NDJ-8s viscometers, scale glasses, petri dish, high speed mixing machine (scientific benchmark bench mixer Vortex BV1000 115V), cuvette, test tube, volumetric flask, centrifuge, UV-Vis spectrophotometer (EMC-11S UV Spectrophotometer).

b. Method

Sampling

Wild nettle plants were taken from Aikmel village, Aikmel district, East Lombok district, NTB in February 2024. The sample was divided into two parts, where the first sample was taken intact from the root to the tip of the young leaf which was placed in a pot for the process of plant identification/determination. Then other samples are used for the purpose of making simplicia where the criteria for leaf samples Urtica dioica L. What is used is dark green leaves taken from the 4th strand to the bottom which are obtained from plants measuring 0.5-2 meters picked during the day (Hudairiah et al., 2021). Determination is made by matching the parts of the Nettle plant according to its morphological characteristics to establish the truth related to the Nettle plant (Urtica dioica L.)(Astika et al., 2022). The samples that have been collected are then sorted wet by sorting and then separated from impurities such as soil, dirt, stems, roots and other plant parts, then washed using running water, then dried in the sun between 12-13 noon with a black cloth. Nettle leaves that have dried, then sorted again to separate the leaves that overcook or those that are still wet, then mashed using a blender and sifted using a sieve 40 Mesh. After becoming powder, it is then stored in a closed container (Nahor et al., 2020). The flavonoid test was carried out by the Willstatter Test method where 0.2 g of sample + several drops of concentrated HCl + Mg powder. Positive reaction when given red-orange, dark red, yellow, or orange on the amyl alcohol layer at 3 minutes (Rialita Lifiani, 2021).

Sample and simplicia

The sample collected and determined to be asked is correctly Urtica dioica L. Leaf sample weighing results Urtica dioica L. which was obtained as much as 5.83 kg. Plant determination is carried out which aims to determine the name or type of plant specifically to find out the truth of the plant used and avoid mistakes at the time of (Astika et al., 2022). The results of dried simplicia were obtained 515 grams from 5,830 Kg of samples Urtica dioica L. After reducing the size to powder, the weight of the powder sample was reduced by 5 g to 510 g.

Phytochemical screening results

The results of phytochemical screening can be seen in table 3.

Table 3. Results of phytochemical screening of flavonoids and tannins in ethanol extract of wild nettle leaves

Compound	Reagents	Result	Interpretation
Flavonoid	0.05 g Mg powder + 3 drops of concentrated HCl	Orange red-deep red	+
Tannins	FeCl3	Green-Black	+

Information:

(+) positively contains compounds

(-) does not contain any compound

Phytochemical screening is used to detect plant compounds based on their class as preliminary information in determining the class of chemical compounds that have biological activity of a plant extract related to its efficacy or pharmacological activity (Putri & Lubis, 2020). tannins are polar compounds due to the presence of OH groups, therefore when samples are added FeCl3 10% will have a colour change such as dark blue or blackish green which indicates the presence of tannin compounds. Addition of leaf ethanol extract Urtica dioica L. wild that is suspected to contain tannins with FeCl3 will give rise to strong green, red, purple and black colours. The formation of a blackish-green colour in the extract after the addition of FeCl3 is because the

tannins will react with Fe3+ ions and will form complex compounds trisianoferitrikaliumFerri(III) (Halimu et al., 2020).

A positive result for flavonoids is characterized by a change in colour to reddish-brown by using metal reagents Mg and HCl 10%, where these reagents can be used in the identification of flavonoids are flavanols and flavones (Iin Nurjannah et al., 2022). The addition of Mg aims to convert the carbonyl group into a hydroxyl group in flavonoid compounds, then the addition of concentrated HCl aims to reduce the nucleus Benzopyrone which is present in the structure of flavonoids until salts are formed flavylium characterized by a change in colour to dark red or orange (Karlina & Nasution, 2022).

Extraction

The results of Urtica dioica L extraction are shown in the following table 4:

Table 4. Extraction of wild nettle leaves

Powder (grams)	Weight	Extract Weight (Gram)	rendemen (%)
500		185,5161	37,103

From the table above, it can be seen that the extraction process produced 185.5161 grams of extract from 500 grams of nettle leaf powder, with a yield of 37.103%. This yield shows that almost 37.103% of the initial powder weight was successfully extracted into an extract form containing the active compound. This fairly high yield value indicates the effectiveness of the extraction method used, which in this case is able to optimally extract important compounds from nettle leaves(Kemenkes RI, 2023). These results are important in the development of cosmetic product formulations, such as sunscreen Lotion, which utilizes the extract as the main active component. High yield not only indicates process efficiency, but also greater potential use of natural ingredients in the final product formulation (Astika et al., 2022).

Ethanol-free test

The results of the ethanol-free test on Urtica dioica L extract can be seen in the following table 5:

Table 5. Results of ethanol-free testing on Urtica dioica L extract

PROCEDURE	RESULT	Interpretation of results
Thick extract of Urtica dioica L. wild + glacial acetic acid + concentrated sulfuric acid 1ml	No smell aroma ester	Ethanol-free samples

The results of the study showed that there was no indication of the presence of free ethanol in the preparation Lotion tested, as indicated by the absence of an ester odor detected. To validate the results, the same treatment was carried out with the ethanol sample which showed the presence of ester odor after receiving the same treatment, which indicated the presence of ethanol residue in the control sample. So it can be stated that leaf extract Urtica dioica L. is free from ethanol (lenggu et al., 2020). This ethanol-free test is carried out to avoid irritation to the skin during use lotion.

Evaluation of sunscreen lotion preparations

The results of the physical evaluation of the sunscreen lotion preparation using ethanol extract of wild nettle leaves can be seen in table 7 and Images of each formulation can be seen in Figure 1.

Table 7. Physical evaluation of Urtica dioica L sunscreen lotion preparations

Formula	Colour	Construction	shape	Homogeneity	pH	Spread power	Adhesion	viscosity
F0	White	Odourless	Semi solid	Homogeneous	6	5,76	12,368	9926
F1	Light brown	Typical extracts			6	5,76	11,58	8646
F2	Brown				6	5,36	10,752	7051.6
F3	Dark Brown				6	5,34	13,884	9086

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

Figure 1. (a) F0 (without extract), (b) F1 (1.5% extract), (c) F2 (3% extract), (d) F3 (4.5% extract).

Results of organoleptic testing on sunscreen formulations lotion showed the colour variation from white at F0 to dark brown at F3, which reflects the increase in the concentration of nettle leaf extract shown in Figure 1, where the brown colour that appears in the formulations F1 to F3 is a characteristic of the extract used. All formulations except F0 have a distinctive aroma of nettle leaf extract, indicating that the extract imparts a distinctive smell to the product. The form of all formulations is semi-solid, which is the desired consistency for the preparation lotion, facilitating even application and good absorption in the skin (Hastuti & MP; Kothrun Nada, 2023).

Results of homogeneity testing on sunscreen preparations lotion Ethanol extract of wild nettle leaves for 28 days showed that all formulations showed good homogeneity, indicating that the ingredients had been mixed evenly. This is important to ensure a consistent distribution of the active ingredients in the product, thus providing uniform protection against UV rays (Irmayanti et al., 2021).

Average pH test results on sunscreen preparations lotion Urtica dioica L ethanol extract for 28 days showed that the pH value of all formulations was 6, which was within a safe and appropriate range for skin use, supporting the skin's natural balance and reducing the risk of irritation. The results are in accordance with national references and standardization regarding the standard pH in the preparation sunscreen lotion which ranged from 4.5 to 8.0 where these results showed that the concentration of the extract in the tested range did not significantly affect the pH lotion. (Aljanah et al., 2022).

Results of the average spread ability test on sunscreen preparations lotion ethanol extract of wild nettle leaves at 28 days showed that lotion can spread well on the skin, with values ranging

from 5,34 cm (F3) to 5,76 cm (F0 and F1). Lotion Eligible if the spread is in the range of 5-7 cm (Mulyani et al., 2018). These results confirm that the product can be applied easily and evenly over the skin, increasing efficiency and comfort of use. Thus, the formulation of lotion It is feasible for use in cosmetic applications, with sufficient spread ability to meet the quality and comfort standards expected by consumers (Saryanti et al., 2019).

Results of the average adhesion test on sunscreen preparations Lotion ethanol extract of wild nettle leaves at 28 days showed that F3 has the highest adhesion (13.884 seconds) of F0 (12.368 seconds), F1 (11.58 seconds), and F2 (10.572 seconds). This explains that the F3 formulation lasts longer on the skin, providing longer-lasting protection. Adhesion test results show that all formulations (F0, F1, F2, and F3) meet the requirements with a >4 second adhesion capability, in accordance with the recommended standard (Mulyani et al., 2018). Evaluation of adhesion to sunscreen lotion with leaf extract Urtica dioica L. indicates that all formulations meet the standards set for the product Lotion. The good adhesion ability of this formulation ensures that the product can adhere effectively to the skin, increasing the absorption efficiency of the active ingredient and providing optimal benefits to the user (Geraldine & hastuti, 2018).

Results of the average viscosity evaluation of sunscreen preparations Lotion ethanol extract of wild nettle leaves at 28 days. Measurements were taken on days 0, 7, 14, 21, and 28 after formulation Lotion Prepared. Viscosity requirements according to SNI 16-4399-1996 for topical preparations have a viscosity between 2,000-50,000 mPa.s (Arifin et al., 2023). Viscosity test results indicates that all formulations, from F0 to F3, have a viscosity that meets the recommended requirements for the product lotion, with F0 (9926 mPa.s), F1 (8646 mPa.s), F2 (7051.6 mPa.s), and F3 (9086 mPa.s) maintaining good viscosity stability over the observation period, indicating that this formulation is consistent and acceptable for topical application. Viscosity can affect the way lotion applied and release of active substances to the skin (Hastuti & MP; Kothrun Nada, 2023). Viscosity can also play a role in maintaining the stability of the formulation. Ensuring that viscosity lotion Staying within the desired range helps prevent unwanted changes in the preparation, such as phase separation or sediment (Maya & Mutakin, 2017).

Value of SPF Sunscreen lotion ethanol extract Urtica dioica L

The results of obtaining SPF values in the formulation of Sunscreen lotion of Urtica dioica L extract with three replications and the average is shown in the following table 8:

Table 8. SPF value of sunscreen lotion ethanol extract Urtica dioica L. leaf

Formulation	SPF			Average	Category
	Rep_1	Rep_2	Rep_3		
F0	2,7	3,54	3,35	3,2	Minimal
F1	23,81	20,26	19,74	21,27	Ultra
F2	38,77	39,52	38.13	38,81	Ultra
F3	39,88	39,21	40,13	39,74	Ultra
FC+	35,08	35,27	35,25	35,20	Ultra

Based on the results of the study, the formulation of sunscreen lotion with Urtica dioica L extract (Urtica dioica L.) showed a significant improvement in the ability to protect against UV rays, as measured by the Sun Protection Factor (SPF) value. The level of sunscreen capability can be differentiated as follows: (a) minimum, if SPF is between 2-4, (b) moderate, if SPF is between 4-6, (c) Extra, if SPF is between 6-8, (d) Maximum, if SPF is between 8-15, (e) Ultra, if SPF is more than 15 (Hatidjah et al., 2023). The F0 formulation, which contains no extracts, provides only minimal protection with an average SPF value of 3.2, falling into the "Minimal" category according to FDA standards. This suggests that in the absence of extracts, this formulation has very low protective capabilities.

However, with the addition of Urtica dioica L. extract, there is a substantial improvement in UV protection. The F1 formulation, which contains 1.5% of the extract, has an average SPF value of 21.27, falling into the "Ultra" category, which indicates excellent protection against UV rays. The F2 formulation, with an extract concentration of 3%, showed further improvement with an average SPF value of 38.81, also in the "Ultra" category. The F3 formulation, which contains 4.5% of the extract, provides the highest SPF value of 39.74, shows excellent protection against UV rays and is also in the "Ultra" category. From the results of SPF measurement, it can be seen that the extract Urtica dioica L. has the potential to be a sunscreen agent, especially at higher concentrations (Keeping up with the Kardashians, 2020).

In comparison, the positive control formulation (FC+), which is an "N" branded commercial sunscreen lotion product that claims to have SPF 15 with added vitamin C, shows an average SPF value of 35.20, which is also included in the "Ultra" category. These results show that formulations with Urtica dioica L. (F1, F2, F3) extracts not only meet high UV protection standards but can also exceed the protective effectiveness of positive control products.

To validate the results of the SPF test, data analysis was carried out a is performed. The results of the Tukey test show that the formulation of F0 is significantly different from F1, F2, F3, and FC+, and conversely, F1 is significantly different from F0, F2, F3, and FC+. The formulation of F2 differs significantly from F0, F1, and FC+, but does not differ significantly from F3. The formulation of F3 differs significantly from F0, F1, and FC+, but does not differ significantly from F2. Finally, the positive control (FC+) showed significant differences compared to all other formulations.

CONCLUSION

Based on the physical evaluation and ability of the sun protector, it was concluded that the F3 formulation, which contains 4.5% ethanol extract of Urtica dioica L., was considered the best formulation based on activity of the sun protector. This formulation showed good although the dispersion was slightly lower but still within acceptable limits. With these results, the F3 formulation is perfect for use as a sunscreen lotion based on Urtica dioica L. extract which effectively protects the skin from UV exposure.

ACKNOWLEDGEMENT

Thanks to the pharmacy study program, Faculty of Health, Bumigora University, the head of the Pharmacy Study Program, the Head of the Pharmacy Laboratory, the staff of the Pharmacy laboratory, Bumigora University, and all parties involved in the preparation of the structure and guidance during the preparation of this manuscript.

REFERENCES

Agus, e., monica, e., & hendra, g. A. (2022). Eksplorasi bahan alam sebagai kosmetik guna pencegahan stres oksidatif pada kulit manusia literature review. *Sainsbertek jurnal ilmiah sains & teknologi*, *2*(2), 53–66. Https://doi.org/10.33479/sb.v2i2.120

Aljanah, f. W., oktavia, s., & noviyanto, f. (2022). Formulasi dan evaluasi sediaan hand body lotion ekstrak etanol daun semangka (citrullus lanatus) sebagai antioksidan. *Formosa*

journal of applied sciences (fjas), *1*(5), 799–818. Https://doi.org/doi prefik: https://10.55927/fjas.v1i5.1483

Arifin, a., pakki, e., & fitrah, f. (2023). Formulasi dan uji stabilitas fisik sediaan losio bubur rumput laut (eucheuma alvarezii (doty)) asal kabupaten luwu sulawesi selatan. *Jurnal farmamedika (pharmamedica journal)*, *8*(2), 174–184. Https://doi.org/10.47219/ath.v8i2.251

Astika, r. Y., sani k, f., & elisma. (2022). Uji aktivitas antiinflamasi ekstrak etanol daun kayu manis (cinnamomum burmanni) pada mencit putih jantan. *Jurnal ilmiah manuntung*, *8*(1), 14–23. Https://doi.org/10.51352/jim.v8i1.465

Claudia a. Espinosa-leal, s. G.-l. (2019). Current methods for the discovery of new active ingredients from natural products for cosmeceutical applications. *Thieme*, *4*, 535–551. Https://doi.org/https://doi.org/10.1055/a-0857-6633

Fajar, d. R., niku, i., & hardianti, s. (2021). Gambaran tingkat pengetahuan sikap dan perilaku masayarakat terhadap upaya pencegahan covid-19 di desa jenetallasa kabupaten gowa. *Jurnal farmasi pelamonia*, *01*(1), 44–51.

Gao, s., liu, j., wang, m., qi, y., zhang, b., liu, h., & xiao, p. (2018). Traditional uses, phytochemistry, pharmacology and toxicology of codonopsis: a review. *Journal of ethnopharmacology*. Https://doi.org/10.1016/j.jep.2018.02.039

Geraldine, elsa tamara, & hastuti, ema dwi. (2018). Formulation of sunscreen cream of parijoto fruit extract (medinilla speciosa blume) and in vitro spf value test. *Jurnal farmasi sains dan komunitas*, *15*(2), 92–98.

Halimu, r. B., s.sulistijowati, r., & mile, l. (2020). Identifikasi kandungan tanin pada sonneratia alba. *Jurnal ilmiah perikanan dan kelautan*, *5*(4), 93–97.

Hastuti, e., & qothrun nada, c. M. (2023). Analisis metil paraben dalam beberapa merk hand and body lotion yang beredar di pasar pagi kaliwungu semarang. *Jkm (jurnal kesehatan masyarakat) cendekia utama*, *11*(1), 1. Https://doi.org/10.31596/jkm.v11i1.1452

Hatidjah, n., halid, a., & rahmaniar, d. (2023). Formulasi dan evaluasi sediaan emulgel tabir surya kombinasi ekstrak daun kopi robusta (coffea canephora) dan daging lidah buaya (aloe vera l .). *Majalah farmasi dan farmakologi*, *15*, 15–19. Https://doi.org/10.20956/mff.special

Hu, y., zeng, h., huang, j., jiang, l., chen, j., & zeng, q. (2020). Traditional asian herbs in skin

whitening: the current development and limitations. *Frontiers in pharmacology*, *11*(july), 1–10. Https://doi.org/10.3389/fphar.2020.00982

Hudairiah, n. N., rosalinda, s., & widyasanti, a. (2021). Formulasi handbody lotion (setil alkohol dan karagenan) dengan penambahan ekstrak delima merah. *Jurnal teknotan*, *15*(1), 41. Https://doi.org/10.24198/jt.vol15n1.7

Iin nurjannah, mustariani, baiq ayu aprilia, & suryani, n. (2022). Skrining fitokimia dan uji antibakteri ekstrak kombinasi daun jeruk purut (citrus hystrix) dan kelor (moringa oleifera l.) Sebagai zat aktif pada sabun antibakteri. *Spin jurnal kimia & pendidikan kimia*, *4*(100), 23–36. Https://doi.org/10.20414/spin.v4i1.4801

Irmayanti, m., rosalinda, s., & widyasanti, a. (2021). Formulasi handbody lotion (setil alkohol dan karagenan) dengan penambahan ekstrak kelopak rosela. *Jurnal teknotan*, *15*(1), 47. Https://doi.org/10.24198/jt.vol15n1.8

Iskandar, b., sidabutar, s. E. B., & leny, l. (2021). Formulasi dan evaluasi lotion ekstrak alpukat (persea americana) sebagai pelembab kulit. *Journal of islamic pharmacy*, *6*(1), 14–21. Https://doi.org/10.18860/jip.v6i1.11822

Karlina, v. R., & nasution, h. M. (2022). Skrining fitokimia dan uji aktivitas antibakteri ekstrak etanol daun jeruk purut (citrus hystrix dc) terhadap bakteri staphylococcus aureus dan escherichia coli. *Journal of health and medical science*, *1*(april), 131–139.

Kemenkes ri. (2023). Farmakope herbal indonesia edisi ii 2017. In *pills and the public purse*. Https://doi.org/10.2307/jj.2430657.12

Kurdiansyah, k., forestryana, d., & noviadi, a. (2022). Skrining fitokimia dan penentuan nilai spf lotion ekstrak etanol 96% daun tanjung (mimusops elengi linn.). *Jurnal hutan tropis*, *10*(3), 259. Https://doi.org/10.20527/jht.v10i3.14968

Lenggu, c. K. L., rini, d. I., & shinta, a. L. (2020). Uji aktivitas ekstrak etanol kulit daging buah lontar (borassus flabellifer linn) terhadap pertumbuhan escherichia coli secara in virto. *Cendana medical journal (cmj)*, *8(2)*(april), 96–107.

Lifiani, r., tampubolon, m. ., purba, h. I. D. B. ., & oktaviana, l. (2021). Formulasi krim anti-aging ekstrak etanol daun jelatang vera). *Jurnal tekesnos*, *3*(2), 361–369.

Maimunah, s., nasution, z., & amila, a. (2020). Pemanfaatan ekstrak daun *Urtica dioica L.*

Sebagai anti-aging alami dalam sediaan krim. *Jurnal penelitian saintek*, *25*(2), 124–134.

Https://doi.org/10.21831/jps.v25i2.34296

Maryam, f., taebe, b., & toding, d. P. (2020). Pengukuran parameter spesifik dan non spesifik ekstrak etanol daun matoa (pometia pinnata j.r & g.forst). *Jurnal mandala pharmacon indonesia*, *6*(01), 1–12. Https://doi.org/10.35311/jmpi.v6i01.39

Maya, i., & mutakin, m. (2017). Formulasi dan evaluasi secara fisikokimia sedian krim anti-aging. *Majalah farmasetika*, *3*(5), 111. Https://doi.org/10.24198/farmasetika.v3i5.23342

Mulyani, t., ariyani, h., rahimah, r., & rahmi, s. (2018). Formulasi dan aktivitas antioksidan lotion ekstrak daun suruhan (peperomia pellucida l.). *Journal of current pharmaceutical sciences*, *2*(1), 111–117.

Musthofa, m. C., hutahaen, t. A., & februyani, n. (2023). Formulasi dan uji stabilitas antioksidan ekstrak etanol daun jelateng (urtica dionica l.) Pada sediaan krim antiaging. *Indonesian journal of health science*, *3*(2a), 424–430. Https://doi.org/10.54957/ijhs.v3i2a.584

Nahor, e. M., rumagit, b. I., & tou, h. Y. (2020). Perbandingan rendemen ekstrak etanol daun andong (cordyline futicosa l .) Menggunakan metode ekstraksi maserasi dan sokhletasi comparison of the yield of andong leaf ethanol extract (cordyline fruticosa l .) Using maceration and sokhletation extraction. *Ejournal poltekes manado*, *1(1)*, 40–44.

Nurfita, e., mayefis, d., & umar, s. (2021). Uji stabilitas formulasi hand and body cream ekstrak etanol kulit buah naga merah (hylocereus lemairei). *Jurnal farmasi dan ilmu kefarmasian indonesia*, *8*(2), 125. Https://doi.org/10.20473/jfiki.v8i22021.125-131

Putri, d. M., & lubis, s. S. (2020). Skrining fitokimia ekstrak etil asetat daun kalayu (erioglossum rubiginosum (roxb.) Blum). *Amina*, *2 (3)*(3), 120–125.

Riwanti, p., izazih, f., & amaliyah. (2020). Pengaruh perbedaan konsentrasi etanol pada kadar flavonoid total ekstrak etanol 50,70 dan 96%. *Journal of pharmaceutical care anwar medika*, *2*(2), 82–95.

Sari, d. E. M., & fitrianingsih, s. (2020). Analisis kadar nilai sun protection factor (spf) pada kosmetik krim tabir surya yang beredar di kota pati secara in vitro. *Cendekia journal of pharmacy*, *4*(1), 69–79. Https://doi.org/10.31596/cjp.v4i1.81

Saryanti, d., setiawan, i., & safitri, r. A. (2019). Optimasi asam stearat dan tea pada formula sediaan krim ekstrak kulit pisang kepok (musa paradisiaca l.). *Jurnal riset kefarmasian*

indonesia, *1*(3), 225–237. Https://doi.org/10.33759/jrki.v1i3.44

Sekar, t., deli, d., kapten, j., no, m., & utara, s. (2022). *Pemanfaatan tanaman jelatang (urtica dioica l .) Pada kelompok*. *September*.

U.s food and drug administration. (n.d.). *Defines cosmetic and cosmetic product*. Cosmetics & u.s. Law. Https://www.fda.gov/cosmetics/cosmetics-laws-regulations/cosmetics-us-law

Widiyawati, r. S. P., albari, a., & basith, a. (2023). Formulasi dan uji anti-aging krim ekstrak etanol. *Indonesian journal of health science*, *3*(2), 365–373.

Yulina, i. K. (2017). Back to nature: kemajuan atau kemunduran. *Mangifera edu*, *2*(1), 20–31. Https://doi.org/10.31943/mangiferaedu.v2i1.15

Yusharyahya, s. N. (2021). Mekanisme penuaan kulit sebagai dasar pencegahan dan pengobatan kulit menua. *Ejournal kedokteran indonesia*, *9*(2), 150. Https://doi.org/10.23886/ejki.9.49.150