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Formulation and Physical Evaluation of Sleeping Mask Gel Preparation of Mahogany Leaf Extract (*Swietenia Mahagoni* (L.) Jacq) As Antioxidant

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Abstract

Antioxidants are used to neutralize free radicals. Mahogany leaves (*Swietenia mahagoni* (L.) Jacq) contain flavonoid chemicals that exhibit antioxidant properties. The purpose of the study was to determine the physical characteristics and antioxidant activity of sleeping mask gel preparations with the addition of mahogany leaf extract. Mahogany leaf extract is made using the maceration process. Determination of antioxidant activity using the DPPH method. The formulation is made by varying the concentration of mahogany leaf extract into 4 formulas, F0 (bases, F1 (0.0195%, IC_{50}), F2 (0.0975%, 5xIC_{50}) and F3 (0.195%, 10xIC_{50}). There were several tests used to evaluate formulas, including homogeneity, dispersion, viscosity, pH, and organoleptic (odor, color, and shape) testing. IC_{50} value of mahogany leaf extract was 19.48 µg / mL. Mahogany leaf extract antioxidant gel sleeping mask preparations F0, F1, F2 and F3 was evaluated such as organoleptic testing requirements, homogeneity and pH produced between 6.15-6.65 including the skin's normal pH range of 4.0-7.0 during 28-day storage. F2 exhibits the best antioxidant stability, with an inhibition value of 54.59%.

Keywords: Mahogany leaf (*Swietenia mahagoni* (L.) Jacq), DPPH (2,2-diphenyl-1pikrylhidrazyl), sleeping mask gel, antioxidant

1 Introduction

Impaired skin can impede both physical well-being and aesthetic appeal, necessitating the implementation of a skin care regimen. The skin can be affected when air conditions deteriorate because of excessive air pollution, leading to the formation of free radicals. If these free radicals are not neutralized, they can harm the skin by reducing or damaging collagen and elastin fibers. [1]. Skin damage can be overcome with antioxidant compounds [2].

Antioxidants are compounds to neutralize free radicals. The body naturally creates antioxidants, but its production may not be sufficient to counter the increased levels of free radicals. Therefore, external sources of antioxidants are required to meet the body's needs [3]. Antioxidants can be classified into two categories: natural antioxidants and synthetic antioxidants. The permissible range for the utilization of synthetic antioxidant doses is rigorously confined to 0.01-0.1%. Any surpassing of this established limit can potentially have adverse consequences on human health. Therefore, the incorporation of natural antioxidants is necessary as they offer a safer alternative [4]. Plant parts that are known to have antioxidant activity, one of which is mahogany leaves. The mahogany leaf extract was tested for its antioxidant activity using the DPPH method, and the findings showed an IC50 value of 91.01 µg/mL, indicating a potent antioxidant [5]. Dosage forms in principle to increase its convenience and benefit. The use of topical preparations at night has a higher efficacy compared to use in the morning or afternoon [6]. Gel formulations are used as sleep masks. The gel was selected due to its high-water content, specifically ranging from 85% to 95%. This allows the gel to effectively moisturize the outermost layer of the skin, known as the stratum corneum, and facilitates the easier penetration of active ingredients into the skin [7].

Sleeping mask is a skin care product that is used at night and has a gel consistency packaged in a pot container, used by applying the preparation to the face, avoiding use of the mouth and eyes before going to bed and rinsing in the morning. Gel is a preparation with a transparent or translucent semi-solid form containing one or more active substances dispersed on a base [8].

2 Method

2.1 Materials and Tools

Materials used during the study include mahogany leaf (*Swietenia mahagoni* (L.) Jacq) obtained from the village Cicadas sub-district, Sagalaherang district, Subang. Sodium carboxy-methyl cellulose (CMC Na), glycerin, methyl paraben, water, DPPH and methanol pro analysis.

The study utilized many tools in the Pharmaceutical Technology Laboratory, a Shimadzu scale, an ultraviolet-visible spectrophotometer (UV-Vis), an ATC pH meter, and a Brookfield VR-3000 viscometer.

2.2 Material Collection and Determination

Mahogany plants (*Swietenia mahagoni (L.) Jacq*) were carried out to determine the types of plants worked on at the Indonesian Biological Generation Foundation.

2.3 Simplicia Characteristic Examination

2.3.1 Water Content

Simplicia as much as 5 g is put into a round flask, then added about 200 mL of saturated water toluene. The moisture content requirement ≤ 10% [9]. The moisture content was calculated using **Equation (1)**.

$$\text{Water content} = \frac{volume\ water}{weight\ simplisia} \times 100\% \qquad (1)$$

2.3.2 Ash content

Two grams of mahogany leaf simplicia were accurately measured and placed into porcelain crucibles that had been preheated. The crucibles containing the simplicia were then heated on a stove until they turned incandescent. After that, they were transferred to a furnace and heated at a temperature between 500-600 °C until the charcoal turned into ash. The samples were cooled in a desiccator and then re-weighed repeatedly until a consistent weight was obtained [9]. The ash content was calculated using **Equation (2)**.

$$\%\text{ash content} = \frac{weight\ ash\ (g)}{weight\ simplisia\ (g)} \times 100\% \qquad (2)$$

2.4 Extraction

Mahogany leaf extraction by maceration using methanol solvent. The macerate obtained is then concentrated with a rotary evaporator at a temperature of ±50 ° C until a thick extract is obtained and then dried using a freeze dryer (-40 ° C).

2.5 Phytochemical Screening Test

The phytochemical screening test was conducted on both the simplicia and extract of mahogany leaves according to the procedures in [14,15].

2.6 Testing of Antioxidant Activity of Mahogany Leaf Extract

Testing the antioxidant activity of mahogany leaf extract using UV-Visible spectrophotometry at maximal wavelengths. Then the measurement of the IC50 value is calculated from a linear regression curve between % absorption inhibition with various concentrations of extract and Vitamin C (test solution).

2.7 Formulation of Sleeping Mask Gel Leaf Extract Preparation

Measuring and quantifying materials based on a predetermined weighing as in **Table 1**. The gel formulation is created by adding CMC Na to hot water in a ratio of 20:1 and grinding until the gel base achieves homogeneity. Methyl parabens are added to various mortars, then glycerin is crushed once more until it becomes uniform and added to a grinding gel base until it becomes uniform. The mahogany leaf extract was dissolved in a small amount of distilled water and added to a gel basis. The mixture was then ground until it became uniform, and the remaining distilled water was added to obtain 100 g of mahogany leaf extract gel.

Table 1. Formulation Sleeping Mask Gel

Material	Concentration (%w/v)			
	F0	F1	F2	F3
Mahogany Leaf Extract	-	0.0195	0.0975	0.195
CMC Na	3	3	3	3
Glycerin	10	10	10	10
Methyl Paraben	0.2	0.2	0.2	0.2
Water	100	100	100	100

2.8 Evaluation of Sleeping Mask Gel Preparations

The evaluation of the gel preparation formula involves conducting organoleptic examination tests [10], assessing homogeneity [10], measuring viscosity [11], pH [10], and testing spreadability [12], and antioxidant activity of the gel preparations. The antioxidant activity is determined by evaluating the DPPH free radical suppression activity using UV-visible spectrophotometry at a maximum wavelength of DPPH 518 nm on days 0, 7, 14, 21, and 28.

3 Result and Discussion

This study made a sleeping mask gel preparation with the addition of mahogany leaf extract as an antioxidant. The plant used is a type of small-leaved mahogany leaf (*Swietenia mahagoni* (L.) Jacq) originating from the village. Cicadas sub-district, Sagalaherang district, Subang.

The determination of mahogany leaf simplicia characteristics includes the determination of moisture content and total ash content which aims to provide limits as a standardization of materials to obtain simplicia materials that are guaranteed quality and quality. The purpose of measuring water content is to determine the quantity of water present in simplicia. The water content of 8.6% in mahogany leaf simplicia suggests that it meets the criteria of having less than 10% water content [9].

The ash content value represents the quantity of both internal and external minerals permitted in the simplicia, indicating the level of purity and contamination. It also signifies the presence of inorganic compounds originating from mahogany plants or from other sources [9]. Based on the examination, ash content obtained was 7.95%. The observations are shown in **Table 2**.

Table 2. Results of Mahogany Leaf Characteristics Determination

Parameters	Requirement [9]	Result
Water Content	< 10%	8.6
Ash content	-	7.95%

Phytochemical screening of simplicia and mahogany leaf extract (**Table 3**) is intended to determine the group of secondary metabolites contained in simplicia and mahogany leaf extract [13].

The extraction of mahogany leaf extract involves the use of a procedure called maceration, which is designed to draw out the various chemical components present in natural materials while minimizing any potential damage or loss of heat-sensitive secondary metabolites, such as flavonoids and polyphenols. Methanol is chosen as the solvent due to its ability to dissolve both polar and nonpolar compounds. Antioxidant activity is tested using the DPPH method because this method is relatively simple to process.

Table 3. Phytochemical Screening Results

Compound	Ref. [14][15]	Simplicia	Extract
Flavonoids	+	+	+
Alkaloids	-	-	-
Saponins	+	+	+
Tannins	+	+	+
Polyphenols	+	+	+
Steroids-Triterpenoids	+	+	+
Monoterpenoid-sesquiterpenoid	+	+	+

Pro-analysis methanol solvents are used because they can dissolve DPPH and nonpolar compounds from extracts. Measurement of antioxidant activity of mahogany leaf extract used UV-Vis spectrophotometer. The parameter that indicates the presence of antioxidant activity is inhibition concentration (IC_{50}). Results of measurement of absorption and %damping of mahogany leaf extract and vitamin C shown in **Table 4**. Vitamin C serves as a positive control antioxidant for the purpose of comparing the properties of extract mahogany leaves.

Table 4. Test Results of Antioxidant Activity of Mahogany Leaf Extract and Vitamin C Comparator

Material	IC_{50}
Mahogany leaf extract	19.48
Vitamin C	4.79

The test results showed IC_{50} values of 19.48 µg/mL for the mahogany leaf extract and 4.79 µg/mL for vitamin C. The test sample was determined to possess a potent antioxidant with an IC value of less than 50 µg/mL. The IC_{50} yield of mahogany leaf extract is less than that of vitamin C, although it nevertheless exhibits antioxidant action. The IC_{50} value obtained was compared with the literature value of 48.07 µg/mL [13]. Both are included in the same classification as strong antioxidants.

The gel preparation is made into 4 formulas, the base is given different concentrations of mahogany leaf extract. F0 is a base without the addition of mahogany leaf extract, F1 contains a

base and mahogany leaf extract worth 10xIC_{50} (0.0195%), F2 contains a base with mahogany leaf extract worth 50xIC_{50} (0.0975%) and F3 is a base with an extract concentration of 100xIC_{50} (0.195%). The formula comprises several concentrations of extracts with the purpose of quantifying the variation in damping percentage and identifying the optimal stability.

Mahogany leaf extract gel sleeping mask preparation is evaluated consisting of several tests carried out during 28 days of storage, including: Organoleptic testing of gel preparations to observe the physical form of the preparation that has been made consisting of odor, color and dosage form. The preparation of sleeping mask gel with the addition of mahogany leaf extract is stable and there is no deformation between the newly made gel preparation until storage for 28 days meets organoleptic requirements.

Homogeneity testing is conducted to assess the thorough blending of gel preparations by examining the similarity in color and the absence of any clumpy particles. All four formulae pass the homogeneity test as they exhibit consistent colors and absence of lumpy grains. Furthermore, the active components are evenly distributed and maintain a uniform shape during the 28-day observation period [16].

Determination of the pH of the preparation has the aim of knowing that the preparation of sleeping mask gel has a pH value in accordance with the pH of normal skin so that the preparation is safe to apply.

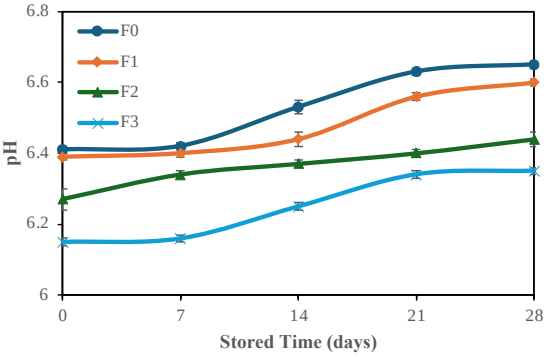

Figure 1. Relationship between stored time and pH

pH measurement is carried out to determine the pH stability of the preparation sleeping mask Mahogany leaf gel during storage. In preparations F0 to F3 have increased, the pH shown is within the normal skin pH required range of 4.0-7.0 as shown in **Fig. 1**. Acidic preparations cause skin irritation such as the appearance of pain and burning while the alkaline pH value will make the skin dry and scaly [17]. An increase in the pH of gel preparations can occur due to poor storage so that the preparation is exposed to light from outside [18].

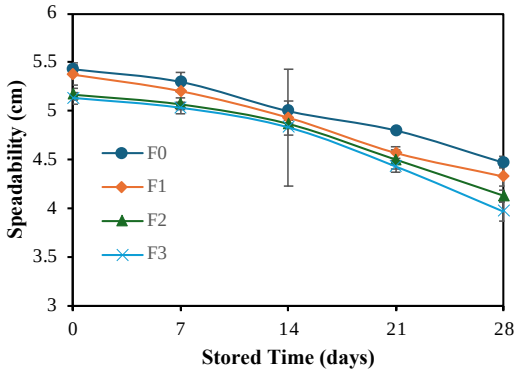

Figure 2. Relationship between stored time and spread ability

The spread ability results (**Fig. 2**) in each formula show a decrease during 28 days of storage caused by an increase in viscosity or viscosity in the preparation sleeping mask gel (**Fig. 3**) [19]

Testing of the antioxidant activity of the gel preparation was carried out on all four formulas by measuring the percent damping during 28 days of storage. Antioxidant test uses the DPPH method.

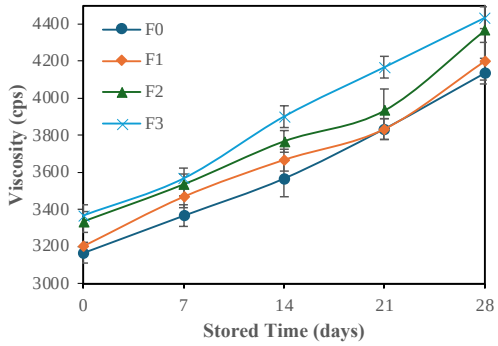

Figure 3. Relationship stored time between viscosity

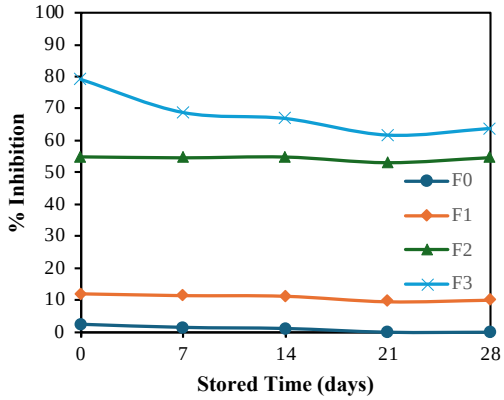

Figure 4. The relationships stored time between % inhibition antioxidant activity

Based on **Fig. 4**, the antioxidant activity of gel preparations decreases because of oxidation processes caused by exposure to light, leading to a decrease in their antioxidant activity. Tests demonstrate a positive correlation between the quantity of the extract used and the level of antioxidant activity. F3 shows a decrease in antioxidant values over 28 days. This is supposed to be because the extract is oxidized at high concentrations due to storage [20]. F2 exhibits the best antioxidant stability, with an inhibition value of 54.59%.

4 Conclusion

The antioxidant activity of mahogany leaf extract (*Swietenia mahagoni* (L.) Jacq) is highly potent, having an IC 50 value of 19.48 µg/mL. The mahogany leaf extract F2 has the best stability in antioxidant activity, with an inhibition percentage value of 54.59%.

References

[1] Maula ER., 2017, Kosmetik Antipolusi: Kosmetik Zaman Now, *Majalah Farmasetika*, 2(5): 9.

[2] Sari AN., 2015, Antioksidan alternatif untuk menangkal bahaya radikal bebas pada kulit. *Elkawnie: Journal of Islamic Science and Technology*, 1(1): 63-68.

[3] Sayuti K., Yenrina R., Antioksidan Alami dan Sintetik [Internet], Padang: Andalas University Press; 2015 [cited 2024 August 14]. 15-16 p.

[4] Panagan AT., 2011, Pengaruh penambahan tepung wortel (*Daucus carota* L.) terhadap bilangan peroksida dan asam lemak bebas pada minyak goreng curah, *Jurnal Penelitian Sains*, 14(2): 18–21.

[5] Pratama, MJP., Hartanti DAS., Zuhria SA., 2022, Uji Kandungan Antioksidan dan Flavonoid pada Ekstrak Daun Tanaman Mahoni (*Swietenia mahagoni*), *Stigma: J. MIPA Unipa*, 15(02): 73–6.

[6] Mayangsari FD., Kusumo DW., Muarifah Z., 2022, Uji Karakteristik Fisik Dan Hedonik Dari Antiaging Sleeping Mask Dengan Ekstrak Kulit Buah Delima Merah, *Jurnal Ilmiah Manuntung*, 8(2): 302-310.

[7] Rawat S., 2011, Release Enhancement of Meloxicam From Transdermal Gel Through, *Int J Pharm Sci Res*, 2(2): 357–65.

[8] Praptiwi P., Iskandarsyah I., Kuncari ES., 2014, Evaluasi, uji stabilitas fisik dan sineresis sediaan gel yang mengandung minoksidil, apigenin dan perasan herba seledri (*Apium graveolens* L.), *Indonesian Bulletin of Health Research*, 42(4): 20088.

[9] Kementerian Kesehatan Republik Indonesia, 2017, Farmakope Herbal Indonesia. Kementerian Kesehatan Republik Indonesia.

[10] Rusli D., Amelia K., Sari SGS., 2021, Formulasi dan Evaluasi Sediaan Gel Ekstrak Daun Kelor (*Moringa Oleifera* Lam.) Dengan Variasi NaCMC Sebagai Basis, *Jurnal Ilmiah Bakti Farmasi*, 6(1): 7-12.

[11] Hariningsih Y., 2019, Pengaruh variasi konsentrasi Na-CMC terhadap stabilitas fisik gel ekstrak pelepah pisang ambon (*Musa paradisiaca* L.), *Parapemikir: Jurnal Ilmiah Farmasi*, 8(2): 46-51.

[12] Irianto IDK., Purwanto P., Mardan MT., 2020, Aktivitas antibakteri dan uji sifat fisik sediaan gel dekokta sirih hijau (*Piper betle* L.) sebagai alternatif pengobatan mastitis sapi, *Majalah Farmaseutik*, 16(2): 202-210.

[13] Safrudin B., Mursiti S., 2022, Isolation and Identification of Flavonoid Compounds from Mahogany Leaves (*Swietenia mahagoni*) and Their Antioxidant Activity with the DPPH Method, *Indonesian Journal of Chemical Science*, 11(2): 170-180.

[14] Sandra PA., Daniel D., Saleh C., 2021, Uji Fitokimia Dan Antibakteri Ekstrak Metanol Daun Mahoni (*Swietenia mahagoni* (L.) Jacq), *Jurnal Atomik*, 6(2): 64-67.

[15] Anam S., Hartanti AS., Chusnah M., Puspaningrum Y., 2023, Uji Kandungan Flavonoid Dan Tanin Pada Ekstrak Daun Dan Kulit Pohon Kayu Mahoni (*Swietenia mahagoni*), *Buana Sains*, 23(1): 41-44.

[16] Dominica D., Handayani D., 2019, Formulasi dan Evaluasi Sediaan Lotion dari ekstrak daun lengkeng (*Dimocarpus longan*) sebagai Antioksidan, *Jurnal*

Farmasi dan ilmu kefarmasian Indonesia, 6(1): 1-7.

[17] Erwiyani AR., Destiani D., Kabelen SA., 2018, Pengaruh Lama Penyimpanan Terhadap Sediaan Fisik Krim Daun Alpukat (*Persea Americana* Mill) dan daun sirih hijau (*Piper betle* Linn), *Indonesian Journal of Pharmacy and Natural Product*, 1(1).

[18] Dewi SR., Argo BD., Ulya N., 2018, Kandungan flavonoid dan aktivitas antioksidan ekstrak *Pleurotus ostreatus*, *Rona Teknik Pertanian*, 11(1): 1-10.

[19] Agustiani FRT., Sjahid LR., Nursal FK., 2022, Kajian literatur: peranan berbagai jenis polimer sebagai gelling agent terhadap sifat fisik sediaan gel, *Majalah Farmasetika*, 7(4): 270-287.

[20] Septiani S, Wathoni N, Mita SR., 2012, Formulasi Sediaan Masker gel Antioksidan Dari Ekstrak Etanol Biji Belinjo, *Students e-journals Universitas Padjajaran, 1(1):* 1–26.