Determination of Sun Protection Factor Lotion of Pulai Stem Extract (Alstonia scholaris (L.) R.Br)


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Abstract

BACKGROUND: The bark of pulai (Alstonia scholaris [L.] R.Br.) by the Gorontalo community is used for powder preparation (as a wedding ceremony custom), containing flavonoid compounds that function as sunscreens. Thus, the bark of pulai can be made in pharmaceutical preparations in the form of lotion dosage forms.

AIM: This study aims to determine the SPF value of the lotion preparation of pulai bark extract. There are four formulas, formula F0 (lotion base), formula F1 (0.5%), formula F2 (1%), formula F3 (2%).

METHODOLOGY: Physical evaluation of lotion preparations was carried out with organoleptic test parameters, spreadability, homogeneity, stability, pH. The SPF value of the lotion preparation was tested using the ultraviolet-Vis Spectrophotometry method with a wavelength of 290–400.

RESULTS: The results of the physical evaluation of the organoleptic test and the homogeneity test were obtained that the lotion had a clear white color (F0), light yellow (F1), yellow (F2), dark yellow (F3), a characteristic smell of olive oil, and the four formulas had a thick and homogeneous consistency. The dispersion power of F0, F1, and F2 does not meet the requirements of the dispersion test value except F3. The three lotion formulations F1, F2, and F3 showed physical instability, except for F0 (lotion base). The pH of the lotions of the four formulas was in the range that was in accordance with the standard of topical preparations.

CONCLUSION: The determination of the SPF value in the formulas F1, F2, and F3, respectively, was 3.3427 (minimum protection), 4.7752 (medium protection), and 5.0968 (medium protection).

Introduction

The sun’s rays that harm the skin are ultraviolet (UV) radiation. The impact of sun exposure can also cause photaging. It is estimated that 80% or more of changes in the skin that occur over time are caused by the extrinsic effects of sunlight [1, 2]. The skin is the largest organ of the human body and functions as a physical, biological, and physiological barrier. These factors trigger various signs of aging skin, which are generally characterized by the formation of fine wrinkles, reduced water content, and reduced skin thickness. Wrinkles or photaging of the upper dermis are closely related to collagen/elastin-based connective tissue, while wrinkles are formed by degradation of the extracellular matrix through changes in matrix metalloproteinase (MMP) levels [3].

The sun protection factor (SPF) is an international laboratory measure used to assess the efficacy of sunscreens. The SPF can range from 1 to over 80 and indicates the time a person can be exposed to UV rays before getting sunburn with sunscreen application relative to the time a person can be exposed without sunscreen. SPF levels are determined by the minimal amount of UV radiation that can cause erythema and/or pain stimulated by UV light [4]. According to (Daud, et al, 2018) [1], the concentration of extracts that provide the ability to protect the skin from exposure to UV rays with the ultra protection category is 7.5%.

Pulai plant (Alstonia scholaris [L.] R.Br.) is one of the medicinal forest plants that is rich in active compounds. Part of the island. Plants that are commonly used are leaves, stems, and bark. The bark of the pulai extract contains flavonoids, alkaloids, saponins, tannins, and terpenoids [3], [5], [6]. The bark of the pulai contains flavonoid compounds that are effective antioxidants. Due to the presence of these antioxidants, the antioxidant mechanism can attract free radicals caused by frequent sun exposure, anti-cancer drugs, anti-malaria drugs, hypertensive drugs, respiratory drugs, analgesics, anti-inflammatory drugs, and anti-malaria. In addition, Pulai can also be used as
a cure for hepatitis, tumors, rheumatism and earache [6], [7], [8], [9].

Empirically, the people of Gorontalo use the bark of the island for powder preparations (as preparation for the wedding ceremony). Judging from the efficacy and content of compounds contained in the Pulai plant (A. scholaris (L.) R.Br), the bark extract of the Pulai is very suitable for making lotion preparations in a predetermined concentration formula. Then, the lotion formed will be continued with the SPF testing method. To facilitate its use on the body’s skin, it can be made in pharmaceutical preparations as a UV ray protector, namely sunscreen lotion.

Based on the description above, the authors are interested in conducting research on Determining the Value of SPF Lotion of Batang Pulai Bark Extract (A. scholaris (L.) R.Br) using the UV-VIS spectrophotometry Method.

Methods

**Tool**

Stirring Rod, Glass Beaker, Maceration Vessel, Caliper, Micropipette, Analytical Balance, Oven, UV-Vis (Shimadzu UV-1800®), Horn Spoon, Test Tube, and pH Meter (Senz pH®).

**Ingredient**

Pulai Bark from Potanga Pilolodaa (Gorontalo Province), Stearic Acid (CV. Chem-Mix P.A Grade), Aquadest (Department Pharmacy Chemistry Laboratory Polkesgo, Pharmaceutical Grade), Ethanol 70% (CV. Chem-Mix P.A Grade), Ethanol 96% (CV. Chem-Mix P.A Grade), Glycerin (CV. Chem-Mix P.A Grade), Methyl Paraben (CV. Chem-Mix P.A Grade), Olive Oil (CV. Chem-Mix P.A Grade), Cetyl alcohol (CV. Chem-Mix P.A Grade), Tween 80 (CV. Chem-Mix P.A Grade), Mg Powder (CV. Chem-Mix P.A Grade), HCl (CV. Chem-Mix P.A Grade), FeCl3 10% (CV. Chem-Mix P.A Grade), Mayer reagent and Dragendorf reagent (CV. Chem-Mix P.A Grade).

**Preparation of Simplicia Bark Pulai**

The bark of the pulai was taken and then washed with running water; then wet sorting was carried out to separate the dirt that was still left behind during washing, chopped into small pieces and then dried in the oven at 50°C until it reached a moisture content of <10% [9]. Then calculated % water content with the following formula.

\[
\% \text{ Moisture Content} = \frac{\text{initial weight-final weight}}{\text{initial weight}} \times 100\%
\]

**Preparation of Pulai Bark extract**

Withdrawal of chemical compounds in the bark extract of pulai was carried out by maceration method for \(3 \times 24\) h protected from light and occasionally stirring. Extraction using 70% ethanol solvent with a ratio of 1:3.5. On the 2nd and 3rd days, the solvent was filtered for remaceration so as to get three filtrates for each solvent so that the filtrate was obtained. The filtrate was concentrated with a rotary evaporator at a temperature of 60°C [10].

**Pulai Bark phytochemical Screening**

Handling Simplicia samples and Pulai Bark extract

A total of 6 g of simplicia of pulai bark extract and 0.5 g of pulai bark extract were dissolved in 30 ml of methanol and then filtered. The filtrate obtained was used added with each reagent [11], [12].

**Identification of alkaloids**

Mayer test

The experimental solution was taken 2 ml, then added five drops of mayer; a positive result was indicated by the formation of a white precipitate.

Dragendorff test

The experimental solution was taken 2 ml, then added five drops of Dragendorf; a positive result was indicated by the formation of an orange–brown precipitate [12].

**Identification of flavonoids**

A total of 2 ml of the sample was added with 0.05 g of Mg powder and 1 ml of concentrated HCl, then shaken vigorously. Positive results are indicated by the formation of red, intense yellow, or orange colors [12].

**Identification of tannins**

Take 2 ml of sample and add ten drops of 10% FeCl3. Positive results contain tannins if there is a green–black or blue–black color change [12].

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Function</th>
<th>Concentration (%b/v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulai bark extract</td>
<td>Active substance</td>
<td>F0: 0 F1: 0.5 F2: 1 F3: 2</td>
</tr>
<tr>
<td>Stearic acid</td>
<td>Emulsifying</td>
<td>2.5 2.5 2.5 2.5 2.5</td>
</tr>
<tr>
<td>Cetyl alcohol</td>
<td>Emollient</td>
<td>2 2 2 2 2</td>
</tr>
<tr>
<td>Glycerin</td>
<td>Humectant</td>
<td>10 10 10 10 10</td>
</tr>
<tr>
<td>Olive oil</td>
<td>Humectant</td>
<td>5 5 5 5 5</td>
</tr>
<tr>
<td>Tween 80</td>
<td>Emulgator</td>
<td>10 10 10 10 10</td>
</tr>
<tr>
<td>Methyl paraban</td>
<td>Preservative</td>
<td>0.02 0.02 0.02 0.02 0.02</td>
</tr>
<tr>
<td>Aquadest</td>
<td>Solvent</td>
<td>83.02 76.78 76.42 75.35 75.35</td>
</tr>
</tbody>
</table>

\( F_0 \): Negative control formula (lotion formula without active substance), \( F_1 \): Lotion formula with 0.5% extract concentration, \( F_2 \): Lotion formula with 1% extract concentration, \( F_3 \): Lotion formula with 2% extract concentration.
Identification of Saponins

A total of 2 ml of extract was added with 10 ml of water while shaking for 1 min. If the foam formed remains stable for approximately 7 min, then the extract is positive for saponins [12].

Preparation of Pulai Bark extract lotion

Prepare tools and materials to be used. The ingredients in the oil phase (stearic acid, cetyl alcohol, tween 80, and olive oil) were put into a porcelain cup. The water phase ingredients (aquadest, glycerin, and methylparaben) were put into a beaker. Heated the oil phase and the water phase and stirred at a temperature of 70°C–75°C separately until homogeneous, then mixed at a temperature of 70°C, while stirring until both phases were homogeneous. The active substance of the ethanol extract of the bark of the pulai was added to the mixture at a temperature of 35°C, then stirred for approx. 1 min [13].

Determination of SPF value of Pulai Bark extract lotion

Each lotion formula was made in a concentration of 100 ppm by weighing 2 g of each lotion sample F0 (-), F1, F2, and F3 dissolved in 100 ml (Table 1). The solution obtained is filtered if the solution is cloudy. The absorbance obtained was measured using a UV-Vis spectrophotometer at a wavelength of 290-400 nm to determine the SPF lotion value.

The determination of the SPF value is calculated using the following formula [2].

\[
\text{AUC} = \left( \frac{\text{Serapan} \lambda_n + \text{Serapan} \lambda_{n+1}}{2} \right) \left( \lambda_{n+1} - \lambda_n \right)
\]

- \(\Delta \text{AUC} = L_1 + L_2 + L_3 + L_4 + L_5 + L_6\)
- \(\log \text{SPF} = \frac{\Delta \text{AUC}}{L_{\text{maks}} + L_{\text{min}}} \times 2\)
- \(\text{SPF} = \text{Arc. Log SPF}\)

Description:
- AUC = Area of Absorption Curve
- \(\lambda_n\) = Largest wavelength (with A ≥ 0.05 for extract; with A ≥ 0.01 for preparation)
- \(\lambda_{n+1}\) = The smallest wavelength (290 nm)
- L = Result of AUC value.

Evaluation of physical properties of Pulai Bark extract lotion

Organoleptic Test

The organoleptic test of the lotion preparation was carried out by observing the physical appearance of the lotion preparation, which included color, odor, and consistency [14].

Spreadability Test

A total of 0.5 g of ointment is placed on a round glass with a diameter of 15 cm; another glass is placed on it and left for 1 min. The diameter of the distribution of the preparations was calculated for the diameter. After that, 100 g of additional load were added and allowed to stand for 1 min, and then, a constant diameter was calculated [15].

Homogeneity Test

Each lotion formula is weighed 0.1 g, spread evenly on a glass object, and no coarse grains should be seen.

Stability Test

Stability test was carried out to test the preparations were Freeze Thaw for three cycles. One cycle which is 48 h consisting of 24 h at 4°C and 24 h at 40°C [15].

pH test

Weighed as much as 1 g of lotion preparation and then diluted with 10 ml of distilled water. Then, a pH meter is used to measure the pH of the lotion preparation [16].

Results and Discussion

Water content of Simplicia Bark Pulai

Moisture content is a parameter to determine residual water after the drying process [17]. The results of the water content are shown in Table 2.

<table>
<thead>
<tr>
<th>Initial weight</th>
<th>Final weight</th>
<th>Moisture content</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.000 g</td>
<td>3.085 g</td>
<td>4%</td>
</tr>
</tbody>
</table>

The results of the water content are obtained from the process of making simplicia that meet the quality requirements of the water content. The requirement for simplicia water content in accordance with the quality is 10%. Water content that is too high (>10%) can cause the growth of microbes which will reduce the stability of the simplicia and extract and affect the resistance to storage. Hence that the low water content will make the material storage longer [11], [17].

Pulai Bark extract yield

Yield is the ratio of the dry weight of the resulting sample to the weight of the raw material. The
yield of a sample is very necessary because it is to
determine the amount of extract obtained during the
extraction process. In addition, the yield data has to do
with the active compound from a sample. Hence, the
higher the yield of the resulting extract, the higher the
active compound contained in the sample [18].

The yield of the Pulai bark extract is shown in
Table 3.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Weight Simplicia</th>
<th>Extract</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etanol 70% Pulai Bark</td>
<td>3.000 g</td>
<td>36 g</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Based on the table above, the yield results
are below the standard yield value, so that the extract
obtained is very little. According to Ramadhani et al.
[19], the standard extract yield value is >10%. This
is due to the amount of solvent used. In this study a
solvent ratio of 1:3.5 was used, while in the study
(Zuraida dan Mariya, 2019) [5] the extraction of the bark
of the pulai used the amount of solvent in a ratio of 1:10.
And other factors that affect the yield are plant varieties,
plant age, plant maintenance processes, environmental
factors where plants grow, harvest processes, and plant
processing processes [9].

Results of phytochemical screening

Phytochemical screening is the initial stage to
identify the chemical content or chemical compounds
contained in plants. Phytochemical screening is a qualitative
analysis of secondary metabolites using reagents [12].

<table>
<thead>
<tr>
<th>Chemical content</th>
<th>Reactor</th>
<th>Test parameter results</th>
<th>Research result</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>Mayer’s reagent</td>
<td>White precipitate</td>
<td>White precipitate</td>
<td>Positive (+)</td>
</tr>
<tr>
<td></td>
<td>Dragendorf’s reagent</td>
<td>Orange to brown precipitate</td>
<td>Orange precipitate</td>
<td>Positive (+)</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Concentrated Mg + HCl</td>
<td>Red, yellow or orange</td>
<td>Yellow</td>
<td>Positive (+)</td>
</tr>
<tr>
<td>Tannins Flavooid</td>
<td>FeCl3, 10%</td>
<td>Dark green or dark blue</td>
<td>Yellow</td>
<td>Negative (−)</td>
</tr>
<tr>
<td>Saponins</td>
<td>Hot water</td>
<td>There is a foam that can last for 7 min</td>
<td>No foam</td>
<td>Negative (−)</td>
</tr>
</tbody>
</table>

The results of the phytochemical screening
of simplicia and the bark extract of pulai are shown in
Tables 4 and 5.

<table>
<thead>
<tr>
<th>Chemical content</th>
<th>Reactor</th>
<th>Test parameter results</th>
<th>Research result</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>Mayer’s reagent</td>
<td>White precipitate</td>
<td>White precipitate</td>
<td>Positive (+)</td>
</tr>
<tr>
<td></td>
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<td>Orange to brown precipitate</td>
<td>Orange precipitate</td>
<td>Positive (+)</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Concentrated Mg + HCl</td>
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<td>Yellow</td>
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</tr>
<tr>
<td>Saponins</td>
<td>Hot water</td>
<td>There is a foam that can last for 7 min</td>
<td>No foam</td>
<td>Negative (−)</td>
</tr>
</tbody>
</table>

Based on the table above, the phytochemical
screening of simplicia and extracts of the bark of
the pulai bark was found to be positive for containing
alkaloids and flavonoids. This is in accordance with
research conducted by [20] that the simplicia of the bark
of the Pulai stem is positive for alkaloids and flavonoids.

In the Tannin test, it was found that the simplicia
and the bark extract of pulai were negative. This is
different from the research conducted by [21]. This
is due to the differences in the extraction methods used.
In his research, the extraction method for the withdrawal of
tannin compounds used the reflux method, while in this
study using the maceration method. Tannin compounds
are complex compounds that can only be attracted
with the help of heating, so that the reflux method is suitable
for attracting tannin compounds.

In the saponin test, it was found that the simplicia
and the bark extract of pulai were negative. This is due
to the use of different reagents. In a study conducted by
Itam et al. [22], the saponin test after adding hot water,
shaking for a few minutes, positive results were indicated
by the formation of foam that did not disappear after
adding HCl. Whereas in this study, only hot water was
used and no foam was formed. The function of adding
HCl is to accelerate the reaction in the saponin test,
which is characterized by the formation of foam.

Result of determination of value (sun protection factor) preparation of Pulai Bark extract lotion

The SPF value indicates the ability of a
sunscreen product to reduce burning on the skin caused
by UV rays or a product that acts as a UV protector [23].
The results of the SPF test are shown in Table 6.

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>Absorbance</th>
<th>Formula F1</th>
<th>Formula F2</th>
<th>Formula F3</th>
<th>Formula F4</th>
</tr>
</thead>
<tbody>
<tr>
<td>280</td>
<td>0.043</td>
<td>0.743</td>
<td>1.0429</td>
<td>1.2095</td>
<td></td>
</tr>
<tr>
<td>290</td>
<td>0.025</td>
<td>0.696</td>
<td>0.9776</td>
<td>1.1035</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>0.020</td>
<td>0.665</td>
<td>0.9283</td>
<td>1.0187</td>
<td></td>
</tr>
<tr>
<td>310</td>
<td>0.0183</td>
<td>0.6345</td>
<td>0.8763</td>
<td>0.9282</td>
<td></td>
</tr>
<tr>
<td>320</td>
<td>0.0138</td>
<td>0.6105</td>
<td>0.8336</td>
<td>0.8565</td>
<td></td>
</tr>
<tr>
<td>330</td>
<td>0.011</td>
<td>0.5946</td>
<td>0.8058</td>
<td>0.8139</td>
<td></td>
</tr>
<tr>
<td>340</td>
<td>0.010</td>
<td>0.5839</td>
<td>0.7872</td>
<td>0.7904</td>
<td></td>
</tr>
<tr>
<td>350</td>
<td>0.0091</td>
<td>0.5737</td>
<td>0.7717</td>
<td>0.7810</td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>0.0082</td>
<td>0.5625</td>
<td>0.7521</td>
<td>0.7624</td>
<td></td>
</tr>
<tr>
<td>370</td>
<td>0.0070</td>
<td>0.5479</td>
<td>0.7272</td>
<td>0.7335</td>
<td></td>
</tr>
<tr>
<td>380</td>
<td>0.0063</td>
<td>0.5316</td>
<td>0.6973</td>
<td>0.7056</td>
<td></td>
</tr>
<tr>
<td>390</td>
<td>0.0051</td>
<td>0.5151</td>
<td>0.6657</td>
<td>0.6760</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>0.0043</td>
<td>0.4962</td>
<td>0.6338</td>
<td>0.6475</td>
<td></td>
</tr>
<tr>
<td>410</td>
<td>0.0037</td>
<td>0.4796</td>
<td>0.6043</td>
<td>0.6173</td>
<td></td>
</tr>
<tr>
<td>420</td>
<td>0.0032</td>
<td>0.4665</td>
<td>0.5788</td>
<td>0.5867</td>
<td></td>
</tr>
<tr>
<td>430</td>
<td>0.0028</td>
<td>0.4534</td>
<td>0.5573</td>
<td>0.5650</td>
<td></td>
</tr>
<tr>
<td>440</td>
<td>0.0025</td>
<td>0.4437</td>
<td>0.5398</td>
<td>0.5499</td>
<td></td>
</tr>
<tr>
<td>450</td>
<td>0.0018</td>
<td>0.435</td>
<td>0.5255</td>
<td>0.5380</td>
<td></td>
</tr>
<tr>
<td>460</td>
<td>0.0017</td>
<td>0.428</td>
<td>0.5127</td>
<td>0.5273</td>
<td></td>
</tr>
<tr>
<td>470</td>
<td>0.0019</td>
<td>0.421</td>
<td>0.5016</td>
<td>0.5146</td>
<td></td>
</tr>
<tr>
<td>480</td>
<td>0.0017</td>
<td>0.4144</td>
<td>0.4912</td>
<td>0.5041</td>
<td></td>
</tr>
<tr>
<td>490</td>
<td>0.0014</td>
<td>0.408</td>
<td>0.4414</td>
<td>0.4950</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>0.0011</td>
<td>0.4023</td>
<td>0.4718</td>
<td>0.4859</td>
<td></td>
</tr>
<tr>
<td>SPF value</td>
<td>1.0363</td>
<td>3.3427</td>
<td>4.7752</td>
<td>5.0968</td>
<td></td>
</tr>
</tbody>
</table>

Based on the data obtained in the table above, it
shows that Formula F0 is a lotion base that does not have
effectiveness as a sunscreen because it has a value below
the minimum protection value. Formula F1, which added
the active substance of pulai bark with a concentration

https://oamjms.eu/index.php/mjms/index
of 0.5% had an SPF value of 3.3427 with a minimal protection category. Formula F2, which added the active substance of the bark of pulai with a concentration of 1% had an SPF value of 4.7752 with the protection category medium, Formula F3 which added the active substance of pulai bark with a concentration of 2% had an SPF value of 5.0968 with a moderate protection category.

According to [25], the effectiveness of sunscreen is based on the SPF value with the category of sunscreen protection, namely minimal protection with an SPF value of 2-4, moderate protection with an SPF value of 4-6, extra protection with an SPF value of 6-8, maximum protection with an SPF value of 8-15 and ultra protection with a value of 15.

Hence, the best formula that has the highest SPF value is Formula F3. The higher the concentration of the active substance, the higher the SPF value, making it more effective at protecting the skin from UV exposure. [24]. Compounds that have a function as a sunscreen are flavonoid compounds.

According to Fadliaturrahmah et al. [25], flavonoid compounds are a group of secondary metabolites that have antioxidant properties and play a role in preventing cell damage by free radicals such as UV light, smoke, and pollution [25].

According to Seed et al. [26], absorption of UV light by flavonoids will cause changes in the structure of these flavonoids [Figure 1].

![Figure 1: UV absorption by quercetin pentamil ether](image)

The mechanism of flavonoids in protecting the skin from UV exposure is by absorbing UV rays that penetrate the skin. Flavonoids have a structure in the form of conjugated double bonds so that almost all flavonoids can act as chromophore. Flavonoids will absorb UV light and cause electron excitation from the ground state to orbitals with higher energy. In addition, flavonoids are also thought to have anti-inflammatory activity that acts on the arachidonic pathway. Flavonoids can inhibit the expression of COX-2 so that the synthesis of prostaglandins such as PGI2 and PGE2, which play an important role in the pathogenesis of erythema induced by UV light, will be inhibited [26].

**Spreadability test**

The spreadability test aims to see the ability of the lotion preparation to spread when applied to the skin. The dispersion requirement for topical preparations is 5-7 cm which shows a semi-solid consistency which is very comfortable to use. [1]. The results of the dispersion test can be seen in Table 8.

### Table 7: Organoleptic test results of Pulai Bark extract lotion

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Observation result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Clear white</td>
</tr>
<tr>
<td>Smell</td>
<td>Has no smell</td>
</tr>
<tr>
<td>Consistency</td>
<td>Thick</td>
</tr>
</tbody>
</table>

Based on the description in the table above Table 7, it is found that the color parameter in the F0 formula has a clear white color because it is a lotion base that does not add extract. Formula F1 has a pale yellow color to which the extract is added with a concentration of 0.5%. Formula F2 has a yellow color to which extract is added with a concentration of 1%, and Formula 3 has a dark yellow color to which extract is added with a concentration of 2%. Hence, the difference in color produced in the formulas F1, F2, and F3 can be affected by different concentrations. Parameters odor or aroma in formula F0 has no odor. Formula F1, F2, and F3 have a distinctive olive oil smell. This is due to the difference in the concentration of the lower extract with a high concentration of olive oil. The consistency parameter was observed directly, and the four formulas produced the same consistency. This happens because the lotion formula contains a lotion base that functions as a thickening agent or stiffening agent [28].

### Table 8: Results of spreading the power of Pulai Bark lotion

<table>
<thead>
<tr>
<th>Formula</th>
<th>Burden Diameter length (cm)</th>
<th>1 replication 2 replication 3 replication Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Glass 50 g 4.8 4.9 4.7 4.8</td>
<td>4.9</td>
</tr>
<tr>
<td>F1 (0.5%)</td>
<td>Glass 3.5 4.6 4.7 4.3</td>
<td>4.6</td>
</tr>
<tr>
<td>F2 (1%)</td>
<td>Glass 3.8 4.9 4.5 4.4</td>
<td>4.4</td>
</tr>
<tr>
<td>F3 (2%)</td>
<td>Glass 4.2 4.1 4.3 4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Average</td>
<td>Glass 5.3 5.2 5.3 5.3</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Based on the results of observations and calculations on the spreadability test, Formula F0, F1, and F2 did not meet the requirements for the spreadability test for lotion preparations because they were under the range of requirements for the

Results of physical evaluation of Batang Pulai Bark extract lotion preparations

**Organoleptic Test**

The organoleptic observations included the shape, color, smell, and consistency of the lotion preparation. This observation aims to determine the factors that affect the physical and chemical changes in lotion preparations are also related to the convenience of using lotion preparations, including attractive colors, easy to use, and not rancid [27].

**Results of physical evaluation of Batang Pulai Bark extract lotion preparations**

**Organoleptic Test**

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spreadability test for topical preparations. While the F3 formula meets the requirements for the dispersion test. The factor that affects the diameter of the spreadability is the effect of adding the amount of extract used in each of the formulas. This is because the higher the concentration of the added extract, the wider the dispersion value and the better the spreadability of the preparation. Good spreadability. This causes extensive contact between the active substance and the skin so that the absorption of the active substance into the skin takes place quickly or the release of the desired therapeutic effect on the skin will be faster [29].

**Homogeneity Test**

The homogeneity test was conducted to determine whether the active substance in the lotion was mixed with the lotion base that had been made. Homogeneous preparations will produce good quality because they show the drug ingredient or active substance is evenly dispersed in the base material. If the drug ingredient or is not evenly dispersed in the base material, then the active substance does not achieve the desired therapeutic effect [29]. The homogeneity test image is shown in Figure 2.

Based on the observations, the stability test evaluation was carried out on the preparation using the Freeze-Thaw method for three cycles, and the phase separation was measured. It was found that the lotion formula F0 (without the active substance) did not separate. In the formulas F1, F2, and F3, separation occurred with different heights of phase separation. This was caused by adding different extract concentrations in the lotion formulas F1, F2, and F3. This is due to the instability of the emulsion, namely creaming, where there is a separation into two parts starting from the movement of droplets caused by oil having a smaller density than water so that the oil droplets will be on the surface of the emulsion and form a separate layer. The droplets experience a higher repulsion force than the attractive force so that the droplets break, and the oil phase will recombine with the oil phase, and the water phase droplets will recombine with the water phase [23], [31].

**pH test**

The pH test was carried out to find out the lotion that had been made met the pH requirements for topical preparations, which was between 4.5 and 6.5. Topical preparations with a pH value that is too acidic can irritate the skin while being too alkaline can make the skin dry and flaky [29].

Based on the table above Table 10, it can be seen that the Pulai Bark Extract lotion meets the requirements for topical preparations because it does not pass the range for topical preparations, namely 4.5–6.5.

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**Table 9: Stability test results for lotion preparations for Batang Pulai Bark extract**

<table>
<thead>
<tr>
<th>Formula</th>
<th>Phase separation height measurement (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>No separation occurs</td>
</tr>
<tr>
<td>F1</td>
<td>1.2</td>
</tr>
<tr>
<td>F2</td>
<td>1.4</td>
</tr>
<tr>
<td>F3</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Table 10: pH test results for the lotion formula of Batang Pulai Bark extract**

<table>
<thead>
<tr>
<th>Formula</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>5.6</td>
</tr>
<tr>
<td>F1</td>
<td>5.3</td>
</tr>
<tr>
<td>F2</td>
<td>5.2</td>
</tr>
<tr>
<td>F3</td>
<td>5.2</td>
</tr>
</tbody>
</table>
Conclusion

The SPF value is affected by the total concentration of pulai bark extract in the lotion, where Formula F0 is a lotion base that is ineffective as a sunscreen since it has a value below the minimum protection value. Formula F1 contains an SPF value of 3.3427, Formula F2 contains an SPF value of 4.7752, Formula F3 contains an SPF value of 5.0978, Formula F4 contains an SPF value of 4.7752, Formula F5 contains an SPF value of 5.0978, Formula F4 contains an SPF value of 4.7752, Formula F5 contains an SPF value of 4.7752, Formula F5 contains an SPF value of So, the higher the concentration, the better.

References


