Formulation and Determination of in Vitro SPF Values of Buas-Buas (*Premna serratifolia* L.) Leaves Ethanolic Extract

Weni Puspita[1)], Heny Puspasari [1)], Ayu Shabrina[2)*)]
[1]Akademi Farmasi Yarsi, Pontianak Timur, Kalimantan Barat, Indonesia, 78232
[2]Program Studi S1Farmasi, Fakultas Farmasi, Universitas Wahid Hasyim, Semarang, Indonesia, 50224
*email: shabrina@unwahas.ac.id

Abstract

The ethanol extract of buas-buas leaves has high levels of flavonoids which can function to ward off free radicals and are able to absorb UV rays, both UV A and UV B, thereby reducing their intensity on the skin. This research aims to formulate and determine the sunscreen activity of the ethanol extract lotion preparation of buas-buas leaves. The sunscreen activity test was carried out using the UV-Vis spectrophotometer method with a wavelength of 290-320 m. The ethanol extract of buas-buas leaves is formulated in lotion with varying concentrations of ethanol extract of buas-buas leaves (F1: 1%, F2: 2%, F3: 3%). Lotion was tested for physical properties including organoleptic, viscosity, spreadability, pH, homogeneity, type of lotion and protective ability. The results of the research show that the ethanol extract of the buas-buas leaves can be formulated into a lotion preparation, where the three lotion formulas with varying concentrations of the ethanol extract of the buas-buas leaves of 1%, 2% and 3% produce a brownish green preparation, with a distinctive smell of citric oil, semi-solid. homogeneous, O/W type emulsion, meets the requirements for pH, viscosity, spreadability and provides from maximum to ultra-protection. The results of the sunscreen activity test respectively were 10.50± 0.10; 26.11±0.25; 34.60 ± 0.73, with the highest SPF value of 34.60 ± 0.73 at a concentration of 3% which is included in the ultra-protection category.

Keywords: buas-buas leaves, formulation, lotion, sunscreen

1. INTRODUCTION

Excessive exposure to sunlight can cause sunburn and the dangerous effects of free radical synthesis which trigger erythema, wrinkled skin, tumors and skin cancer (Minerva, 2019). Skin protection from sunlight can be done by using sunscreen (Adi and Zulkarnain, 2015). Some synthetic sunscreens can cause skin irritation and in long-term use can cause hormonal disorders (Pirotta, 2020). Several natural ingredients can be used as sunscreen, one of which is buas-buas leaves.

Research shows that buas-buas leaves contain secondary metabolites of flavonoids, saponins, tannins and triterpenoids/steroids, where flavonoids are known to have properties as free radical scavengers or antioxidants, inhibitors of hydrolysis and oxidative enzymes and work as anti-inflammatories (Veronika et al., 2016). The results of the research prove that the ethanol extract of buas-buas leaves has the ability

Very high reduction of free radicals is shown by the IC50 value of 20.66 ug/mL (Puspita et al., 2020). Previous research also stated that the ethanol extract of buas-buas leaves has a total flavonoid content of 3.70±0.02% mg/g QE and an SPF value of 38.28 ± 0.12, where this value is included in the category of ultra-protection sunscreen ability level (Puspita and Puspasari, 2021). Phenolic compounds, especially the flavonoid group, have potential as

sunscreens because of the chromophore group which is able to absorb UV rays. both UV A and UV B, thereby reducing their intensity on the skin (Lumempouw et al., 2012). The efficacy of natural ingredients with high flavonoid content can be increased by formulating them in semi-solid form.

Lotion preparations can increase the efficacy and spreadability of sunscreen products so that the range of use on the skin is wider (Safitri et al., 2017). Lotion can easily absorb onto the surface of the skin and does not leave a white cast or white stain after being applied to the skin (Pujiastuti and Kristen, 2019). Based on the background description above, this research needs to be carried out to create a formula and determine the sunscreen ctivity of the lotion preparation of ethanol extract of buas-buas leaves (Premna serratifolia L.).

2. METHOD

Tools and Materials

The tools used in this research were mortar and stamper, analytical balance, stir bar, hot plate (Maspion), aluminum foil, beaker glass (Pyrex), watch glass, pH meter (Handylab pH 11/SET), viscometer (Rion VT- 06), refrigerator (Sharp), rotary evaporator (Heidolph), UV/Vis spectrophotometer (Shimadzu), pH meter,measuring flask (Pyrex), measuring cup (Pyrex), micropipette, dropper pipette, stopwatch. The materials used in the research were ethanol extract of buas-buas leaves (Premna serratifolia L.) obtained from Pontianak. 96% ethanol (analytical grade), 70% ethanol (analytical grade). Propylene glycol (cosmetics grade). Tween 80 (cosmetics grade), Paraffin liquidum (cosmetics grade), cetyl alcohol (cosmetics grade), stearic acid (cosmetics grade), methyl paraben (cosmetics grade), Propyl paraben (cosmetics grade), citric oil (cosmetics grade), aquadest (distilled water).

Production of Buas Buas Ethanolic Extract (BBEE)

The buas-buas leaves that were taken are cleaned of adhering dirt by washing them with running water. The buas-buas leaves are chopped and then dried using direct sunlight. The dried leaves are sorted dry and ground into powder. A total of 2100 g of powder from buas-buas-buas leaves was put into a maceration vessel then poured with 70% ethanol solvent until the volume was above the surface of the powder, then covered and left for 3x24 hours stirring occasionally. The maceration results are filtered after 24 hours and the dregs are squeezed to obtain a liquid extract. These results were concentrated using a rotary evaporator and obtained a thick ethanol extract of buas-buas leaves (Puspita and Puspasari, 2021).

Formulation of BBEE lotion

The lotion formula for ethanol extract of buas-buas leaves (BBEE) can be seen in table 1.

Tabel 1. Formula of BBEE Lotion

Material	Concentration (%b/v)		
	FI	**FII**	**FIII**
Ethanolic extract of buas-buas leaves (EEBB)	1	2	3
Propilen glycol	15	15	15
Tween 80	10	10	10
Paraffin liquid	10	10	10
Cetyl alcholol	8	8	8
Stearic acid	6	6	6
Methyl parabene	0,2	0,2	0,2
Propyl parabene	0,1	0,1	0,1
Oleum citri	0,5	0,5	0,5
Aquadest up to	100 g	100 g	100g

The manufacturing of BBEE lotions begins with determining the water phase and the oil phase. The oil phase consists of cetyl alcohol, stearic acid, propyl paraben and paraffin liquidum. The oil phase is placed in a porcelain crucible and melted in a water bath to a temperature of 70°C. The water phase consists of Tween 80, propylene glycol, methyl paraben and distilled water. The water phase was put into a glass beaker and heated over a water bath to a temperature of 70°C. the melted oil phase is poured into a warm mortar, stirred until homogeneous. The water phase is added little by little while stirring slowly until a lotion mass is formed. The ethanol extract of buas-buas leaves and citric oil are added to the lotion mass little by little, and stirred until homogencous.

Evaluation of Physical Properties of BBEE Lotion

Evaluation of the physical properties of the ethanol extract lotion preparation of buas-buas leaves (Premna serratifolia L includes organoleptic tests, homogeneity, pH, lotion type, viscosity, spreadability and protective ability.

Determination of SPF Value in Vitro Lotion BBEE

BBEE FI (1%), FII (2%), and FII (3%) lotions were weighed as much as 0.1 gram. added with 5 mL of 96% ethanol and mixed until homogeneous in a 5 mL measuring flask. The UV-Vis spectrophotometer was calibrated first using 96% ethanol. Samples were read at wavelengths between 290-320 nm using 96% ethanol as a blank. The absorbance results of each concentration were recorded and then the SPF value was calculated using the Mansur method as below (Damogalad et al., 2013).

$$SPF = CF \times \Sigma_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda) \quad ...(1)$$

Note:
CF = Correction factor
Abs (λ) = Absorption of sunscreen product
Σ_{290}^{320}EE (λ) = Erythemal effect spectrum
I (λ) = Intensity of light spectrum

Data Analysis

The quantitative data of the physical characteristics result such as pH. viscosity, spreadability, stickiness and SPF value were analyzed statistically by linear regression.

3. RESULT AND DISCUSSION

Extraction of buas-buas leaves uses 70% ethanol solvent because the secondary metabolite content of this plant is predominantly polar so it is hoped that all types of flavonoids ca be extracted (Trisna et al., 2022). The extraction method used in this research is the maceration method because it prevents the decomposition of the flavonoid compounds contained in the buas-buas leaves (Tušek et al., 2022). This research is a follow-up research to a previous study with a yield of 21.42% (Puspita et al., 2020).

The organoleptic test results of the ethanol extract of the buas-buas leaves of the lotion can be seen in Figure 1. The results of the organoleptic observations can be seen that the brownish green color of the lotin comes from the active substance of the ethanol extract of the buas-buas leaves. The aroma of the lotion preparation is produced from the aroma of oleum citri, and the texture resulting from this lotion preparation is semi-solid. This is in line with previous research that the ethanol extract of buas-buas beast leaves affects the color of the preparation (Puspita et al. 2020).

The results of examining the homogeneity of BBEE lotion preparations can be seen in Figure 2. The test results using glass preparations from the three formulas show that each preparation is homogeneous and has evenly distributed particles. This is because in all formulas there are no coarse grains and show a homogeneous composition or no lumps in the preparation. This is in line with previous research that lotion based on the formula above produces a homogeneous mixture (Safitri et al., 2017).

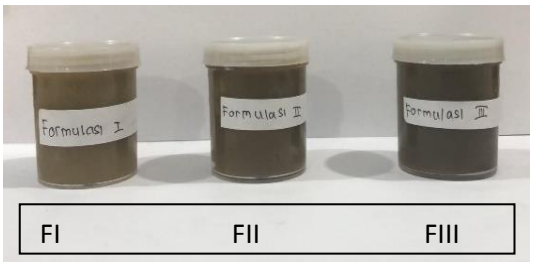

Figure 1. The organoleptic result of BBEE lotion (FI: 1%; FII: 2%; FIII: 3% of BBEE)

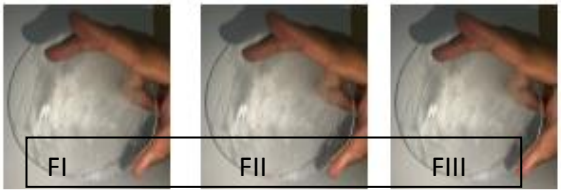

Figure 2. The homogeneity test of BBEE lotion (FI: 1%; FII: 2%; FIII: 3% of BBEE)

The results of the BBEE lotion emulsion type test can be seen in Figure 3. The results of the lotion preparation emulsion type test show that the methyl blue color can dissolve in the lotion, meaning that the lotion preparation made has an oil-in water (o/w) emulsion type. This type of emulsion has the advantage that it spreads more easily on the skin surface, is not sticky and is easily removed by washing (Kusumawardani, 2019).

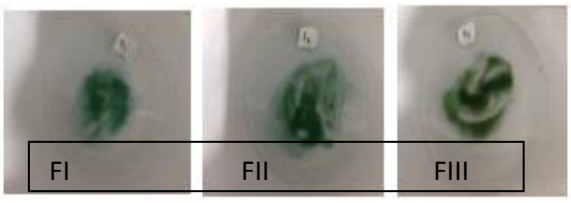

Figure 3. The result of emulsion type of BBEE lotion (FI: 1%; FII: 2%; FIII: 3% of BBEE)

Protection testing is carried out to determine the protection ability or protection against foreign influences from outside which can reduce the effectiveness of the lotion. Testing for protective effect used phenolphthalein (PP) and KOH 0.1 N as indicators. The results of observations of protection capabilities show that all formulas have good protection capabilities. The difference in concentration of ethanol extract of buas-buas leaves does not affect the protective power of the lotion made. This is indicated by the absence of red color on all filter papers from the three formulas. These results stated that the ethanol extract lotion preparation of buas-buas leaves was able to provide good protection so that it could prevent the reaction between potassium hydroxide and the PP indicator as indicated by the absence of a red color (Lumempouw et al., 2012).

Table 2. The result of BBEE physical characterization

Parameters	Result				
	FI	FII	FIII	Recommendation	R^2
pH	6.13 ± 0.015	5.83 ± 0.015	5.60 ± 0.010	4.5-6.5	0.9908
Viscosity (cP)	33385 ± 6.02	36676 ± 4.58	46677 ± 3.05	2000-50000 cP	0.9217
Spreadability (cm)	6,40 ± 0,47	5,83 ± 0,76	5,69 ± 0,60	5-7 cm	0.8501

The results of the pH test, viscosity and spreadability of BBEE lotion can be seen in table 4. The average pH value in the three formulas ranges from 5.60 ±0.10 6.17 ± 0.15, where the pH in the three formulas corresponds to the skin's pH, namely 4 5-65. If the pH of the preparation is outside the skin's pH interval, it is feared that it will cause scaly skin or even irritation, whereas if it is above the skin's pH it can cause the skin to feel slippery, dry quickly, and can affect skin elasticity (Lau, 2019). Based on tests carried out, the preparation is still within the pH value range which is within safe limits for topical preparations. namely around 4.5-6.5 (Rabani, 2019). The result of linear regression showed of y = -0.27x + 6.39 with R^2 of 0.9908. The R^2 result showed that 99.08% of the pH was influenced by the concentration of EEBB. The higher of EEBB concentration the less of pH obtained. This is in line with the previous result that EEBB had an acidic pH (Puspita et al., 2021).

The average viscosity in the three formulas ranged from 33333 5.77 cP 46667 +5.77 cP. The three formulas have good viscosity values because the viscosity test results obtained are still within the recommended range of lotion viscosity values, namely 2000-50.000 cP (SNI. 1996). The results of this research are in accordance with previous studies that the viscosity of lotions with natural ingredients

ranges from 2000-50000 cP (Fransiska et al., 2021).

An examination of the spreadability was carried out with the aim of determining the ability to spread the lotion over the skin layers. Based on the results of the spreadability test in table 4, the average spreadability of the three formulas ranges from 5.60 ± 0.10-6.17 ± 0.15 cm, where the three formulas have good spreadability because they are in accordance with the recommended spreadability for the preparation. topical. namely 5-7 cm (Yasin. 2017). The result of linear regression of the viscosity data of y = 6646x + 25621 with the R^2 = 0.9217. This R^2 means that 92.17% of the viscosity was influenced by the amount of buas-buas ethanolic extract. This is in line with the previous result that the amount of extract can increase the viscosity of the preparation (Yasin, 2019).

Lotion with good spreadability will be able to spread evenly on the skin so that the resulting effect is even. Apart from that, the viscosity of a preparation also affects the extent of its distribution. The smaller the viscosity of a preparation, the greater the distribution Saptarini and Hadisoebroto, 2020). Spreadability is related to the spreading properties of the lotion when used in topical peparations. The result of linear regression of spreadability showed the equation of y = -0.4033x + 6.8056 with R^2 = 0.8501. This means that 85.01% of the spreadability was influenced by the amount buas-buas ethanolic extract in the lotion. This result is connected to the viscosity. The greater the spreadability, the wider the surface area of the skin in contact with the lotion and the active substances will be distributed better Lotion that has great spreading power so it can be applied to a large surface of the skin without excessive pressure (Safitri et al., 2017).

Table III shows the results of the SPF values for all of the ethanol extract lotion formulas of buas-buas leaves. These results show that BBEE lotion is able to provide protection from UV B rays. The lowest SPF value is FI lotion (BBEE 1%) which is included in the maximum protection category. The highest SPF value is found in lotion FIII (BBEE 3%), namely 34.60. which is included in the ultra-protection category. The extract concentration affects the SPF value level. The result of the linear regression of the SPF value data showed the equation of y = 12.05x - 0.3633 with R^2 = 0.9717. This result means that 97.17% of the SPF value was influenced by the amount of the buas-buas ethanolic extract in the lotion. This is in line with previous research which states that the higher the extract concentration, the greater the SPF value produced (Akbar et al., 2021; Damogalad et al., 2013).

Table 3. The result of SPF value of EEBB Lotion

Formula	SPF Value	Protection Category	R^2
FI	10,50 ± 0,10	Maximum Protection	
FII	26,11 ± 0,25	Ultra Protection	0.9717
FIII	34,60 ± 0,73	Ultra Protection	

The sunscreen activity of the ethanol extract of buas-buas leaves is due to the flavonoid content of 3.70 ± 0.02% (Puspita and Puspasari, 2021). Flavonoids have potential as sunscreen because of the chromophore group which is able to absorb UV rays, both UV A and UV B, thereby

reducing their intensity on the skin (Yanuarti et al., 2017).

4. CONCLUSION

Based on the results of the research conducted, it can be concluded that the ethanol extract of the leaves of the savage-buas (Premna serratifolia L.) can be formulated into a lotion preparation with the highest SPF value of extract concentration of 3%. namely 34.60 t 0.73, which is included in the ultra-protection category.

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