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Artikel

The effectiveness test of sunscreen cream with raw materials of coconut oil and active ingredients of Soursop (*Annona Muricata* L) leaf and Bay (*Eugenia Polyantha* Wight) leaf ethanol extracts

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ABSTRAK: The purpose of this study was to determine the effectiveness of cream made of coconut oil as a raw material and the active ingredients of soursop leaf ethanol extract and bay leaf ethanol extract as sunscreens. The cream was made by mixing the hot (700C) water phase (glycerin, distilled water, methyl paraben, and triethanolamine = TEA) and the hot (700C) oil phase (s tearic acid, coconut oil, cetyl alcohol, propyl paraben, andlanolin). After the cream was formed, the active ingredients of soursop leaf ethanol extract and bay leaf ethanol extract were added. A cream without an active ingredient was also made as a comparison. The produced cream was determined to have ultraviolet (UV) radiation absorption by using a UV spectrophotometer. The resulting absorbance value was used to calculate the value of the sun protection factor (SPF) using the Mansur equation. The results showed that creams without active ingredients had the lowest SPF values. With an SPF of 3.048, the cream with 2% active ingredients and 2.5% bay leaf extract was labeled as a low-performance sunscreen cream

INTRODUCTION

Sunscreen is a cosmetic preparation that is used to protect the skin from the dangers of ultraviolet radiation from the sun. Usually, sunscreens contain active ingredients, either inorganic compounds, organic compounds, or a mixture of these two ingredients [1] and [2]. Currently, many studies have been carried out on the manufacture of sunscreens with active ingredients derived from natural sources. Coconut oil is one of the ingredients that comes from nature. This oil is made of coconut flesh and is an example of a compound that can be added to the sunscreen preparation. Coconut oil is an oil that has many advantages. For example, this oil contains saturated fatty acids in a high percentage (93%), so coconut oil is suitable for preparing cosmetics [3]. C=O groups are found in the saturated fatty acids of coconut oil, while C=C and C=O groups are found in the unsaturated fatty acids [4]. Such functional groups can absorb ultraviolet (UV) radiation [5]. Research results show that coconut oil has an SPF value of 7.119, so it is recommended to be added in the manufacture of sunscreen [6].

Active ingredients for sunscreen preparations are plants that contain flavonoids. Flavonoids are a class of compounds that belong to secondary metabolites. These compounds are potential active ingredients of sunscreen because they have a chromophore group that can absorb UV radiation from sunlight and can protect the skin from harmful UV radiation [7]. In order to improve the use of plant-based active ingredients, research is being done on how to make sunscreens from plant-based active ingredients that contain flavonoids [8, 9, and 10].

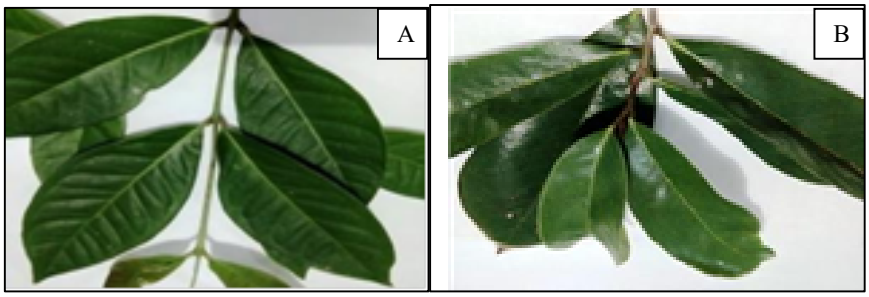

Fig 1. (A). Bay leaf and (B). Sours op leaf

One of the parameters that can be used to determine the effectiveness of a sunscreen is the value of the sun protection factor (SPF). Usually, a sunscreen with a high SPF value will be more effective in protecting the skin from UV radiation compared to a sunscreen that has a low SPF value [6]. By determining the absorption of UV radiation from sunscreen cream using a spectrophotometer, one can determine the SPF value. The UV radiation absorption value result can be used to calculate the SPF of the preparation using the Mansur equation [12] and [13].

A review of several papers shows that sunscreens with active ingredients made from plant extracts usually have a low SPF value, which means that they don't offer much protection from UV radiation. on the preparation and characterization of sunscreen by using the active ingredient of bay leaf extract has been done. From this research, it can be seen that a cream with 5% active ingredients has an SPF value of 1.016, so it was not very effective as a sunscreen [14]. To increase the SPF value, so that the cream becomes effective, more than one active ingredient of plant extract can be added [1]. From the literature study until now, there has been no research on the effectiveness test of the cream with the active ingredients of a mixture of bay leaf extract and soursop leaf extract. Therefore, this research needs to be done.

RESULT AND DISCUSSION

Cream with active ingredients of bay leaf extract and soursop leaf extract

In this research, five samples of creams with different concentrations of active ingredients (bay leaf ethanol extract and soursop leaf ethanol extract) have been made. The form of the resulting cream is semi-solid with a soft texture. The resulting creams have a different color depending on the color and the percentage of active ingredients added. The pictures of all the creams are shown in Figure 2.

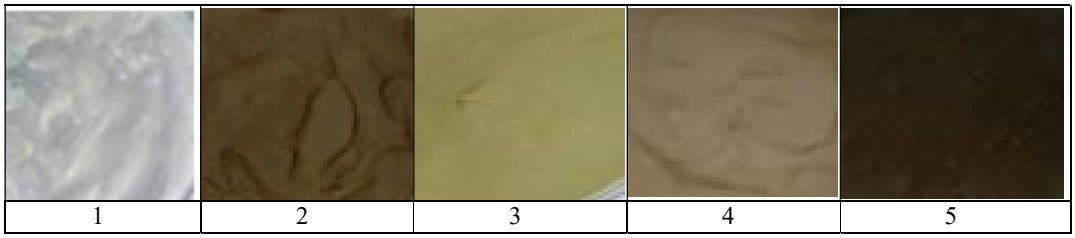

Fig. 2. The picture of the obtained creams (Sample 1 = cream without active ingredient, Sample 2 = cream with 0.5% soursop leaf extract, Sample 3 = cream with 0.5% bay leaf extract, Sample 4 = cream with 0.5% bay leaf extract and 0.5% soursop leaf extract, Sample 5 = cream with 2.5% bay leaf extract and 2% soursop leaf extract.

From Figure 2, it can be seen that sample 1 (cream without active ingredients) has a white color. The color of sample 2 (cream with 0.5% soursop leaf extract) is brownish green. Sample 3 (cream with 0.5% bay leaf extract) is yellowish green. Sample 4 (cream containing 0.5% soursop leaf extract and 0.5% bay leaf extract) is light brown in color. Sample 5 is a cream containing 2% soursop leaf extract and 2.5% bay leaf extract, which has a blackish brown color. From the results of the study, it can be concluded that the higher the concentration of active ingredients added, the darker the color of the cream produced.

UV Radiation absorption of cream containing bay leaf ethanol extract and soursop leaf ethanol extract

The effectiveness of a sunscreen preparation can be seen from its SPF value. The SPF value can be calculated from the amount of absorption of UV radiation of cream in the UV B area, namely at a wavelength of 290-320 nm (with 5 nm intervals). In this study, the determination of the UV radiation absorption of the cream was carried out, and the results are presented in Table 3.

From Table 3, it can be seen that at the same wavelength, sample 1 has the lowest absorption value when compared to the other 4 creams. This is because sample 1 is a cream without active ingredients, so there is no absorption with a high intensity in the UV B region (290–320 nm). Samples 2–5 are samples that contain active ingredients, either singly or in a mixture.

Because the active ingredient has a compound containing a chromophore group, as a result it can absorb UV radiation, there is absorption with a higher intensity in the UV B area. The amount of absorption intensity depends on the type and concentration of the active ingredient added. High-concentration creams with a mix of active ingredients will have a high absorption intensity in the UV B area.

The sample that has the highest absorption value of UV radiation is sample 5, because it contains a mixture of active ingredients with the highest concentration (2% soursop leaf ethanol extract and 2.5% bay leaf ethanol extract).

Table 1. UV radiation absorption of cream at wavelength of 290-320 nm (5 nm interval)

No	Wave length (nm)	UV Radiation Absorption of				
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	290	0,02527	0,03393	0,06057	0,10373	0,39718
2	295	0,01945	0,02761	0,05593	0,08828	0,35372
3	300	0,01567	0,02453	0,05285	0,07903	0,32586
4	305	0,01424	0,02243	0,05075	0,07163	0,30122
5	310	0,01361	0,02109	0,04942	0,06442	0,27723
6	315	0,01407	0,01905	0,04737	0,05850	0,25694
7	320	0,01448	0,01772	0,04605	0,05378	0,24226

The SPF value and the effectiveness of creams

The SPF value of the cream can be calculated from the UV radiation absorbance value of creams by using the equation developed by Mansur. The SPF value of creams that have been calculated is presented in Figure 3. From Figure 3, it can be seen that the cream without active ingredients (sample 1) has the lowest SPF value (0.1512).

The SPF value of the cream increases if 0.5% soursop leaf extract (sample 2) or 0.5% bay leaf extract (sample 3) is added to the base cream. The SPF value of sample 2 is 0.2302 and the SPF value of sample 3 is 0.5132. If a mixture of active ingredients (0.5% soursop leaf extract and 0.5 bay leaf extract) is added to the base cream, the SPF value of the cream will increase to 0.7285. A cream containing 2.5% bay leaf extract and 2% soursop leaf extract (sample 5) has a higher SPF value (SPF = 3.0485) than a cream containing 0.5% soursop leaf extract and 0.5% bay leaf extract (sample 4).

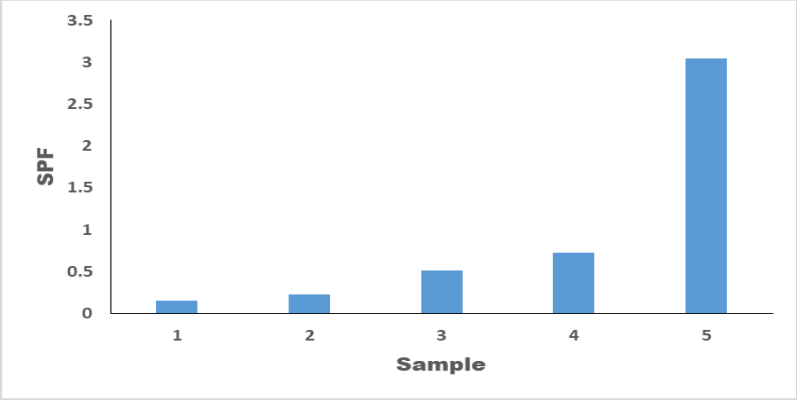

Fig 3. SPF Value of creams ((Sample 1 = cream without active ingredient, Sample 2 = cream with 0.5% soursop leaf extract, Sample 3 = cream with 0.5% bay leaf extract, Sample 4 = cream with 0.5% bay leaf extract and 0.5% soursop leaf extract, Sample 5 = cream with 2.5% bay leaf extract and 2% soursop leaf extract.)

From the results of this study, it can be seen that sample 3 (cream with active ingredient 0.5% bay leaf extract) has a higher SPF value than sample 2 (cream with active ingredient 0.5% soursop leaf extract). It is possible that bay leaf extract contains more active ingredients than soursop leaf extract, so that the absorption of UV radiation is higher. As a result, the SPF value of sample 3 is higher than sample 2, even though the concentration of active ingredients is the same.

In this study, samples 2-4 had SPF values below 2, so according to FDA (Food and Drug Administration) standards, these creams cannot be classified as a cream that has activity as a sunscreen. Sample 5 had the highest SPF value because it contained a mixture of active ingredients and had an increased concentration. This cream belongs to a class of sunscreen creams that have low protection power (low effectiveness).

CONCLUSION

In this research, samples 2-4 had SPF values below 2, so according to FDA standards, this cream cannot be classified as a cream that has activity as a sunscreen. Sample 5 (sunscreen cream with active ingredients mixed between 2.5% bay leaf extract and 2% soursop leaf extract) has the highest SPF value of 3.0485. This cream is included in the sunscreen cream with low protection power (low effectiveness).

EXPERIMENTAL SECTION

The materials that were used in this research include bay leaf extract, soursop leaf extract, virgin coconut oil, lanolin, cetyl alcohol, stearic acid, glycerin, triethanolamine (TEA), isopropanol (p.a), methyl paraben (p.a), propyl paraben (p.a) and distilled water (aquadest)

The apparatus that was used in this research includes laboratory glassware (such as measuring cups, beaker glass, measuring flasks, measuring pipettes, stirring rods, glass funnels, and watch glasses), electric stoves, digital scales, UV-Vis spectrophotometers (Hitachi U-2900), rotary evaporators, cream containers, and filter paper.

Work procedures

Preparation of cream with the active ingredients of bay leaf ethanol extract and soursop leaf ethanol extract

Using the formula in Table 1, sample 1 was prepared by heating the water phase (16 gram glycerin, 2 g TEA, 0.4 g methylparaben, and 142.3 g aquadest) and the oil phase separately, until they reached a temperature of 70 ^{o}C.

Table 2. Formula of cream

Materials	Sample				
	1	2	3	4	5
Oil phase					
Stearic acid (g)	16	16	16	16	16
Coconut oil (g)	20	20	20	20	20
Cetyl Alcohol (g)	2	2	2	2	2
Lanolin (g)	2	2	2	2	2
Prophyl paraben (g)	0.1	0.1	0.1	0.1	0.1
Water phase					
Glycerol (g)	16	16	16	16	16
Aquadest (g)	142.3	141.3	141.3	140.3	133.3
TEA (g)	2	2	2	2	2
Methyl paraben (g)	0.4	0.4	0.4	0.4	0.4
Actives ingredient					
Bay leaf extract	-	-	1	1	5
Soursop leaf extract	-	1	-	1	4

The water phase was then gradually added to the oil phase while stirring until homogeneous and the temperature reached approximately 35 o C. Using the formula in Table 1 and the same procedure as in the preparation of samples 1–5, were also made, but they were added the active ingredients of soursop leaf extract or bay leaf extract, or a mixture of both. A total of 50 mg of cream was dissolved with isopropanol in a 50 volumetric flask. Then the cream solution was determined to absorb UV radiation using a spectrophotometer at a wavelength of 290-320 nm (with 5 nm intervals). The resulting absorbance value is used to calculate the SPF value.

Calculation of SPF cream

The UV radiation absorption value of the cream that has been obtained was used to calculate the SPF value using the formula developed by Mansur. The Mansur equation [1] was:

$$SPF\ spectrophotometric = CFx \sum_{320}^{290} EE(\lambda)x\ I(\lambda)x\ abs(\lambda) \ldots\ldots\ldots (1)$$

Note:

CF = correction factor = 10, EE = erythema effect spectrum, I = sun intensity spectrum, Abs = absorbance of sunscreen products [15]. The normal values of EE x I for the SPF calculation are presented in Table 2. From the calculated SPF value, it can be determined whether the cream produced was effective or not. According to the Food and Drug Administration (FDA), based on the value of SPF cream, the effectiveness of sunscreens could be categorized into: low protection (SPF value 2–15), medium protection (SPF value 15–30), high protection (SPF value 30–50), and maximum protection level (SPF value > 50) [16].

Table 2. Normal value of EE x I for SPF calculating

Wavelength (nm)	EE x I
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180
Total	1

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