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Sunscreen Lotion Base on Ethanol Extract of Balakacida (*Chromolaena odorata)* Leaves to Prevent Skin Cancer

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Abstract.
Cases of skin cancer caused by exposure to ultraviolet rays continue to increase from year to year. So far, the prevention of skin cancer uses inorganic sunscreen lotion, only a few use ingredients from plants. In this research, a sunscreen lotion formula was made using the basic ingredients of the balakacida plant extract (*Chromolaena odorata*). The research was carried out in 4 stages namely; (1) preparation of balakacida leaf samples, (2) preparation of extracts, (3) preparation of lotion, (4) testing of the quality of sunscreen lotion including; sun protection factor (SPF), homogeneity, spreadability and pH values. Testing the SPF value using the ultra violet spectroscopy method and testing the pH using a pH meter. The results showed that the ethanol extract of balakacida leaves was 21.5% and the sunscreen lotion was a light green semi-solid substance. The results of the lotion quality test showed that the value of SPF, homogeneity, spreadability and pH values were respectively 26.95 at a concentration of 10%, homogen, 5.6 cm and 6.7. Based on the results obtained, it can be concluded that a sunscreen lotion made from balakacida leaves is very good to be developed as a sunscreen lotion to prevent skin cancer.

Keywords: ***s***unscreen, *e*xtract, lotion

Abstrak.
Kasus kanker kulit yang disebabkan oleh pajanan sinar ultraviolet terus mengalami peningkatan dari tahun-ketahun. Selama ini pencegahan kanker kulit menggunakan lotion tabir surya annorganik, hanya sedikit yang menggunakan bahan-bahan dari tumbuhan. Pada penelitian ini dibuat formula lotion tabir surya menggunakan bahan dasar ekstrak tumbuhan balakacida (*Chromolaena odorata).* Penelitian dilaksanakan dalam 4 tahap yaitu; (1) penyiapan sampel daun balakacida, (2) pembuatan ekstrak, (3) pembuatan lotion, (4) pengujian kualitas lotion meliputi; nilai sun protection factor (SPF), homogenitas, daya sebar dan pH. Pengujian nilai SPF menggunakan metode spektroskopi ultra violet dan pengujian pH menggunakan pH meter. Hasil penelitian menunjukkan bahwa kadar ekstrak etanol daun balakacida sebesar 21,5%. Lotion tabir surya yang dihasilkan berupa bahan semi padatan berwarna hijau muda. Hasil pengujian kualitas lotion menunjukkan bahwa nilai SPF, homogenitas, daya sebar dan pH berturut-turut sebesar 26,95 pada konsentrasi 10%, homogeny, 5,6 cm dan 6,7. Berdasarkan hasil penelitian dapat disimpulkan bahwa lotion tabir surya berbahan dasar ekstrak daun balakacida

memiliki kualitas sangat baik untuk dikembangkan sebagai losion tabir surya untuk mencegah kanker kulit.

Kata kunci: tabir surya, ekstrak, losion

Introduction

The sun is the main source of heat and light in the solar system and produces a wide range of electromagnetic radiation. Sunlight is very important to support survival on earth, such as the process of photosynthesis in plants that produces oxygen, synthesis of vitamin D, kills germs, phototherapy as well as a provider of light and a feeling of warmth (Gonzalez dkk., 2006). The skin requires sufficient moisture and also vitamin D which is produced by the body stimulated by sunlight (Anita, 2018). However, excessive exposure to sunlight can cause problems for the skin, ranging from the lightest skin turning black, burning, early aging of the skin to the most severe form of skin cancer and even death (Budiana dan Paul, 2022, Wright et al., 2012, Agung et al., 2020). Solar ultra violet radiations (UVR) are divided into three categories: UV-C (200-280 nm), UV-B (280-320 nm) and UV-A (320-400 nm) (Ferrero et al., 2002; Chawla et al., 2011) . UV-C is the most biologically damaging radiation, but it is filtered out by ozone layer. Currently UV-B radiation and to a lesser extent UV-A radiation are responsible for inducing skin cancer (Bendove et al., 2007).

One of the characteristic of UV rays is their ability to reach the earth even in cloudy weather and also through glass. UV light is also emitted by several types of light bulbs in rooms (WHO, 2003). So material or product is needed to protect the skin inside and outside the room. Products that function to protect the skin from sun exposure are sunscreens. Sunscreens and sun blocks are chemicals that absorb or block UV rays and show a variety of immunosuppressive effects of sunlight. The use of skin care products specially sunscreens may be an effective approach for reducing UVB-generated ROS-mediated photo-aging (Khan, 2018). About one million people are diagnosed with skin cancer every year and about 10,000 die. Most skin cancers occur on the parts of the body that are most often exposed to the

sun, such as the face, neck and head (Dutra dkk., 2004). Judging from how it works, sunscreen is divided into two, namely organic and inorganic sunscreens. Organic sunscreens work by absorbing harmful ultraviolet radiation, while inorganic sunscreens work by reflecting ultraviolet radiation (Duale et al., 2010). However, currently inorganic sunscreens have begun to be abandoned due to negative effects found in the form of irritation and triggering the formation of oxygen radicals which can damage skin cells (Murphy, 1999). Therefore, current research is more directed to find organic sunscreens. Organic sunscreen is increasingly in demand because it does not cause DNA damage, high efficacy, and does not cause whitish colour when applied (Duale et al., 2010, Budiana et al., 2014).

The efficacy of a sunscreen is also determined by the Sun Protection Factor (SPF) which is defined as a value that describes the ultraviolet energy needed to cause a minimal dose of erythema to protect the skin (Wolf et al., 2010, Mbanga, 2014). SPF is determined by spectrophotometric method reported by Mansur et al. Hydro alcoholic dilutions of oils were prepared and in vitro photo protective activity was studied by UV spectrophotometer in the range of 290-320 nm. It was observed that the SPF values for the in vitro screening methods are advantageous as they may represent a fast and reasonable tool reducing the number of in vivo experiments and risks related to UV exposure of human subjects. The in vitro SPFs were determined according to the method described. The observed absorbance values at 5 nm intervals (290-320 nm) were calculated by using the formula (Khan, 2013);

$$SPF_{spectrophootmetric} = CF \times \sum_{290}^{320} EE(\lambda) \times I \times Abs(\lambda)$$

Here, CF = correction factor (10), EE (λ) = erythmogenic effect of radiation with wavelength λ, Abs (λ) = spectro photometric absorbance values at wavelength λ.

The use of synthetic organic chemicals is still widely used in the manufacture of sunscreen preparations, while natural materials have not been widely used in the sunscreen product industry. Most research on natural ingredients as sunscreens is limited to testing extracts, very few of which extend to

the manufacture of products, either in the form of lotions or creams. One of the plants that has been studied as a sunscreen product is cherry leaf (*Muntingia calabura* L.) which turns out to be efficacious as a natural sunscreen even though its SPF value is still low (Anita, 2018). Secondary metabolite compounds contained in cherry leaves can function as antioxidants as well as sunscreens, including flavonoids, saponins, polyphenols, and tannins (Puspitasari, 2017). According to Lago et al (2008) compounds that can absorb ultraviolet radiation must have conjugated double bonds between aromatic rings in their molecules. Flavonoid compounds have quite long conjugated double bonds as shown in Figure 1, so it is very possible that these compounds function as absorbers of harmful UV rays.

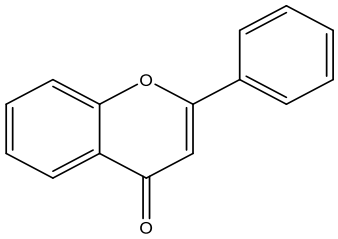

Figure 1. The basic structure of flavonoids

One of the plants that are widely found on the island of Timor is balakacida (Chromolaena odorata) which has been used traditionally as a source of medicine in various countries such as West Africa and Asian countries. This plant has the potential as a traditional medicinal ingredient because it contains phytochemical substances. This plant is known to contain bioactive compounds such as alkaloids, flavonoids, tannins, saponins, cardiac glycosides and mineral anthraquinones, vitamins and other compounds that have pharmacological activity. This plant also contains other compounds such as α-pinene, β-pinene, germacrene D, β-copaen-4-alpha-ol, β-caryophylene, geigerene, pregeijerene, cadinene, camphor, limonene (Agbafor et al 2015).

Method

Sample preparation

Balakacita leaf specifications obtained from Baumata Village, District of Kupang, East Nusa Tenggara. Baloakacia leaf determination is carried out in biologi aboratory to ensure the identity of the balakacida material, which are harvested properly and can be used in study. After being harvested, the balakacida leaves are sorted to choose balakacida leaves that are in good condition and to separate leaves from other impurities such as branches, twigs, soil, and so on. Results Sort the leaves then washed and dried in the oven for five days.

Extraction

A total of 1 kg of dried balakacida leaves was put in a glass botle and then soaked in 5 L of 70% ethanol for 7 days. The ethanol extract which still contains solvent is filtered and evaporated to obtain a solvent-free dry extract.

Sunscreen Lotion Formulation

The lotion is made by mixing 10 g of stearic acid and 5 ml of Moringa seed oil in a beker glass (oil phase). The oil phase than heated in a water bath until it melts (the temperature is maintained at 70-75 ^{o}C). An aqueous phase consisting of 5 g of glycerin, 5 g of triethanol amine (TEA) and 100 mL of distilled water was prepared, the mixture was heated in a water bath until liquid (temperature maintained at 70-75 ^{o}C). The two phases were put into a 250 mL beaker alternately and homogenized until a lotion mass was formed. Then 2.5 g of ethanol extract of balakacida leaves which had been dissolved in 5 g of glycerin was added to the mixture of the water phase and oil phase until a lotion was formed.

Sunscreen Quality Testing

Determination of SPF value

A total of 1 g of lotion was dissolved in 10 mL of 96% ethanol. The solution was then put into a cuvette and its absorbance was determined at a wavelength range of 290 to 320 nm. The absorbance value at each wavelength is entered into the equation;

$$SPF_{spectrophotometric} = CF \times 290 \sum 320\ EE(\lambda) \times I \times Abs(\lambda) \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Homogeneity Test

Apply 0.1 g of lotion on the watch glass evenly, the cream should show a homogeneous composition and no visible spots.

Spreadability Test

Weighed as much as 0.5 gram of lotion placed in the middle of a petri dish which is in an inverted position. Place another petri dish on top of the cream. Left for one minute. Measure the diameter of the lotion that spreads. Added 50 grams of additional load. Set aside for 1 minute and measure the diameter after the load reaches 500 grams.

pH determination

The examination was carried out by dipping the electrode into 0.5 gram of lotion which had been diluted using 10 mL of distilled water. The pH value indicated on the pH meter is read and recorded.

Result

The results of the extraction process showed that the ethanol extract of balakacida leaves was dark green, with a yield of 21.5% as shown in Figure 1.

Figure 1. ethanol extract of balakacida leaves

The results of making sunscreen lotion show that the resulting lotion is in the form of a light green semi solid as shown in Figure 2.

Figure. 2. Sunscreen lotion

The results of the SPF value test showed that the SPF value was 26.95 at a concentration of 10%. Data on the results of determining the absorbance of sunscreen in the wavelength range of 290-320 nm are shown in table 1.

Table 1. Absorbance data of 10% concentration sunscreen at various wavelengths

No	λ (nm)	EE x I	Absorbance	EExI x Absorbance
1	290	0.015	4.82	0.0723
2	295	0.0817	4.68	0.382
3	300	0.2874	4.51	1.296
4	305	0.3278	4.27	1.399
5	310	0.1864	3.95	0.736
6	315	0.0839	3.58	0.3
7	320	0.018	3.21	0.057
				∑ 2.695

The SPF value is obtained by plugging in the value of ∑ EExI x Absorbance into equation 1. Checking the homogeneity of the sunscreen formula aims to observe the presence of coarse particles on the slide. The test results show that the sunscreen lotions produced is homogeneous. The results of the spreadability test showed that the three lotions had a spreadability 6.5 cm. Which means it meets the requirements of a good sunscreen lotion.

The pH measurement aims to know the sunscreen lotion that is made is acid or base. According to SNI standard 16-4399-1996 pH value of skin products for sunscreens ranged from 4.5 to 7.5. The results of the pH test showed that the product has a pH of 6.7. This value indicates that the pH value is in the neutral range.

Discussion

The results of the extraction process showed that the ethanol extract of balakacida leaves was dark green, with a yield of 21.5%. The extraction stage in the study of active compounds (secondary metabolites) is one of the most important stages, because at this stage medicinal compounds are extracted from the plants. The extraction process uses the like-dissolve like principle, meaning that compounds that have similar polarity will be attracted by solvents or solvents that have the same polarity. In this study, the secondary metabolites found in the leaves of balakacida plant were extracted using pro-analytical ethanol solvent. The method chosen for the extraction process is the maceration method. This method has several advantages namely; easy to do, simple equipment and does not damage the active compounds that function as sunscreen.

Samples balakacida leave was prepared in the form of dry powder. The sample form in dry form can prevent damage to the drug or bioactive compounds contained in the sample by the zymatic process. While the preparation of samples in powder form aims to expand the contact area, so that the bioactive compounds can be attracted as much as possible.

To test the quality of the sunscreen produced, it is necessary to carry out a series of tests including determining the value of SPF, pH, spreadability and homogeneity. The results of the SPF value test showed that the SPF value was 26.95 at a concentration of 10%. The SPF value of 26.95 includes the criteria for ultra protection, which means that as much as 97% of UVB rays have been absorbed by the sunscreen produced by this study. The way organic sunscreen works is by absorbing the energy of UV radiation and converting it to a very low energy level so it won't harm the skin. Checking the homogeneity of the sunscreen formula aims to observe the presence of coarse particles on the slide. The test results show that the sunscreen lotions produced is homogeneous. Sunscreen that has good homogeneity can be applied evenly to the skin, thereby protecting all parts of the skin properly.

Spreadability Sunscreen cream must also meet the requirements for ease of use or application, so a spreadability test must be carried out. The diameter obtained in this test was observed because the larger the diameter, the easier it is to apply the cream tested. The results of the spreadability test showed that the lotion has a good spreadability. The results of the pH test showed that the product has a pH of 6.7. This value indicates that the pH value is in the neutral range. Sunscreen that has a neutral pH value will not cause irritation to the skin so it is safe to use.

When compared with the results of other similar studies, sunscreen lotion made from balakacida leaf extract has a better SPF value than sunscreen lotion made from cherry leaf extract with an SPF of 19.08 (Anita et al., 2018). This lotion is also higher than lotion made from the ethanol extract of faloak bark (*Sterculia urceolata* Smith) which has an SPF value of 1.8.

Conclusion

Based on the analysis of the results of the research that has been done, it can be concluded that sunscreen lotion can be made using the ethanol extract of balakacida leaves. The lotion has an SPF value which is in the category of ultra protection, has good of homogeneity and spreadability and has a neutral pH. So it can be concluded that a lotion made from balakacida leaf extract has the potential to be developed as a lotion to prevent skin cancer.

Suggestion

It is necessary to determine the SPF value at various extract concentrations above 10% so that at what concentration the lotion provides ultra protection to the skin

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