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Research Article

UV-Protection Activities of Labu Siam (*Sechium edule*) Extract Based on Sun Protection Factor (SPF)

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ABSTRACT: Exposure to sunlight has a negative effect on the skin. Sunscreens are used to protect the skin from the harmful effects caused by UV radiation. The ability of a sunscreen to protect the skin by delaying erythema is expressed by the value of the Sun Protection Factor (SPF). The purpose of this study was to analyze the UV protection activity of chayote (*Sechium edule*) based on the Sun Protection Factor (SPF) value, which was measured using UV-Vis spectrophotometry and calculated using the Mansyur equation. Based on the results of the study, it can be concluded that the SPF value of chayote (*Sechium edule*) extract has UV protection activity. At concentrations of 1%, 2%, and 3% there is activity as UV protection with SPF values of 7.487; 11.817; and 16,889. From the results obtained, it can be seen that the higher the concentration, the greater the SPF value obtained.

KEYWORDS: Chayote (*Sechium edule*); SPF; UV protection; UV-Vis spectrophotometry.

1. INTRODUCTION

The use of sunscreen is one effort that can be made to protect the skin from the harmful effects caused by UV radiation. The ability of a sunscreen to protect the skin by delaying erythema is expressed by the value of the Sun Protection Factor (SPF). The SPF value shows how often skin protection is obtained to be safe in the sun without experiencing damage. Sunscreens on the market are generally made from synthetic chemicals. Plant-natural ingredients have not been widely used in the sunscreen product industry (Nauclea., 2015).

The use of antioxidants in sunscreen preparations can increase photoprotective activity. The use of substances that are antioxidants can prevent various diseases caused by UV radiation. Several classes of active antioxidant compounds, such as flavonoids, tannins, anthraquinones, cinnamic and vitamin C have the ability to protect against UV rays (Hogade., 2010; Fawwaz et al., 2020; Fawwaz et al., 2023).

The natural material used in this study was chayote (*Sechium edule*). Siamese pumpkin leaves (*Sechium edule*) contain saponins, flavanoids, and polyphenols (Riana., 2010). While the flesh of chayote (*Sechium edule*) contains alkaloids, saponins, cardenolin/bufadienol, flavonoids, tannins, polyphenols and anthocyanins. Some of these active compounds, such as flavanoids, have been shown to exhibit antioxidant activity, which functions as a free radical blocker (Marliana et al., 2005).

Based on the description above, a study was carried out to analyze the UV protection activity of chayote juice (*Sechium edule*) based on the Sun Protection Factor (SPF) value.

2. EXPERIMENTAL SECTION

2.1. Sample collection and preparation

This study used chayote (*Sechium edule*) as a sample, which has a homogeneous population and purchased at a market in Makassar. The chayote (*Sechium edule*) sample was then peeled and washed, after that it was cut into pieces and put into the juicer, then filtered using a vacuum pump and filter paper, 500 mL of extract was then freeze-dried.

Dry chayote extract was weighed, various concentrations were made (0.1% w/v, 1% w/v, 2% w/v and 3% w/v) each was put into a 10 mL beaker and dissolved with 96% ethanol . The solution was ultrasonicated for 5 minutes and filtered using filter paper, each solution was put into a 10 mL volumetric flask then the volume was made up and homogenized (Mbanga et al., 2014).

2.2. Determination of SPF

The absorbance of each solution was measured at a wavelength of 290-320 nm using a 1 cm quartz cuvette at a wavelength interval of 5 nm using a UV-Vis spectrophotometer. In the measurement, 96% ethanol was used as a blank. The SPF value is calculated using the Mansur equation (Malsawmtluangi C. et al., 2013).

2.3. Data analysis

The data analysis of chayote extract with the absorption value obtained is multiplied by EE x I for each interval. The EE x I value for each interval can be seen in **Table 1**. The number of EE x I obtained is multiplied by the correction factor to finally obtain the SPF value of the sample tested.

How to calculate SPF according to the Mansyur method:

$$SPFspektrofotometer = CF \; x \; \sum_{290}^{320}\big((EE) \; x \; I(\lambda)\big) \; x \; (Abs(\lambda))$$

Where:
CF = Correction factor
EE = Spectrum of erythema effect
I = The intensity spectrum of the sun
Abs = Absorbance of sample
a). Absorption was measured at wavelengths of 290, 295, 300, 305, 310, 315 and 320 nm.
b). The absorption value obtained is multiplied by the EE x I value for each wavelength contained in table 1.
c). The absorption multiplication results with EE x I are added up.
d). The sum result is multiplied by a correction factor whose value is 10 to get the SPF value of the preparation.

3. RESULTS AND DISCUSSION

The results of research on UV-protection activity using chayote (*Sechium edule*) samples were measured using UV-Vis spectrophotometry and calculated using the Mansyur equation can be seen in **Table 1**.

Table 1. SPF value of Siamese pumpkin (*Sechium edule*) extract at several concentration variations

Sample	Concentration (%)	SPF Value	SPF Category
Extract labu siam (*Sechium edule*)	0.1	1.61	-
	1	7.48	Low
	2	11.82	Low
	3	16.88	Intermediate

Information:
SPF Strength Classification (Anderson., 2011).
a. Low SPF (low) SPF 2 - 11
b. Medium SPF (medium) SPF 12 - 29
c. High SPF (high): SPF 30 – 50

Exposure to sunlight harms the skin, such as premature aging, dark spots, or, most severely, skin cancer. To reduce the bad effects of sunlight, it is not enough to change behavior, and external protection measures must also be taken. SPF is a parameter that describes the effectiveness of a product or substance that is a UV protector. The SPF value indicates how often the skin protection is multiplied to be safe in the sun without experiencing erythema (Dutra et al., 2004).

The skin under excessive sunlight will last for 10 minutes before redness occurs, so the selection of UV-protection products is based on the SPF value multiplied by 10 minutes, which shows the durability of the sunscreen in protecting the skin. For example, the SPF value is 16, so the product can protect the skin for 16 x 10 minutes = 160 minutes, or 2 hours and 40 minutes under the sun before the skin turns red and feels burned. The SPF mechanism can ward off free radicals by absorbing and inhibiting melanin pigment that can accumulate, so that it can prevent the appearance of dark spots caused by excessive UV exposure.

In this study using samples of dried chayote (*Sechium edule*) juice, chayote (*Sechium edule*) juice had antioxidant activity, which showed an IC50 value of 34.35567 µg/mL. In this category, chayote (*Sechium edule*) had the highest antioxidant activity. tall. The use of antioxidants in sunscreen preparations can increase photoprotective activity. The use of substances that are antioxidants can prevent various diseases caused by UV radiation (Hogade., 2010). The extraction method used is squeezed using a juicer and dried using the freeze-dry method to minimize the water content.

The working method used is the spectrophotometric method, which is suitable for measuring SPF because the sample used is in the form of a solution and measurements are also carried out in the UV light area. Measurements were made at a wavelength of 290-320 nm, which is the UV-B wavelength. The experiment was carried out at UV-B wavelengths to measure the ability of compounds that have potential as sunscreens to protect the skin from UV-B. UV-B has energy that can penetrate the outermost layer of the skin (epidermis), whose effects can be seen directly in the form of erythema (Rai et al, 2007). This study also used a sonicator tool, used for 6 minutes, which aims to increase the permeability of plant cell walls so that they are more permeable to solvents and active compounds dissolve more quickly in solvents (Depkes RI., 2000).

Based on the measurement results, the SPF value is obtained using the Mansyur equation. Siamese pumpkin extract (*Sechium edule*) samples at a concentration of 1% and 2% had an SPF value in the low category, while 3% had an SPF value in the medium category. With values for each concentration of 7.48; 11.82; and 16,88. From the results obtained, it can be seen that chayote extract (*Sechium edule*), at a concentration of 3% has UV protection activity.

4. CONCLUSION

Based on the results of the study, it can be concluded that the SPF value of chayote (*Sechium edule*) extract has UV protection activity. At concentrations of 1%, 2%, and 3% there is activity as UV protection with SPF values of 7.48;

11.82; and 16.88. From the results obtained, it can be seen that the higher the concentration, the greater the SPF value obtained.

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