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Potential and Activities *in vitro* of the Sunscreen Lotion Preparation of Bawang Dayak (*Eleutherine americana* (Aubl.) Merr. by Ethanol Fraction from East Boneo

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Abstract

Has conducted research potential and activities *in vitro* of the sunscreen lotion of bawang Dayak (*Eleutherine americana* (Aubl.) Merr. by ethanol fraction from East Borneo. The aim of the research was to determine the activity and potential for inhibiting erythema (%Te) and pigmentation (%Tp) of the Dayak onion ethanol fraction in sunscreen lotion preparations in vitro at room temperature (27°C) and accelerated storage (40°C). The lotio preparation formulation uses Dayak onion ethanol fraction with concentrations of 0.1% and 0.2%, and the positive control uses Bless Sunscreen Lotion SPF 15®. Stages of research include the formulation and measurement of absorbance and value %Te) and %Tp at various storage temperatures with UV-Vis spectrophotometry at λ 292.5 to 372.5 nm. Analysis of research data used the SPSS 22 program, for homogeneity testing using the Levenne test and statistical analysis of comparative tests using the independent t-test. The results showed that ethanol fraction concentration in lotion preparations of bawang Dayak 0.1% and 0.2% active as a sunscreen included in the category of sunblock. The fraction is active as a sunscreen and in the Sunblock category, with the best concentration as a sunscreen being 0.2%, with its sunscreen potential not being significantly different from the control Sunscreen SPF 15® at the 5% level.

Keywords: Bawang Dayak, *Eleutherine americana*, lotion, sunscreen, erythema, pigmentation

1. INTRODUCTION

Sunscreen is an ingredient formula that contains active chemical compounds that absorb, scatter, or reflect sunlight on the skin, so it can be used to protect the function and structure of human skin from the damaging effects of solar rays [1]. Design sunscreen is intended to allow the compounds capable of effective prevention mechanisms against exposure to UV rays are three types of UV-A (λ= 320-400 nm), UV-B (λ= 290-320 nm), and UV-C (λ= 200-290 nm). [2]. Sunscreen compound is it can protect the skin against erythema (λ= 290-320 nm) is referred to as sunscreen UV-B or a compound that can protect the skin against the dangers of pigmentation (above λ320 nm) called sunscreen UV-A [3]. In human exposure to B-UV rays, the erythematous quick response usually occurs only in people who have skin types I and II, but the response is slow erythema and can occur in any person exposed to UV-B [9]. On the skin types III and IV of this response began to appear after 3-12 hours and reached its peak 20-24 hours after exposure to UV-B is characterized by erythema, followed by itching and pain in the area exposed to solar rays. In the light skin exposure to UV light by energy at 20-27mJ B / cm2 will cause erythema, known as DEM [4,9].

Increased melanin pigment after exposure to UV rays occurs in two stages; type of fast and slow type. Rapid pigmentation (immediate pigmentation) is due to oxidation of melanin pigmentation upon exposure to UV-A, and soon disappears when the exposure is terminated. This response was evident in dark-skinned people. Response was slow pigmentation (delayed pigmentation) occurs gradually, 48-72 hours after exposure to UV B rays due to the formation of new melanin and reached its peak after 5-7 days and disappear after a few weeks [5]. The mechanism of melanogenesis after UV exposure consists of the activation of tyrosinase by DNA damage and DNA recovery as a signal to increase melanogenesis [4].

Herbs that grow in Indonesia one of the widely used is the Plant bawang Dayak (*E. Americana*) has been used for generations by the Dayak community as a medicinal plant. The empirically used local people as a drug laxative urine, drug vomiting, laxatives, drugs jaundice, cancer, cysts, prostate, diabetes, gout, hypertension, digestive disorders of the stomach, cholesterol, mumps, bronchitis, body endurance, sexual disorders, lumbago, and fatigue [6]. In bulbs contained in bawang Dayak natural chemical compound that alkaloids, glycosides, flavonoids, phenolic, steroids and tannins [7]. According to Prasad, at all [8] flavonoids are phenolic compounds important, and has a spectrum of activity including a comprehensive chemical and biological arrest free radicals. Bawang Dayak extract bioactivity obtained ethanol extract values LC_{50} of 89, 12 ppm; n-hexane of 32.35 ppm; ethyl acetate of 87.17 ppm; n-butanol of 89.12 ppm [9]. Antimitotic effects bawang Dayak extract against for Egg Pig (*Tripneustes gratilla* Linn.) each activity is n-hexane extract 16.03 ppm, ethanol extract 4.08 ppm and ethyl acetate extract 2.07 ppm [10]. A search on the determination of the antioxidant activity of ethanol extract of bulbs bawang Dayak showed strong inhibitory activity with a value IC_{50} of 25.3339 ppm [11].

2. MATERIALS AND METHODS

2.1. Material

Bawang Dayak, stearic acid, distilled water, ethyl acetate, glycerin, isopropyl alcohol, methanol, methanol pro analyze, methyl paraben, mineral oil, n-hexane, cetyl alcohol, Tri Ethanol Amin (TEA), and tween 80, patent preparation Sunscreen Lotion SPF 15®.

2.2. Instrument

Separating funnel, pH meter, pipette volume, micro pipette, rotary evaporator, UV-Vis spectrophotometer, analytical balance, incubator (Memmert).

2.3. Method

2.3.1. Research Design

The study design using design laboratory experiments includes testing the activity of ethanol fraction as sunscreen using UV-Vis spectrophotometry at **ʎ** 292.5 to 372.5 nm, base formulations and extracts into the base, the treatment room temperature storage temperature of 27 °C and 40°C accelerated Freeze thaw method with 5 cycles of 30 days [12], absorbance measurement, calculation of percent transmission erythema (%Te) and transmission pigmentation (%Tp) with the trade preparations Bless Sunscreen lotion SPF 15® as a positive control.

2.3.2 Analysis of results potential activity

This research is a descriptive quantitative analysis. The calculation of the potential activity use of the statistics IBM SPSS 22 software [13].

2.3.3 Analysis data Research

Data from measurements of the treatment room temperature at a storage temperature of 27°C and the accelerated Freeze thaw method of 40°C with 5 cycles of 30 days were tested for homogeneity, and for differences test in activity between treatments at room temperature storage (27°C) and accelerated temperature (40°C) between using t -independent test used Levenne test [13].

3. RESULT AND DISCUSSION

3.1. Activities ethanol fraction bawang dayak (BD)

In the measurement of sunscreen from BD ethanol fraction, the ethanol fraction of prepared using the test solution concentration methanol pro analyze with concentration of 20, 40, 60, 80 and 100 ppm. Concentrations measured absorbance by using UV-Vis spectrophotometer at a wavelength (**ƛ**) of 292.5 to 372.5 nm which is a wavelength that can cause erythema and pigmentation. Calculation of percentage transmission erythema (%Te) and pigmentation transmission (%Tp) based on the absorbance (A) of each wavelength used absorbance (A).

Results of calculations %Te and %Tp obtained from the measurement results, then skewer with literature data by categories such as sunblock, protection ultra, suntan, or fast tanning [14]. The percentage value of transmission erythema and pigmentation fraction ethanol BD each test concentration can be seen in Table 1.

Table 1. Value percentage Transmission Erythema and Pigmentation ethanol fraction BD

Cont. (ppm)	% Te	% Tp
20	0,9012	0,8854
40	0.8073	0,7808
60	0.6935	0.6509
80	0,6446	0,5724
100	0,5127	0,4672

Table 1 show that the greater the concentration of the test the smaller the value %Te and %Tp. The percentage decrease in the transmission of erythema and pigmentation indicates that the greater the ability of UV absorption by the fraction extract, meaning that the more strongly inhibits the process of erythema and pigmentation. The calculation of the value of %Te and %Tp (Table 1) concluded that the ethanol fraction BD included in the Sunblock category, as a percentage value of transmission erythema (%Te) obtained is less than 1% [14].

3.2. The concentration of the best preparation as a sunscreen lotion before and after storage

Determining the best concentration of ethanol fraction BD in the preparation of lotions as sunscreens is measured by the ability of inhibition rays Ultra violet (UV) based on the parameter percent transmission erythema (%Te) and the percent transmission of pigmentation (%Tp) values using statistical analysis of comparative tests (t-test) of independently using IBM SPSS 22 software is based on the value of significance which compare with a level of 5%. Data and Charts %Te and %Tp value can calculation results are presented in Table 2.

Table 2. Comparison Value %Tp SD_2 0.2%, and SD_1 to 0.1% storage temperature of 40°C for 30 days Freeze thaw method

No.	Preparation	%Te	%Tp
		after storage Freeze Thaw (40°C)	
1.	SD_2	0.0573	0.0289
2.	SD_1	0.2983	0.2058

The results of t-test calculations independent tets erythema percent transmission (%Te) and the percent transmission of pigmentation (%Tp) between the test preparation SD2 concentrations of 0.2% to 0.1% concentration SD1 obtained significant results (significant difference) with the Sig. 0.011 < 0.05 for the %Te and the Sig. 0.002 < 0.05 for the %Tp at the level of 5%. It indicates that there are differences sunscreen real activity between the test preparation SD2 and SD1 at the level of 5%.

Tabel. 3 Independent test results (t-test) % Te and % Tp of SD_2 and SD_1 test preparations at 40°C storage using the Freeze thaw method

		Levene's Test for Equality of Variances (%Te)		Levene's Test for Equality of Variances (%Tp)	
		F	Sig.	F	Sig.
Value	Equal variances assumed	7.225	0.011	11.354	0.002

3.2. The concentration of the best preparation as a sunscreen lotion before and after storage

Determining the potential of preparations lotion sunscreen lotion test concentrations of 0.2% (SD_2). Election as the test preparation SD_2 compared with the controls trade stocks Sun Screen SPF 15® for activity sunscreen better than the SD_1 test preparation. Analysis of potential sunscreen independent test using statistical tests (t-test). The percentage value of transmission erythema (%Te) and transmission pigmentation (%Tp) preparations trademarks of Sun Screen SPF 15® and test preparation ethanol fraction of BD (SD2) accelerated temperature 40°C can be seen in Table 4.

Table 4. The percentage value of transmission erythema (%Te) and the percent transmission of pigmentation (%Tp) each preparation test.

No.	Preparation	%Te	%Tp
		after storage Freeze Thaw (40°C)	
1.	SC SPF 15® control	0,0222	0,0194
2.	SD_2 0.2%	0,0573	0,0289

Based on the results of independent t-test or Levene's Test calculation of the percentage data erythema (%Te) and pigmentation (%Tp) between SD_2 and control preparations of Sun Screen SPF 15® after 30 days of storage Freeze thaw method 40°C, showed no significant value with the Sig (0.495 > 0.05) for the %Te and the Sig of 0.181 > 0.05 for the %Tp at a level of 5% (Table 5). That is the test preparation SD_2 stated to have potential comparable to sunscreen preparations control of Sun Screen SPF 15® at 5% confidence level

Table 5. The results of an independent test test (t-test) %Te between preparation control SC SPF 15® with test preparations (SD_2) concentration of 0.2% at 40°C storage to uses Freeze thaw method.

Independent Samples Test					
		Levene's Test for Equality of Variances (%Te)		Levene's Test for Equality of Variances (%Tp)	
		F	Sig.	F	Sig.
Value	Equal variances assumed	0.476	0.495	1.871	0.181

Data Table 5 shows that the %Te and %Tp values calculated using Levene's Test for Equality of Variances for each test preparation are less than 1%, this indicates that the ethanol fraction BD included in the Sunblock category. According to Balsam and Sagarin [14] a suntan product with a percent value erythema (%Te) <1.0 and a percent value pigmentation (% Tp) between 3 - 40 belongs in Sunblok (total blocks).

The ability of ethanol fraction BD gives inhibitory activity alleged by the ultraviolet rays of secondary metabolites contained in the ethanol fraction BD. The secondary metabolites class contained in the ethanol fraction BD allegedly provides protection activities are alkaloids, flavonoids, phenolic, and steroids [7]. According Kochevar et al., [4] melanogenesis mechanisms after UV exposure consists of the activation of tyrosinase by DNA damage and DNA recovery as a signal to increase melanogenesis.

Explaining that UV rays cause an increase in the amount of melanin granules scattered throughout epidermal keratinocytes and serve to reflect and absorb UV rays. When these granules are reduced, several UV light energy to reach the surface of the skin so that the skin can occur degeneration process and photocarcinogenesis [15]. Based approach to the working mechanism of the above, it is alleged the working mechanism of secondary metabolites fraction of BD in inhibiting melanogenesis after exposure to UV light is contained secondary metabolites ethanol fraction BD is able to absorbance UV light so that energy UV light cannot reach the surface of the skin in order to prevent the activation of tyrosinase, thus preventing damage to DNA which is a signal for increased melanogenesis and prevent the degeneration process and photocarsinogenesis.

4. CONCLUSION

The ethanol fraction of *E. americana* (Aubl.) Merr is active as a sunscreen and in the sunbloc category, with the best concentration as a sunscreen being 0.2%, with its sunscreen potential not being significantly different from the control Sunscreen SPF 15® at the 5% level.

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