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SCREENING OF SUNSCREEN POTENTIAL IN NATURAL PLANT

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ABSTRACT:

Bougainvillae spectabilis Willd is a shrubby and thorny plant. The flowers are collected into three, belonging to the Nytaginaceae family, which is efficacious as a sunscreen because they contain active compounds such as flavonoids and phenolics, which are polyphenolic compounds. In present work things like the SPF value, the amount of erythema transmitted (Te%), and the amount of pigmentation transmitted (Tp%) was measured for ethanolic extract. *Bougainvillae spectabilis Willd* was extracted by maceration for 4 days and remaceration for 2 days using ethanol as the solvent, and the yield percentage was 12.50%. Furthermore, phytochemical screening and an in vitro Sunscreen Activity Test were carried out using the UV-Vis spectrophotometer. The results showed that the ethanolic extract of *Bougainvillae spectabilis Willd* contained flavonoids, alkaloids, saponins, tannins, and phenolics. Based on the sunscreen activity test, the ethanol extract made in 4 concentrations showed maximum sunscreen activity at SPF values with concentrations of 600 ppm , 800 ppm.

KEYWORDS: *Bougainvillae spectabilis Willd*., Antioxidant and Sunscreen Activity, SPF,.

INTRODUCTION:

Herbal Sunscreen (also known as Herbal sunblock, Herbal suntan lotion) is a lotion, spray or other topical product that helps protect the skin from the sun's ultraviolet (UV) radiation, and which reduces sunburn and other skin damage, with the goal of lowering the risk of skin cancer with the help of herbes.[1]

Advantages of Herbal Sunscreens: (1) Easily available. (2) No side effect. (3) No special equipment needed for preparation. (4) Renewable resources. (5) Botanical ingredients are easily available. (6) They are inexpensive. [3]

Sun protection is vital to protect skin and eyes from the damaging effect of the sun because exposure to ultraviolet radiation contributes to ageing skin and is the main cause of skin cancer. Some people may need to take particular care because of photosensitivity.

According to their wavelength and physiological effects, ultraviolet rays are classified as either ultraviolet-A (320–400nm), ultraviolet-B (290–320nm), or ultraviolet-C (100–280 nm).[1]

The most harmful ultraviolet photons are UV-B rays because they produce both short-term alterations like erythema, pigmentation, and photosensitivity and long-term impacts like premature aging and skin cancer when they strike human skin. Prevention of the adverse effects of sun exposure can be done by using sunscreen.

Sunscreen is that blocks ultraviolet (UV) light from damaging the skin. Physical sunscreens have a mechanism for reflecting and scattering ultraviolet radiation and are not translucent, while chemical sunscreens have a mechanism to absorb ultraviolet radiation.[2]

The development of sunscreens is currently more directed at the use of natural ingredients because they are cheaper, easier to obtain, and do not have harmful side effects.[3] The Sun Protection Factor (SPF) value, the percentage of erythema transmission (%Te), and the percentage of pigmentation transmission (%Tp) all proved to the sunscreen efficacy of *Bougainvillea spectabilis Willd* extract.

The regular, daily use of modern cosmetic products can potentially be very important for the long-term health of the skin. Among the most useful ingredients are sunscreens, which block ultraviolet radiation absorption by the skin, either wholly or in part. Many formulations that are on sale include lotions, creams, pastes and gels, and rely on either chemical or physical agents for their protective action. These are the most important group of preparation herbal sunscreen should either scatter the incident light effectively or they adsorb the erythemal portion of the sun radiant energy. [4]

MATERIALS AND METHODS:

1. Equipment:

The following instruments were used: a conical flask, a measuring cup, a porcelain cup, a test tube, a dropper, a spatula, a beaker, a stirring rod, a maceration vessel, a measuring flask, an analytical balance, an evaporator, an oven, a hotplate, a water bath.

2. Material:

The sample used in this study was *Bougainvillae spectabilis* Willd and materials that had proanalytic quality (pa) were Ethanol (Merck), H_2SO_4 (Merck), $FeCl_3$ (Merck), NaOH (Merck), acetic acid (Merck), 70% ethanol, Mayer's reagent ($HgCl_2$ + KI), HCl (Merck), aluminum foil, filter paper, and tissue.

Method:

1. Collection of samples of *Bougainvillae spectabilis Willd* were collected in bhusawal, Jalgaon City
2. Preparation of Simplicia

   Bougainvillae spectabilis Willd powder which was taken and then washed with running water, then dried by aerating. After that it was mashed and sieved with a 60 mesh sieve, then weighed as needed.
3. Maceration of *Bougainvillae spectabilis Willd* Simplicia

   Powder 250 grams of *Bougainvillae spectabilis* Willd simplicia powder was put into a maceration vessel, then moistened with sufficient ethanol. Following a 30 minute standing time, 800mL of ethanol was added to the maceration solution. kept for five days, stirring every so often, in an area shielded from direct sunlight . 4 days later, the mixture was filtered, and the filtrate was collected. Using 250mL of ethanol, the pulp was re-macerated. In order to obtain a thick extract, the results of the liquid or macerate extract were first evaporated using an evaporator at a temperature of 60°C, then concentrated once more using a water bath. The results were then stored in a closed container and kept in a cool and dark place for two days. Then the % yield was calculated using the formula:

4. Phytochemical Screening of Ethanol Extract *Bougainvillae spectabilis Willd*

a. Identification of Flavonoids

The 0.15 gm thick extract was split into four test tubes after being dissolved in 10mL of ethanol. The first tube served as a positive control, then NaOH and concentrated H_2SO_4 were introduced to the second, third, and fourth tubes, respectively. The tube's hue was contrasted with that of the control tube. If the hue changes, flavonoids are present.[5]

b. Identification of Alkaloids

The 0.5gm extract in a test tube was added with 2 mL of 70% ethanol then stirred, added 5mL of 2N HCl, heated on a water bath. After cooling, the mixture was filtered and the filtrate was added 2-3 drops of Mayer's reagent. The sample is then observed until it is cloudy or a precipitate is formed[6].

c. Identification of Saponins

The extract was weighed up to 0.1 gm, then mixed in 15mL of hot water and boiled for 5 minutes. The mixture was then filtered, and up to 10 mL of the filtrate were obtained and placed in a test tube. The mixture is then agitated until froth or bubbles form. 2 N HCl was added in 1drop. If the foam is allowed to stand for 10minutes, the test for the presence of saponins in the solution will be positive[5].

d. Identification of tannins

The extract was dissolved in ethanol until the sample was completely submerged. Then 2-3 drops of 1% $FeCl_3$ solution were added. Positive results are indicated by the formation of a black or bluish green color[5].

e. Identification of Phenolic

The extract was weighed as much as 0.1gm, then added 20mL of $FeCl_3$ solution. Positive results of the presence of phenolic compounds in the solution were indicated by the formation of a green to blue-black color[5].

5. Preparation of Test Solution A

In order to create a solution with a concentration of 1000ppm, a total of 100mg of extract was weighed in a 100mL volumetric flask, dissolved in pa ethanol, and then diluted once more to get concentrations of 200, 400, 600, 800, and 1000ppm.

6. Determination of the Value of Sun Protection Factor (SPF)

Antioxidant Activity and Sunscreen Test is carried out by determining the SPF value using UV-Vis Spectrophotometry. The ethanol extract solution of *Bougainvillae spectabilis Willd* which had been prepared in 5 concentration series was then measured its absorbance at a wavelength between 200-400nm.

7. Determination of Transmission of Erythema and Pigmentation

The ethanolic extract solution of *Bougainvillae spectabilis Willd* made in 5 concentration series was measured for absorbance at a wavelength between 250-350 nm to calculate the percentage of erythema transmission and at a wavelength of 250-350 nm to calculate the percentage of pigmentation.

Data analysis:

1. Value of Sun Protection Factor (SPF)

The absorption spectrum of the sample was obtained by measuring using a UV-Vis spectrophotometer at a wavelength of 290-400nm using alcohol as a blank, the absorption value was recorded every 5nm interval at a wavelength of 290-320nm. Where the absorption value obtained is multiplied by EE x I for each interval. The value of EE x I for each interval, the number of EE x I obtained is multiplied by the correction factor of 10, finally the SPF value of each sample being tested is obtained.

formula:

CF = Correction Factor

EE = Erythema Effect Spectrum

I = Intensity Spectrum from the Sun

Abs = Absorbance of the Sample

A preparation is said to provide protection if it has an SPF value of 2-100.

2. Percent Value of Erythema

Erythema Transmission (%Te) =

T = Fe transmission value = Erythema flux

Ee = T. Fe = total erythema flux transmitted by the extract at a wavelength of 292.5 - 317.5nm

3. Percent Transmission Pigmentation

The value of % transmission of pigmentation is calculated by the formula:

Transmission of Pigmentation (%Tp) =

T = transmission value Fp = pigmentation flux

Ep = T.Fp = the amount of pigmentation flux transmitted by the extract at a wavelength of 322.5 – 372.5nm

Fp = Amount of UV light energy that causes pigmentation

RESULTS AND DISCUSSION:

A. Preparation of *Bougainvillae spectabilis Willd* Flower:

Making the extract started by taking the simplicia *Bougainvillae spectabilis Willd* in bhusawal Jalgaon City. The criterion is used because at harvest there is a change in plant growth from vegetative to generative and at that time the accumulation of active compounds in high conditions so that they have good quality.[7] *Bougainvillae spectabilis Willd* was then sorted wet and washed with running water with the aim of separating from impurity particles.

The next process is drying by aerating so as not to damage the components of the active compounds contained in *Bougainvillae spectabilis Willd*. After that, the dried simplicia was mashed using a blender and sieved with a sieve no. 60 mesh according to the level of fineness.

The *Bougainvillae spectabilis Willd* powder obtained was then extracted by maceration method. This method is preferred in order to preserve the compounds which are not resistant to heating. Maceration was carried out for 4 days and then re-maceration was carried out for 2 days with ethanol as a solvent. Remaceration is carried out with the hope that the active compounds contained in *Bougainvillae spectabilis Willd* can be extracted optimally. The obtained macerate was evaporated using a rotary evaporator at a temperature of 64 °C, where the temperature corresponded to the boiling point of ethanol so that the solvent could be evaporated and a thick extract was obtained. The ethanol extract of *Bougainvillae spectabilis Willd* obtained had a yield percentage of 12.50%.

B. Phytochemical Screening of Ethanol Extract *Bougainvillae spectabilis Willd*:

Phytochemical screening was carried out to determine the presence or absence of compounds contained in *Bougainvillae spectabilis Willd* such as flavonoids, alkaloids, saponins, tannins, and phenolics. The identification results can be seen in Table1.

Table 1: Phytochemical identification of the ethanolic extract of *Bougainvillae spectabilis Willd*

Compound	*Reagent*	*Result*	*Description*
Flavonoid	1st tube as control	Yellow color formed	Positive
	2nd tube was added with NaOH	Light brown color formed	
	3rd tube was added with concentrated H2SO4	Dark brown color formed	Positive
Alkaloid	Mayer	cloudy	Positive
Saponin	a. Hot water, then was shaken	a. Foam formed	Positive
	b. HCl 2 N,then was shaken	c. Foam stayed	Positive
Tannin	$FeCl_3$ 1%	Blackish green color formed	Positive
Phenolic	$FeCl_3$ 1%	Blackish blue color formed	Positive

The identification of flavonoids in the viscous extract was positive indicated by the difference in color in tube 2 and tube 3. Tube 2 showed a light brown color after adding NaOH and tube 3 when added concentrated H_2SO_4 produced a dark brown color which was suspected that the ethanol extract of *Bougainvillae spectabilis Willd* contained flavonoids.[5]

The results of the identification of alkaloids showed that there was a change in the extract, namely the extract became cloudy which was suspected to be the ethanolic extract of *Bougainvillae spectabilis Willd* containing alkaloid compounds.[6]

The results of the identification of saponins showed the presence of foam which was suspected to be the extract of *Bougainvillae spectabilis Willd* containing saponin compounds.[5]

The results of the identification of tannins showed that the color changed to blackish green which was suspected to be the ethanolic extract of *Bougainvillae spectabilis Willd* containing tannin compounds.[5]

The results of the identification of phenolic in the extract showed a color change to blue-black which was thought to contain phenolic components in the extract of *Bougainvillae spectabilis*.[6]

C. Determination of Sunscreen Activity Ethanol Extract *Bougainvillae spectabilis Willd*:

Sunscreens are preparations designed to reduce the harmful effects of skin exposure to ultraviolet light. In general, sunscreens have a mechanism, namely that UV rays emitted when they meet the sunscreen will be absorbed.[2]

The sun emits light with an ultraviolet (UV) wavelength between 200 and 400 nanometers. Three types of UV rays—UV-A, UV-B, and UV-C—are distinguished by their various wavelengths and radiation effects. In this research, UV-A and UV-B wavelengths (290–400nm) were used to test the effectiveness of sunscreen. The SPF (Sun Protection Factor) number and the Percent Transmission of Erythema and Percent Transmission of Pigmentation are used to determine the efficacy of sunscreen.

Table 2: SPF Value

	SPF Value			
Replication	**200 ppm**	**400 ppm**	**600 ppm**	**800 ppm**
1	2.420	8.531	22.439	73.960
2	2.594	7.128	17.218	53.827
3	2.735	7.178	22.490	65.313
Average	2.583	7.612	20.715	64.367
Category	Minimal protection	Extra protection	Ultra protection	Ultra Protection

Category of sunscreen protection according to FDA SPF Values Category of Sunscreen Protection: 2–4 Minimum, 4–6 Moderate, 6–8 Extra, 8–15 Maximum, >15 Ultra.

A product's or UV protective agent's efficiency is described by the sun protection factor (SPF), the higher the number. The higher the active ingredient's SPF rating, the better the sunscreen's ability to shield the skin from UV radiation damage.[8]

Using the spectrophotometric technique and UV light wavelengths, the SPF value of the ethanolic extract of *Bougainvillae spectabilis Willd* was determined in vitro. With 5 nm intervals, the absorbance (A) of each concentration was measured at a wavelength between 290 and 400nm. Based on Table 4, the results of measuring the SPF value obtained an average SPF concentration value (200, 400, 600 and 800ppm) of 2.583; 7.612; 20.715 and 64.367 respectively.

The average SPF value at a concentration of 200 ppm is 2.583, where both SPF values are included in the minimal protection category. Minimal protection is a category for assessing sunscreen activity where the active substance is able to protect the skin from UV-B rays but only temporarily. At a higher concentration, namely a concentration of 400ppm, the SPF value is 7.612 and this value is included in the category of extra protection. Extra protection is a category of sunscreen activity assessment where the active substance is able to prevent sun exposure by absorbing 95% or more of UV radiation. At doses of 600 and 800ppm, the ultra protection categories are 20.715 and 64.367. Ultra protection is a category for rating the effectiveness of sunscreens when the active ingredient has the capacity to shield the skin from UV rays by absorbing them for an extended period of time. As the extract content increased with increasing SPF value. Among these concentrations, 200 ppm has the lowest SPF value (2.583) and 800 ppm has the highest SPF value (64.367). In addition to the calculated SPF value, the determination of sunscreen activity is also carried out by calculating the erythema transmission value (%Te), and the results of the %Te measurement are shown in Table 3.

Table 3. Percentage of Erythema Contagion (%Te) *Bougainvillae spectabilis Willd* Ethanol Extract

Erythema Values				
Replication	Concentration of Extract			
	200 ppm	**400 ppm**	**600 ppm**	**800 ppm**
I	42.206	17.091	7.630	2.919
II	42.340	18.403	8.934	2.940
III	41.779	18.563	6.847	2.949
Average	42.108	18.019	7.803	2.936
Category	*Fast tanning*	*Fast tanning*	*Regular*	*Extra Protection*

Classification of sunscreens based on the percentage of erythema transmission. Total blocks <1.0, Extra Protection 1-6, Regular 6-12, Quick tanning 10-18. Erythema is a symptom of an inflammation brought on by UV radiation. By converting the sample's absorbance, which was measured between 250 and 400 nm, to the percentage of transmission, one may determine the proportion of erythema transmission. The test was repeated three times, and the average result of %Te at doses of 200 and 400 ppm was included in the rapid tanning group, indicating that the sample exhibited some sunscreen-like action but that it was only moderately strong at these concentrations. better sunscreen than the *fast tanning*, even samples with a concentration of 600ppm showed regular sunscreen activity and 800 ppm in the extra protection category showed maximum sunscreen activity, this indicates that the higher the concentration, the lower the percentage of erythema transmission, where the concentration of 200 ppm had the largest erythema transmission of 42.108 % and the concentration of 800ppm had the smallest percentage of erythema

transmission, which was 2.936 %. The 800 ppm concentration has the ability to protect the skin from sun exposure, which is greater than the 200 ppm concentration.

Table 4: Percent Value of Pigmentation Transmission *Bougainvillae spectabilis Willd*

Replication			**Pigmentation Value**	
	200 ppm	400 ppm	600 ppm	800 ppm
I	57.739	33.020	21.043	12.795
II	56.510	34.376	22.975	13.677
III	56.512	34.671	20.351	12.915
Average	56.920	34.022	21.255	13.129
Category	*Extra protection*	*Total block*	*Total block*	*Total block*

Pigmentation is a discoloration of the skin caused by disease or injury that can cause darkening of the skin. The absorbance conversion value of the material measured at a wavelength of 250-350 nm to the value of % T yields the percentage of transmission pigmentation. Herbal Sunscreen is a lotion, spray or other topical product that helps protect the skin from the sun's ultraviolet (UV) radiation, and which reduces sunburn and other skin damage.[9-16] The test was carried out 3 times, the average value of % Tp (Table 4) and the low concentration of *Bougainvillae spectabilis* Willd ethanol extract showed sunscreen activity in the extra protection category, which means the extract, has more ability to protect the skin so that the skin is more protected from exposure to UV rays that cause pigmentation. *Bougainvillea spectabilis* were highly effective in anti-inflammatory action.[17] This demonstrates that the higher the concentration, the higher the percentage of pigmentation transmission, with the concentration of 200 ppm having the highest percentage of erythema transmission, which was 56.920 and the concentration of 800 ppm having the lowest. The concentrations of 400, 600, and 800 ppm are included in the category of total block or sunblock, which means that the extract has the ability to perfectly protect UVA rays that cause pigmentation.

The concentration of 200 ppm has the ability to protect the skin from sun exposure, which is smaller than the concentration of 800 ppm.

The data reveal that the ethanol extract of *Bougainvillae spectabilis* Willd made in 4 concentration series, namely 200, 400, 600, and 800 ppm, has sunscreen activity. These data include the SPF value, the percentage of erythema transmission (%Te), and the percentage of pigmentation transmission (%Tp). At a concentration of 600 ppm, the SPF value of the ethanolic extract of *Bougainvillae spectabilis Willd* has its full potential,

and at a concentration of 800 ppm and 200 ppm, respectively, the values of %Te and %Tp were both able to effectively block UV-A rays.

CONCLUSION:

The ethanolic extract of *Bougainvillae spectabilis Willd* showed sunscreen activity.

The extract of *Bougainvillae spectabilis Willd* contains flavonoid compounds, alkaloids, saponins, tannins and phenolics. The ethanolic extract of *Bougainvillae spectabilis Willd* has SPF values at concentrations of 200, 400, 600, and 800 ppm, respectively, which are 2.583, 7.612, 20.715 and 64.367. The percentage values of erythema transmission at concentrations of 200, 400, 600 and 800 ppm were 43.809%, 18.019%, 7.803% and 3.072%, respectively. The percentage values of pigmentation transmission at concentrations of 200, 400, 600 and 800 ppm were 42.108, 18.019, 7.803, 2.936 respectively. Furthermore the sunscreen formulation can be prepared with extract of *Bougainvillae spectabilis Willd.*

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