



RESEARCH ARTICLE

Determination of Sun Protecting Factor of Pigment Isolated from *Bixa Orellana*

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ABSTRACT

The aim behind doing this work is to determine SPF (sun protecting factor) of given herbal drug *Bixa Orellana* which is previously used in cosmetics. SPF is a laboratory measure of effectiveness of sunscreen factor. Higher the SPF value more protection against ultraviolet radiation which causes sun burn disease. SPF determination is the in vitro testing of sunscreen activity with the help of UV spectrophotometer (290-320). Here different concentrations of *Bixa Orellana* extract were taken under consideration of photo protective test to prove its efficiency in the sunscreen activity.

KEYWORDS

Bixa Orellana, Sun Protecting Factor, Cosmetics

INTRODUCTION

Ultra Violet Radiations (UVR) exposure to skin causes skin disorders such as squamous cell carcinoma, basal cell carcinoma,¹ accelerated skin ageing, immune depression of skin and photodermatoses.^{2,3} The UV radiations are categories in three categories as such UV-C (200-280nm), UV -B (280-320nm) UV-A (320-400nm). From above three categories of UV radiations, UV-C radiation can cause severe biological damage to skin as compared to UV-B and UV-A radiation. But UV-C radiations are filtered by the ozone layer, so UV-B and UV-A radiation are currently the reason for causing skin cancer.⁴ So as to avoid this radiation to cause damages to the skin sunscreen agents are used which act as an protective agents against harmful UV radiations.

Sunscreen agent formulations are available in large numbers in market today obtained either for synthetic or natural source.

The example for synthetic agents are Octabenzol, Ocetyl methoxyciinan-ate, Benzophenone-3, Provatene, 2-Ethoxy ethyl p-methoxycinnamate, Sulisobenzone, Mexenone, Avobenzone, Dioxybenzone, 4-dimethyl amino benzoic acid, etc. and the example to natural agents are Antioxidant (alpha carotene, Ascorbic acid, Flavonone and Flavones), Vitamins and Enzymes (Superoxidedismutase, Peroxidase and Proteolytic).¹

Sunscreen agents are to be considered effective when they have good sun protecting factor (SPF). Which is the ratio of UV spectrometric energy required to produce a minimal erythema dose (MED) in protected skin to unprotected skin. The in vitro model for determination of SPF is screen the absorbance of prepared solution of herbal extract between 290-320 nm at every 5 nm intervals. SPF can be calculated by applying the following formula known as Mansur equation.^{5,6}

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

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Where,

CF = Correction factor (10)

EE (λ) = Erythmogenic effect of radiation with wavelength λ

Abs (λ) = Spectrophotometric absorbance values at wavelength λ .

The values of $EE(\lambda) \times I(\lambda)$ are constants and given in table 1.

Table 1

Wavelengths (nm)	Value of $EE(\lambda) \times I(\lambda)$
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0837
320	0.0180

Bixa Orellana (Bixaceae) is a native plant of Argentina, Bolivia, Brazil, Chile, and Colombia and exotic to India. It grows to about 5 to 6 meters high and has a peculiar reddish saps about 10-30cm long initially green in colour which changes to red on ripening and it is fully covered by soft spines and opens in to two compartments on drying.

Bixa plant is commercially grown for the high pigment content annatto in its seed coat which is edible colouring agent, antibacterial, antimicrobial, nontoxic, and biodegradable and can be used in preparation of cosmetics.^{7,8,9,10}

Here the determination of SPF (Sun Protecting Factor) of *Bixa Orellana* will prove its Excellency in sunscreen ability.

MATERIALS AND METHODS

Collection of Plant Material

The herbs used for determination of SPF were collected in the month of October 2014 from the medicinal garden of Alard college of pharmacy,

Pune and Authentify by the botanical survey of India (No.BSI/Tech./2014/CP02). The seed powder extract is used for determination of SPF.

Preparation of Standard Solutions

The dry powder of seeds of *Bixa orellana* is extracted with ethanol for 18hrs. After completion of extraction the filtered extract is concentrated to reduce the volume $1/10^{th}$.¹¹ and remaining solvent is evaporated to get a reddish brown extract is used for determination of SPF.

10 mg of extract was dissolved in 100 ml ethanol solvent to produce 100ppm (parts per million) solution. From prepared 100ppm solution 0.2ml, 0.4ml & 0.6ml solution is pipette out and diluted up to 10ml to produce 2ppm, 4ppm & 6ppm. And this solution is subjected to further process for determination of SPF.

Determination of SPF Value

The absorbance of working standards were taken in the fixed wavelength mode and wavelengths are 390nm, 295nm, 300nm, 305nm, 310nm, 315nm and 320nm with the help of UV spectrophotometer (JASCO SPECTROPHOTOMETER152761148) and obtained absorbance were multiplied with EE values and their summation was multiplied with correlation factor 10.

RESULTS AND DISCUSSION

The SPF of different concentration of *Bixa Orellana* was determined by using UV spectrometric analysis is shown in table 2. (JASCO SPECTROPHOTOMETER152761148) and the spectrometric analysis is recorded in Image 1.

Mode	Sample Name	Comment	290.0 nm	295.0 nm	300.0 nm	305.0 nm	310.0 nm	315.0 nm	320.0 nm	
1	Blank-1		0.1941	0.1877	0.1817	0.1763	0.1719	0.1672	0.1624	
2	Sample-1	2 ppm	bixa orellana	0.4518	0.4513	0.4360	0.4192	0.3744	0.3452	0.3575
3	Sample-2	4 ppm	bixa orellana	2.1211	2.1434	2.1208	2.0819	1.9139	1.8320	1.8629
4	Sample-3	6 ppm	bixa orellana	2.7031	2.7856	2.8109	2.8060	2.6821	2.6291	2.6453
5	Sample-4	8 ppm	bixa orellana	2.7816	2.8999	2.9074	2.9301	2.9311	2.8669	2.8710

Table 2

Wavelength (nm)	EE _(λ) employed	Concentration 1. (2ppm)	Concentration 2. (4ppm)	Concentration 3. (6ppm)
290	0.0150	0.4518	2.1211	2.7031
295	0.0817	0.4513	2.1434	2.7855
300	0.2874	0.4360	2.1208	2.8109
305	0.3278	0.4192	2.0619	2.8060
310	0.1864	0.3744	1.9139	2.6821
315	0.0837	0.3452	1.8320	2.6291
320	0.0180	0.3575	1.8629	2.6453

The SPF values of different concentrations are 2ppm, 4ppm, & 6ppm having respectively and shown in table 3.

Table 3

Concentrations	SPF value
2ppm	5.295
4ppm	19.379
6ppm	40.156

Which proves that higher the concentration of extract having higher the SPF value.

CONCLUSION

The research provides highlight on the use of herbal ingredient in the preparation of sunscreen formulation by proving its potency against sun burns. Were *Bixa Orellana* seed extract was previously used in herbal cosmetics lipstick and here we are proving its effectiveness in sunscreen which proves its Excellency in the use of safe herbal preparations and we can say that use of this type of natural ingredient in the

formulations is step towards healthy and safe cosmetics.

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