Formulation & Evaluation of Sun Protective Activity of *Elaeocarpus angustifolia* Blume

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Abstract

SPF stands for Sun Protection Factor and level of protection offered by sunscreens when applied to the skin at a thickness of 2 mg/cm2. Elaeocarpus angustifolia Blume common name is Rudraksha and its family is Elaeocarpaceae. The ethanol extract of Elaeocarpus angustifolia blume leaves was the cream was prepared and evaluated by using different parameters such as Appearance, pH, Spreadability, Viscosity & Washability test Sunscreen activity of plant ethanol extract of plant was found to be 35.06±2.12. Sunscreen activity of cream formulation of ethanol extract of was found 2.55 ±0.006. The conclusion of the study was found to be E. angustifolia leaf extract could be used as additives to improve the SPF of other sunscreen formulas. Ethanol extract of Elaeocarpus angustifolia Blume leaves will considerably improve and enhance the UV absorption qualities of traditional sunscreen composition. Additionally, it will increase the sunscreen's capacity to block UV rays, which is in addition to its biggest benefit of preventing harmful and undesirable effects of artificial sunscreen ingredients.

Key words: *Elaeocarpus angustifolia Blume, Mansur formula, SPF, Sunscreen, UV.*

INTRODUCTION

Herbal sunblock (additionally called herbal sunblock, herbal suntan ointments). It is mostly a topical product and it is a balm, sprinkle, or other topical result that allows the skin to be protected from ultraviolet (UV) radiation from the sun and which reduces sunburns and other skin damage with the goal of lowering the risk of skin cancer with the help of herbs. [1] To help prevent sunburn, sunscreen is a local product that also absorbs or reflects some of the radiation from the sun (UV) rays. It is also known as sultan lotion, sun block, or sun protection. Today, sunscreen is a common type of makeup and offers extra health advantages in addition to aesthetic ones.[2] The UVA and UVB rays make up the metabolically active ingredients of ultraviolet (UV) light. On the sunblock bar, the sun screen factor, or SPF, it mostly refers to the ability to block UVB rays, which are responsible for sunburns. Some of the most recent sunscreens also provide UVA protection. [3]

ADVANTAGE OF SUNSCREEN: [4, 5, 6]

1. Using sunscreen reduces your risk of developing skin cancer and pre-cancers while protecting your skin.
2. Sunscreen shields all skin types
3. Even if you have a darker complexion and some protection from sunburns provided by your skin's melanin, you should still shield your skin from the sun's harmful ultraviolet radiation.
4. Dependend energy source
5. Access to botanical ingredients is simple.
6. Is easily accessible
7. They are inexpensive [7]

Herbal Sunscreen Benefits [8, 9]

Many people who have sunburns and sensitive skin are eager to use herbal remedies instead of chemical sunscreens because of the chemicals, their concentration, and the negative effects they can have on the skin. Nowadays, individuals pay a higher interest rate for herbal products. Without using any extra tools, the herbal sunscreens are simple to make. They may be found easily, and they are produced using renewable resources with widely available materials. They have no negative side effects and cost less.

SPF

SPF, which stands for Sun Protection Factor, is the system used globally to assess the level of protection offered by sunscreens when applied to the skin at a thickness of 2 mg/cm2. The test determines the amount of UV radiation (mostly UVB) needed to produce a scarcely noticeable sunburn on a certain person with and without sunscreen applied. For instance, if it takes 100 minutes to burn without protection and only 10 minutes with protection, the SPF of such sunscreen is 10 (100/10).[10]

In vitro SPF Estimation by Mansur Equation [11]

Equation

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

CF –Correction factor.
EE (λ) – Erythmogenic effect of radiation.
Abs (λ) – Spectrophotometry absorbance values at wavelength λ.

Introduction to *Elaeocarpus angustifolius* Blume[12]
Synonyms: Elaeocarpus grandifloras, Elaeocarpus dentatus, Elaeocarpus kirtonii,
Common Name: Elaei and Carpus are combined to get the Greek word Elaeocarpus. Elaei, which is Greek for "wild olive tree," and Carpus represent "fruit," so the fruit seed from. Elaeocarpus is a genus of untamed olive-like trees. In India, there are several alternative ways to spell Rudraksha (Table: 1).

Table 1: Common name of Rudraksha

Common Names of Rudraksha
Sanskrit, Hindi & Marathi: Rudraksha
Bengali: Rudrakya
Kannada: Rudrakshi
Tamil: Akkamrudrakai
Telugu: Rudraksha Halu
English: Woodenbegar

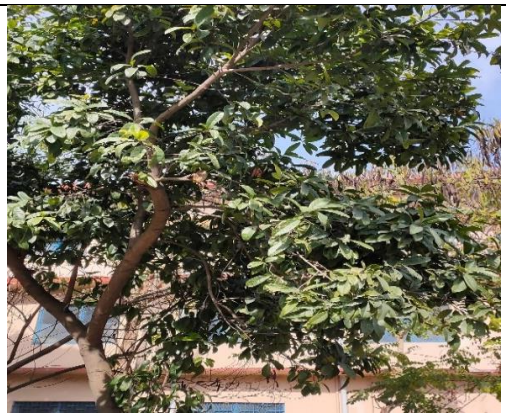

Figure 1: Tree of *Elaeocarpus angustifolia Blume*

MATERIAL & METHODS

Plants Sample

The fresh leaves of the plants *Elaeocarpus angustifolia Blume* were collected from local area Dehradun in month of April. The medicinal plant species was identified and authenticated from Botanical Survey of India, (BSI), Dehradun.

Preparation of Plant Extract

Elaeocarpus angustifolia Blume leaves were employed for extraction utilising the maceration method using ethanol.[13] The leaves of Plants were macerated with 250ml of ethanol at

room temperature for 3 days with frequent agitation and then filtered through filter paper. filtrate was collected, evaporated and concentrated.

Preparation of the extract solution [14]

0.2gm of extract were weighed and transfer to 100ml volumetric flask. Volume that has been ethanol-diluted and then filtered through cotton rejection the first 10ml ,25.0ml, aliquot transfer to 50ml volumetric flask and diluted to volume with ethanol. Then 25.0ml aliquot was transferred to a 50ml volumetric flask and the volume complete with ethanol.

Spectrophotometric measurement & SPF determination of extract. [14]

The absorption spectra of solution were obtained in the range of 290 to 325 nm, at every 5 nm.

Three determinations were made at each point using ethanol as a blank.

Then the SPF value were determined using Mansur equation.

Equation

$$SPF\ Spectrophotometric = CF * {}_{290}\Sigma^{320}\ EE\ (\lambda) * I\ (\lambda) * Abs\ (\lambda)$$

Formulation of Cream

Formulation of an oil in cream with a water (O/W) emulsion base (semisolid formulation). The emulsifier (stearic acid) and other oil soluble components (Oil Phase Part A) were dissolved and heated to 75° C in the oil phase. Plant extract preservatives and other water-soluble components dissolved in aqueous phase (Part B) and heated to 75° C. After heating, the aqueous phase was gradually added to the oil phase, stirring constantly until the emulsifier cooled.[15]

Table 2: Composition of Cream formulation.

S.NO	Ingredients	Uses	Components(%w/w)
1	Cetostearyl alcohol	Emulsifier	5
2	Stearic acid	Emollient ,Emulsifier	2
3	Carbopol	Gelling agent	0.5
4	Methyl paraben	Preservative	0.3
5	Triethanolamine	Surface active agent	0.5
6	Cetyl alcohol	Emollient, Coemulsifier	1
7	Extract	Active ingredient	2
8	Distilled water	Vehicle	q.s (up to 100ml)

Evaluation Parameter of Cream [16]

Appearance:

Colour, Texture, and Odour were used to assess the cream's appearance.

pH Measurement:

1 g of cream was dissolved in 9 ml of distilled water to determine the pH by using pH meter**.**

Spreadability: The parallel plate method is the most commonly used method to determine the propagability of semi-solid preparations. The configuration consists of two glass blades placed in a tripod support in which the excessive formulation (3 g) was applied between two glass slides. The upper slide is mobile and the lower slide was firmly attached to the support. For 5 minutes, 100 g of weight was placed, the cream and the edges were cancelled to compress the lotion for a uniform thickness. Then, a weight of 50 g was added at side of the slide and the slide is pulled until it covers a distance of 10 cm. The time in seconds needed to separate two glass blades in 10 cm was taken as a measure of the Spreadability. A shorter interval indicates better performance**.**

$$S=m.l/t$$

Where S=Spreadability, m= Weight tried to upper glass slide**,** l=Length of glass slide, t=Time taken to separate them.[17]

Viscosity: Viscosity of the cream formulation was determined by Brookfield Viscometer. The viscosity done using spindle no 64 and gradually from 20 rpm.

Washability Test: Amount of cream was applied over the skin of hand and wash with tap water for 10 minutes. Time noted when the cream completely removed.

Preparation of the Cream solution

Place around 1.0g of the sample in a 100mL volumetric flask and fill the remaining 3/4 of the flask with ethanol. For about 10 minutes, sonicate the contents, then add ethanol to adjust. Filter the mixture using Whatman No. 1 filter paper, collecting the filtrate after discarding the first few milliliters of it. Pick up 5 mL from the aliquot. in a 50mL volumetric flask, adding ethanol to an appropriate level. Add 5 mL of the diluted solution to the next step.25mL volumetric flask filled with ethanol to an appropriate level.[18]

Spectrophotometric measurement & SPF determination of Cream

The absorption spectra of solution were obtained in the range of 290 to 320 nm, at every 5 nm.

Three determinations were made at each point using ethanol as a blank.

Then the SPF value were determined using Mansur equation.

RESULTS AND DISCUSSION

Collection and Identification of Plant materials

The fresh leaves of the plants were collected from local area Dehradun in month of March. The medicinal plant species was identified and authenticated from Botanical Survey of India, (BSI), Dehradun under Accession number: BSI/ NRC/Tech./Herb. (Ident.)/2022-23/84 864 on date 6/05/2022.

Preparation of Plant Extract

Figure 2: Ethanol extract of leaves of *Elaeocarpus angustifolia Blume*

SPF values of the ethanol extract of leaves of *Elaeocarpus angustifolia* blume Plant extracts: According to the findings of this investigation, *Elaeocarpus angustifolia blume* ethanol extract exhibits stronger UV absorption than aqueous extract (Table- 3) The SPF value of ethanol extract of leave *Elaeocarpus angustifolia Blume* was be 35.06 ± 2.12.

Table 3: SPF value of Ethanol extract of leaves of *Elaeocarpus angustifolia* Blume

SPF value of Ethanol extract of leaves of *Elaeocarpus angustifolia Blume*			
Wavelength (λ nm)	**$EE_{(\lambda)}$ x $I_{(\lambda)}$**	**Absorbance Value ($abs_{(\lambda)}$)**	**$EE_{(\lambda)}$*$I_{(\lambda)}$*$abs_{(\lambda)}$**
290	0.015	3.9371	0.05905
295	0.0817	3.6156	0.2953
300	0.2874	3.4360	0.9875
305	0.3278	3.6785	1.2058
310	0.1864	3.5227	0.6566
315	0.0839	3.0258	0.2538
320	0.018	2.6758	0.0481
SPF			35.06±2.12

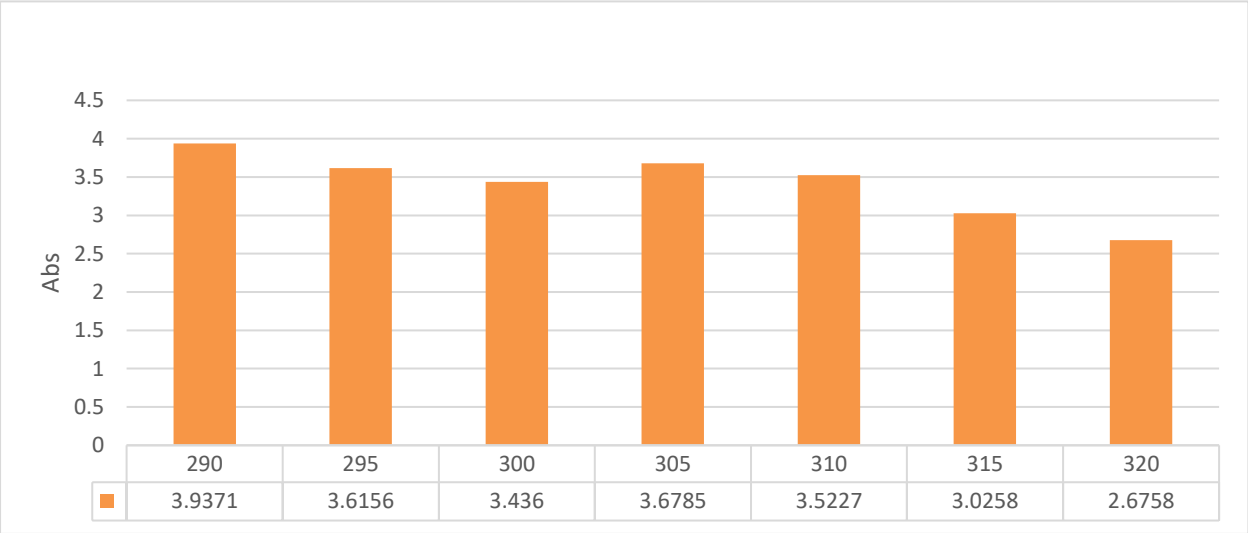

Figure:3 Spectrophotometric Measurement of Ethanol extract of leaves of *Elaeocarpus angustifolia* Blume

Formulation of Cream

The sunscreen formulation of *Elaeocarpus angustifolia* Blume (leaves) ethanol extract was effectively made, and its SPF value was 2.55 ±0.006 (Table 4) determined using the UV Spectrophotometric method.

Table 4: SPF value of formulation of cream

SPF value of formulation of cream			
Wavelength (λ nm)	**$EE_{(\lambda)} \times I_{(\lambda)}$**	**Absorbance Value ($abs_{(\lambda)}$)**	**$EE_{(\lambda)} * I_{(\lambda)} * abs_{(\lambda)}$**
290	0.015	0.3053	0.0045
295	0.0817	0.2847	0.0232
300	0.2874	0.2692	0.0773
305	0.3278	0.2531	0.0829
310	0.1864	0.23803	0.0443
315	0.0839	0.22516	0.0188
320	0.018	0.2138	0.0038
SPF			2.55 ±0.006

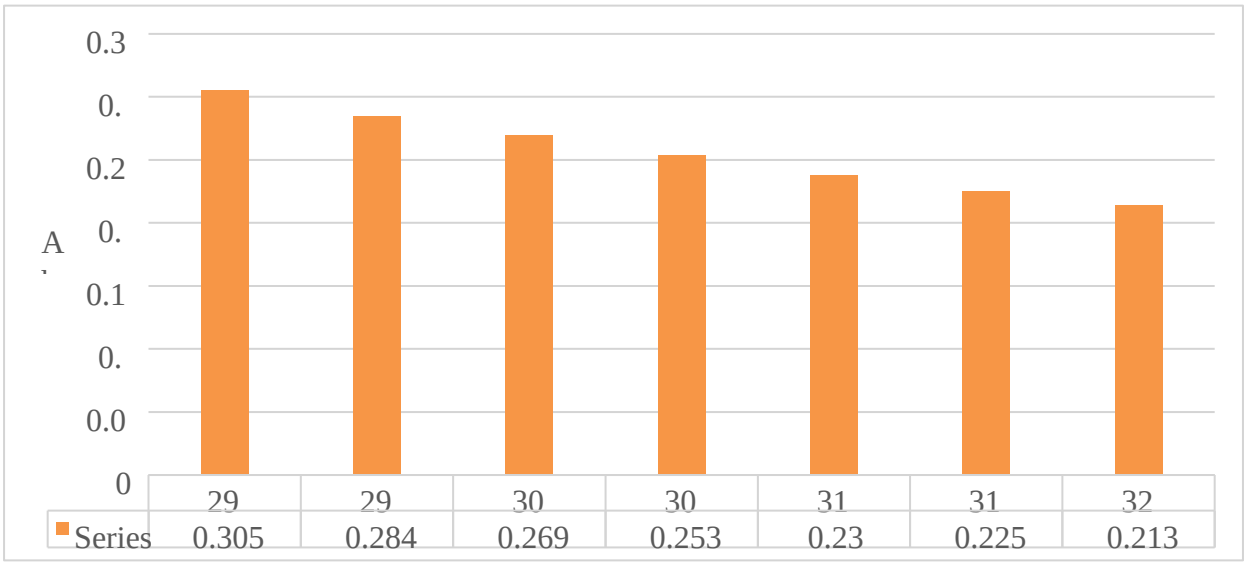

Figure-4: Spectrophotometric Measurement of Cream (Ethanol Extract)

Table 5: Evaluation parameters of Cream

pH	5.0
Color	Pale Yellow
Viscosity	270Cp
Spreadability	100
Texture	Good
Appearance	Smooth
Odour	Pleasant

CONCLUSION

Due to increased knowledge of the need for protection from the sun, it can be stated that the market for sunscreen chemicals, whether synthetic, natural, or combined, has a large potential. UVB and UVA radiation are dangerous. A minimum ideal requirement for a sunscreen product is that it be photo stable, uniform UVA/UVB protective, and have a high SPF. This study looked at the effectiveness of *Elaeocarpus angustifolia Blume* extract as sunblockers. Sunscreen activity of plant ethanol extract of plant was found to be 35.06±2.12. Extract formulations are developed and assessed based on their pH, colour, viscosity, Spreadability, texture, washability, odor & appearance. Sunscreen activity of cream formulation of ethanol extract of was found 2.55 ±0.006, This study came to the conclusion that *E. angustifolia* leaf extract could be used as additives to improve the SPF of other sunscreen formulas. The findings show that these extracts and their formulations can be employed in pharmaceutical compositions as sunscreens. These extracts might be used in products that are safer and more affordable than chemical sunscreens in the future, either by themselves or in combination with other components.

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REFERENCE

1. Boyd AS, Naylor M, Cameron GS, Pearse AD, Gaskell SA, Neldner KH. The effects of chronic sunscreen use on the histologic changes of dermatoheliosis. Journal of the American Academy of Dermatology. 1995 Dec 1;33(6):941
2. Shanbhag S, Nayak A, Narayan R, Nayak UY. Anti-aging and sunscreens: paradigm shift in cosmetics. Advanced pharmaceutical bulletin. 2019 Aug;9(3):348.
3. Jangde R, Daharwal SJ. Herbal sunscreen: An overview. Research Journal of Topical and Cosmetic Sciences. 2011;2(2):35-9.
4. Thakur A. Comparative Life Cycle Assessment of Sunscreen Lotion Using Organic Chemicals Versus Nano-Titanium Dioxide as UV Blocker. Arizona State University; 2014.
5. Geoffrey K, Mwangi AN, Maru SM. Sunscreen products: Rationale for use, formulation development and regulatory considerations. Saudi Pharmaceutical Journal. 2019 Nov 1;27(7):1009-18.
6. Kaimal, Sowmya, and Anil Abraham. "Sunscreens." *Indian Journal of Dermatology, Venereology and Leprology* (2011);77.2: 238.
7. DeBuys HV, Levy SB, Murray JC, Madey DL, Pinnell SR. Modern approaches to photoprotection. Dermatologic clinics. 2000 Oct 1;18(4):577-90.
8. Chauhan R, Bhatt B, Kaushik S. A REVIEW ON NATURAL PHOTOPROTACTANTS FOR SUNSCREEN.
9. Bhatt B , chourasia H, singh R, kaushik S and devi A. Review on: Photoprotection from UV radiation: Role of herbal plants. International Journal of Biology, Pharmacy and Allied Sciences. April, 2021, 10(4): 1235-1247
10. Kim SM, Oh BH, Lee YW, Choe YB, Ahn KJ. The relation between the amount of sunscreen applied and the sun protection factor in Asian skin. Journal of the American Academy of Dermatology. 2010 Feb 1;62(2):218-22.

11. Ali ZS, Muhammad D, Zrieki A. In vitro Assessment of sun protection factor (SPF) and Antioxidant activity of Viola odorata extracts. Research Journal of Pharmacy and Technology. 2022 Feb 26;15(2):655-60.
12. Naresh K, Mukesh D, Vivek A. Rudrakha: A Review On Mythological, Spritual And Medicinal Importance. Global Journal of Research on Medicinal Plants & Indigenous Medicine. 2013;2(1):65.
13. Bhatt B , chourasia H, singh R, kaushik S. Phytochemical Profile and in vitro Sun-Protective Activity of *Polyalthia longifolia* (Sonn.) Thwaites Bark Extracts. Tropical Journal of Natural Product Research. August 2022; 6(8):1174-1177
14. Mbanga L, Mpiana PT, Mbala M, Ilinga L, Ngoy B, Mvingu K, Mulenga M. Comparative in vitro Sun Protection Factor (SPF) values of some herbal extracts found in Kinhasa by Ultraviolet Spectrophotometry. J. of Physical and Chemical Sciences. 2015;2(4):1-6.
15. Bambal V, Wyawahare N, Turaskar A, Mishra M. Study of sunscreen activity of herbal cream containing flower extract of Nyctanthes arbortristis L. and Tagetes erecta L. International Journal of Pharmaceutical Sciences Review and Research. 2011;11(1):142-6.
16. Aswal A, Kalra M, Rout A. Preparation and evaluation of polyherbal cosmetic cream. Der Pharmacia Lettre. 2013;5(1):83-8.
17. Matangi SP, Mamidi SA, Raghavamma ST, Nadendla RR. Formulation and evaluation of anti aging poly herbal cream. skin. 2014;5(6).
18. IMAM S, AZHAR I, MAHMOOD ZA. In-vitro evaluation of sun protection factor of a cream formulation prepared from extracts of Musa accuminata (L.), Psidium gujava (L.) and Pyrus communis (L.). IN-VITRO. 2015;8(3).