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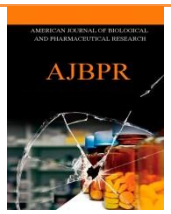


# DESIGN AND DEVELOPMENT OF SUNSCREEN LOTIONS INCORPORATING HERBS

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**ABSTRACT**

The sunscreen lotions are used to protect the skin from UV radiations of the sun. These sunscreens are also used for the treatment of sun induced skin diseases. The experiments are conducted on sunscreen to show activity of anti UV rays. Skin cancers, erythema are commonly occurred dude to UV absorption rays. UV spectrum is divided into three different Categories as UVA, UVB, and UVC. The UVA is of two types such as UVA1 & UVA2. The present study was conducted to produce herbal sunscreen lotioms which are extracted from the plants like aloe vera, SPF that is sun protection factors are evaluated and even protect the skin from ultra violet radiation. From the results of these tests, formulation SS2 was found to be more stable as well as better sunscreen. The formulations with herbal extracts (SS1 and SS2) showed comparatively high SPF on the formulation devoid of these extracts (SS3) and stood competitive to the standard marketed formulations.

## INTRODUCTION

The sunscreen lotions are used to protect the skin from UV radiations of the sun. These sunscreens are also used for the treatment of sun induced skin diseases. The experiments are conducted on sunscreen to show activity of anti UV rays. Skin cancers, erythema are commonly occurred dude to UV absorption rays. UV spectrum is divided into three different Categories as UVA, UVB, and UVC. The UVA is of two types such as UVA1 & UVA2.

The sunscreens are produced by reducing the chemical UV filters and shows anti ultra violet activity. The wavelength of UVA ranges from 320 to 400nm, UVB is about 290 to 320nm and UVC of 100 to 290.The UVA of 99% is reached earth, while UVB up to 10% reaches the earth surface. Bio active agents show safety, less ambient impact and sustainability. In this, the active ingredients are extracted from the plant and used in sunscreen lotions to heal and smoothen the skin. Phyto constituents such as phenolic acid, polyphenols and flavanoids may avoid the inner and outer surface damage to the skin. These are commonly used for the preparation of cosmetic products. At the cancer stage, mutagenic, anti carcinogenic, and non toxic agents of botanical compounds may produce inhibitory effect on plethora [1-6]. The photo protective agents are involved in multi stage method of the carcinogenesis, but these agents are not used frequently in sunscreen lotions due to its toxicity. Phytochemical compositions are of bioactive agent curcumins. Alpinia ganglia avoids UV rays and is commercially used. The raw materials like aloe vera, olive oil, almonds, green tea, cucumber and basil which are extracted from the plants are used in the sunscreen preparations. The allergic reactions like irritation, swelling, hepatic, thrombolytic, tumor, bacteria and protozoans are treated by the sunscreen lotion. The present study was conducted to produce herbal sunscreen lotions which are extracted from the plants like aloe vera, SPF that is sun protection factors are evaluated and even protect the skin from ultra violet radiation [7-10].

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## MATERIALS & METHODS

The plant materials used in the formulation were collected from the whole sale supplier of Herbal Crude Drugs, Mumbai, India. Instruments used for analysis were pH meter (Systronic, India), Brookfield viscometer [DV-I, LV-I spindle, Brookfield Engineering Laboratories, USA], Muffle furnace [77 S8HT8,Tempo, India], Micro centrifuge [RM-12CDX, Remi, India], Deep freezer [RQF 650, Remi, India] and UV-V spectrophotometer [UV 1700, Shimadzu, Japan] [11-17].

### Lab animals

Wistar albino rats (150-200 g) of four groups, including control and standard group, each with three animals were selected. The selected animals were housed in acrylic cages at standard environmental conditions at 25 ± 2ºC, relative humidity of 45-55%, in a well ventilated room maintained at 12:12 h light: dark cycle, fed with standard rodent diet and water *ad libitum*. All the animals were acclimatized for a week before experiment.

### Extraction and Processing

The leaves of *Aloe vera* (Liliaceae)and *Oscimum sanctum* (Lamiaceae) were finely ground and separately passed through sieve no. 80. 500 g of each powder was macerated for 3 days with 95% ethanol and filtered. The filtrates were dried using a vacuum desiccator. 45 g of each extract was weighed and dissolved in 150 ml of ethanol (300 mg/ml). This was concentrated to a final volume of 135 ml [18-20].

### Formulation Design

Accurate quantities of Cetyl alcohol, Zinc oxide**,** stearic acid, glycerin, and Hydroxy propyl methyl cellulose (HPMC) (as per table 1) were weighed. Accurate quantity of water was measured and taken into a 400-mL beaker. 1.0 g of triethanolamine was added to the water and stirred. The water solution was heated to a temperature of 80ºC to 85ºC.After the water solution has reached the required temperature, melted Cetyl alcohol, Zinc oxide, stearic acid, glycerin, Hydroxy propyl methyl cellulose mixture and Propyl paraben was slowly poured into the water solution a little at a time, stirring constantly. Stirring was continued until a smooth, uniform paste was obtained. The prepared sunscreen lotion was set aside to cool. Then weighed quantity of Aloe gel, Ethanol extract of *Oscimum* (EEO), Vitamin E (as per table 1) were added and stirred well until all the ingredients mixed uniformly. Finally Lavender oil was added as flavoring agent. A total of three formulations, SS1, SS2 and SS3 were prepared using various formulas (table 1) [4-6].

### EVALUATION

Efficacy of herbal sunscreens was determined by *In-vitro* method using UV-Visible spectrophotometer. 0.10% solution (w/v) each of the three formulated sunscreen lotions in n-propyl alcohol was prepared by dissolving 0.050 g of the sunscreen lotion in 50.0 mL of n-propyl alcohol. 0.10% solution of the two selected commercial sunscreen lotions (SPF 20 and 55) in n-propyl alcohol was also prepared. The aliquots of each formulation prepared were scanned between 290 and 320 nm, with 5 nm interval. SPF was calculated by using the equation derived by Mansaur et al. EE (λ) x I(λ) values determined by Sayre (Sayre et al., 2003; Sayre 1993) was used in below equation (1). Each sample observed in triplicate [21-23].

### Statistical Treatment

Statistical analysis was carried out by using STATS [70] software and results were expressed as mean S.D. All the parameters were statistically analysed at 95% confidence level in the column. Statistical result of psychometric evaluation was further tested by ANOVA [One way analysis].

## RESULTS AND DISCUSSION

Colour of the formulated sunscreens (1-3) was found to be cream, yellowish orange and white respectively, type of emulsions existed by tested sunscreens was o/w and pH of the sunscreens. As the speed of rotation increased, viscosity of the tested samples decreased, this behavior of all formulations revealed pseudo plastic behavior of the products. The skin irritation test performed in Wistar albino rats showed no signs of sensitivity, erythema and edema. So the prepared formulations were considered to be non-irritant. The absorbance values of these formulations are given in table 3. SPF values of all formulations [SS1-SS3] and the two marketed Sunscreens with known SPF of 55 and 20 were determined using *In vitro* method (Table 4) and the formulation SS2 showed high SPF of 20.436±3.8 due to the presence of aloin [24-28].

**Table 1: Composition of Various Sunscreen Formulations**

| S.No | Ingredients | F 1 (%) | F 2 (%) | F 3 (%) |
|---|---|---|---|---|
| 1 | Aloe gel | - | 5.0 | - |
| 2 | EEA | 6.0 | - | - |
| 3 | Olive oil | 2.0 | 2.0 | - |
| 4 | Lavender oil | 1.0 | 1.0 | - |
| 5 | Rose water | 3.0 | 3.0 | - |
| 6 | Cetyl alcohol | 2.0 | 2.0 | 2.0 |

| | | | | |
|---|---|---|---|---|
| 7 | Zinc oxide | 12.0 | 12.0 | 12.0 |
| 8 | Stearic acid | 4.0 | 4.0 | 4.0 |
| 9 | Glycerin | 2.0 | 2.0 | 2.0 |
| 10 | Vitamin E | 1.0 | 1.0 | 1.0 |
| 11 | Triethanolamine | 1.0 | 1.0 | 1.0 |
| 12 | HPMC | 10.0 | 10.0 | 10.0 |
| 13 | Propyl paraben | 0.50 | 0.50 | 0.50 |
| 14 | Distilled water | 50.50 | 50.50 | 67.50 |

Ethanol extract of *Oscimum sanctum (EEO)*; Hydroxy propyl methyl cellulose (HPMC)

**Table 2: Viscosity profile of formulated sunscreens**

| Sunscreens | Viscosity (cps) | | | | | |
|---|---|---|---|---|---|---|
| | 10rpm | 20rpm | 30rpm | 50rpm | 60rpm | 100rpm |
| SS1 | 183.5 | 91.6 | 60.7 | 30.1 | 27.2 | 18.4 |
| SS2 | 180.3 | 92.8 | 66.9 | 38.5 | 34.3 | 20.7 |
| SS3 | 182.1 | 93.7 | 62.3 | 35.6 | 32.8 | 21.5 |

(cps) Centipoise, (rpm) rotation per minute

**Table 3: Absorbance values of the formulated and marketed sunscreens**

| Wavelength (nm) | SS1 | SS2 | SS3 | Marketed Sunscreen (SPF 55) | Marketed Sunscreen (SPF 20) |
|---|---|---|---|---|---|
| 290 | 4.526 | 4.679 | 3.012 | 8.743 | 4.118 |
| 295 | 4.167 | 4.258 | 3.190 | 8.375 | 4.791 |
| 300 | 3.912 | 3.987 | 3.712 | 7.124 | 4.826 |
| 305 | 3.791 | 3.126 | 3.623 | 7.871 | 3.598 |
| 310 | 2.014 | 3.782 | 2.265 | 6.248 | 3.194 |
| 315 | 2.653 | 2.390 | 0.807 | 6.796 | 3.257 |
| 320 | 1.248 | 1.065 | 0.601 | 6.506 | 2.419 |

**Table 4: SPF of the formulated and marketed Sunscreens**

| S.No. | Sunscreens | SPF |
|---|---|---|
| 1 | SS1 | 17.125±3.1 |
| 2 | SS2 | 20.436±3.8 |
| 3 | SS3 | 15.379±3.5 |
| 4 | Marketed formulation with SPF 55 | 55.123±3.4 |
| 5 | Marketed formulation with SPF 20 | 20.782±3.2 |

All of the values are represented as Mean ± SD (n=3), $p < 0.001$.

**Fig 1. Viscosity profile of formulated sunscreens**

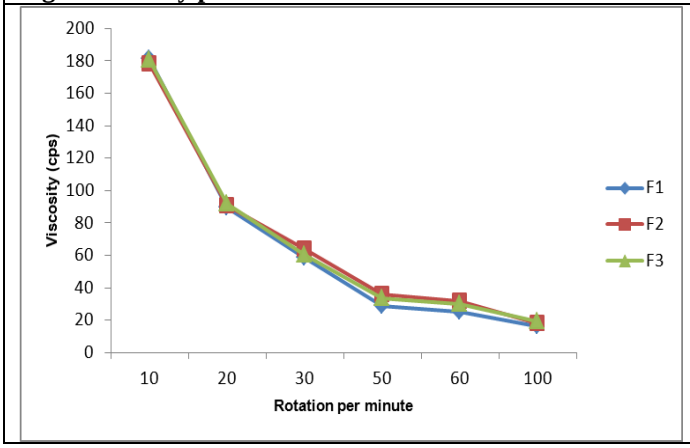
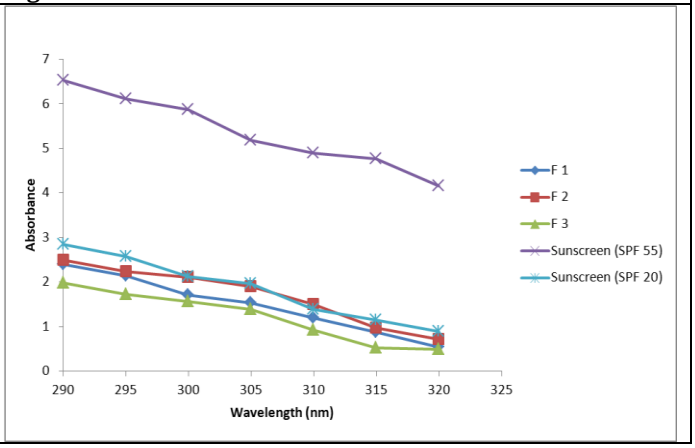



**Fig 2. Absorbance values of the formulated Sunscreens**



## CONCLUSION

The study aimed at developing herbal Sunscreen lotion for preventing sun burns and even skin cancer, using extracts of *Oscimum* and *Aloe vera.* Three formulations of the lotion were prepared by varying the Composition and evaluated for their physicochemical properties like pH, volatile and non-volatile content, ash values, spreadability, viscosity and Sun Protection Factor. From the results of these tests, formulation SS2 was found to be more stable as well as better sunscreen. The formulations with herbal extracts (SS1 and SS2) showed comparatively high SPF on the formulation devoid of these extracts (SS3) and stood competitive to the standard marketed formulations. The sunscreening property of these extracts may be due to the presence of flavanoids, phenols and terpenoids. It can be concluded that the present research might hopefully bring advancement in the treatment of Sun burns and prevent Skin cancer caused by exposure to UV rays, using herbs as well as in developing poly herbal formulations for safe and effective management of Skin diseases due to harmful UV rays. Further, the study reveals that UV Spectroscopy is the rapid, acceptable and reproducible method for the evaluation of herbal sunscreen. Compilation of all stability parameters by using various standard methods from different branches of allied sciences can assist the regulatory authorities, scientific organizations and manufacturers in developing uniform standards for herbal sunscreens.

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