ABSTRACT

The increasing awareness of the risk of skin cancer with the sun exposure requires that sunscreen products be approximately tested and labeled. Although there exists information on the possible photon-induced reaction such as photoirritation and photosensitization produced by sunscreen creams containing synthetic photo-protective chemicals. Effect of sunscreen cream depends upon sun protection factor (SPF) value and substantivity. In addition due to high cost and time consumption of in vivo SPF determination methodologies, in vitro SPF determination is gaining more importance. The aim of present study was to formulate a sunscreen cream containing essential oil of Ocimum basilicum Linn. as an active ingredient and evaluate experimental method for in vitro SPF determination.

Keywords: Ocimum basilicum, UV Protection, Sun protection factor, Sunscreens

INTRODUCTION

Sunlight composed of various wavelengths ranging from ultraviolet light through infrared to visible light. Exposure to solar radiation is recognized to have negative effects on the human skin. Among all, ultraviolet light is the most harmful to the skin and causes sunburns, ageing of the skin and over the long term, skin cancer. Ultraviolet light is made up of UVA 400-320, UVB 320-290 and UVC 290-100 nm range respectively. UVC being the shorter wavelength that is filtered out by the earth’s ozone layer. UVB and UVA penetrate the ozone layer and reach the earth’s surface but the atmosphere filters more UVA than UVB. Fortunately, UVA is not quite so powerful in its effects as UVB as it has an additive (cumulative) effect with UVB on the skin. UVA and UVB are the only wavelengths that need to be screened out as we still have an ozone layer over most of the earth. Sunscreens and sunblocks are the two chemicals that absorb or block UV rays of sunlight. The use of skin care products supplemented with several effective agents working through different pathways in conjunction with the use of sunscreens may be an effective approach for reducing UV-B generated ROS mediated photaging. It has been known for the decades that sunscreens are capable of protecting man from harmful effects of solar radiation such as actinic ageing or cutaneous cancer. All compounds used as sunscreen filter are by their nature, chemicals that are able to absorb UV-A and / or UV-B light. The range of wavelengths which are absorbed by a given compound is termed as absorption spectrum. Basic and applied research concerning sun protection has become a major concern. There exist some information on possible photon induced reaction such as photoirritation, photosensitization and contact dermatitis by sunscreen products containing synthetic photo-protective agents like cinnamates, p- amino benzoic acid and cinnamaldehyde. Although most sunscreen products contain synthetic photo-protective agents of a high sun protection factor (SPF), there is little published data describing use of essential oil in sunscreen products and SPF determination by Optometrics LLC SPF-290S.

One of the key factor in evaluating the potential of sunscreen product is a sun protection factor (SPF) value which can be thought as a time factor for the protection of a skin compared to exposure without any protection. The protection performance of sunscreen product against erythema inducing radiation, calculated from the measured in vitro transmittance and weighed with the erythema action spectrum and with a ‘standard’ output spectrum of a UV solar simulator used for SPF testing. Most recently updated scientific method for evaluating the SPF of sunscreens have been developed by COLIPA international.
hydrodistillate was extracted with solvent ether and extract was concentrated under vacuum to yield basil oil. Collected oil was then dried over anhydrous sodium sulphate and stored in sealed vial.

Sunscreen cream formulation

**Step I: Aqueous phase preparation:** Dissodium EDTA (0.02% w/w), Sodium methyl paraben (0.3% w/w) and Triethanolamine (0.5% w/w) were dissolved in deionised water, meanwhile, carbopol (0.5% w/w) was added to swell using a homogenizer (8000 rpm) and heated up to 80°C.

**Step II: Oil phase preparation:** Sodium propyl paraben (0.06% w/w), Stearic acid (2% w/w), Cetyl alcohol (1% w/w), Cetomacrogel-1000 (2%w/w), Cetostearyl alcohol (5% w/w) and basil essential oil (5% w/w) mixed and heated at 80°C.

**Step III: Mixing phase:** Oil phase was added to water phase at 80°C with continuous stirring for 20-25 min and then it was homogenized (8000 rpm) till uniform emulsion was formed. It was then poured into the wide mouthed container and stored at temperature not exceeding 37°C.

**Determination of in-vitro SPF of sunscreen cream**

Approximately 100 mg of the investigational sample was applied and spread on 50 sq.cm area to obtain a sample film thickness of 2 μl/cm² on Transpore surgical tape to get an even film as suggested in the operation manual of Optometrics LLC SPF-290S for the sample preparation and application technique. The sample thus prepared was exposed to Xenon arc lamp with UV range 290nm to 400nm for determining the SPF.

WIN SPF has used the following equation for calculating SPF value.

\[
\text{SPF}_{\text{in-vitro}} = \frac{\sum \text{MPF}_\lambda \times \text{E}_\lambda \times \text{B}_\lambda}{\sum \text{MPF}_\lambda}
\]

Where,

- MPF\_\lambda = scan MPF value
- E\_\lambda = Spectral irradiance of terrestrial sunlight under controlled conditions
- B\_\lambda = Erythemal effectiveness.

The SPF-290 software used Trapezoidal Approx calculating technique to approximate the integral for SPF and Erythemal UVA protection factor. These include UVA/UVB ratio, critical wavelength, cumulative absorbance, etc. The Average Absorbance method was used for calculating average protection factor. For calculation of standard deviation, Diffey’s method was used.

**RESULTS AND DISCUSSION**

In the present study essential oil of Ocimum basilicum, Linn. was isolated (yield 0.6% w/w) and sunscreen cream was formulated using this oil. The finished product has white colour and gel like consistency. Cream was evaluated for sunscreen activity using in vitro SPF method. The SPF is quantitative measurement of the effectiveness of the sunscreen formulations. The SPF value of sunscreen cream was found to be 1.19 with ultra boot star rating 1. SPF value for sunscreen above 2 is considered as having good sunscreen activity. It indicates that formulated sunscreen cream was found near the range of good sunscreen activity and hence Ocimum basilicum, Linn. essential oil may be considered as good candidate for sunscreen or cosmeceutical purposes. Further this cream was evaluated for spreadability, viscosity, microbial testing etc.

**Table 1:** Results of SPF and other parameters of basil oil sunscreen cream

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Parameter</th>
<th>Scan I</th>
<th>Scan II</th>
<th>Scan III</th>
<th>Average value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SPF</td>
<td>1.24</td>
<td>1.13</td>
<td>1.21</td>
<td>1.19</td>
</tr>
<tr>
<td>2</td>
<td>Standard deviation</td>
<td>0.05</td>
<td>0.04</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>UVA/UVB ratio</td>
<td>0.362</td>
<td>0.163</td>
<td>0.306</td>
<td>0.280</td>
</tr>
<tr>
<td>4</td>
<td>Critical wavelength</td>
<td>366.8</td>
<td>342.9</td>
<td>359.3</td>
<td>356.3</td>
</tr>
<tr>
<td>5</td>
<td>Boot star rating</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**ACKNOWLEDGEMENT**

We express our sincere thanks to Mr. Milind Katariya Sir, Reva Pharma Pvt Ltd.,Sinner, Nashik for his kind guidance to carry out formulation, Dr. Mrs. Chandrashhekhar and Ms. Priyanka, Kelkar Lab, Mulund for their kind help. My colleagues Harsha, Sonali, Bhagyashree for their helpful support at every time.

**REFERENCES**

1. P. Treffel, B. Gabard ; Skin Penetration and SPF of UV Filters from Two Vehicles; Pharmaceutical Research, 1996, 13(8), p770-774
2. CDIPA Guidelines: Guidelines for The Colorimetric Determination of a Skin Color Typing and prediction of The Minimal Erythemal Dose Without UV Exposure,2007, P1-9
5. Westerhop W ; The Relation Between Constitutional Skin Color and Photosensitivity Estimated From UV Induced Erythema and Pigmentation Dose-Response Curve, J. Of Invest Dermatol, 1988, 124, p869-871
6. Sheu, MT; Lin, CW; Huang, MC; Shen, CH; Ho, HO, Correlation of In Vivo and In Vitro Measurements of SPF, J. of Food and Drug Analysis, 2003, 11(2), p128-132
11. The Wealth of India, Vol IX, CSIR, New Delhi, 1956, p81-84