Research Article

Spectrophotometric Determination of Sun Screen Potential of Selected Medicinal Plants

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ABSTRACT

Ultraviolet (UV) radiation emitted by sun has found to be a major cause to damage or alter structure and function of human skin. Various sunscreen cosmetics have been employed to protect the skin from these damaging effects. Many plant materials have shown the potential as sunscreen agent to protect the skin. Previous research revealed the potential of plant products such as fixed oil, volatile oil and plant extracts could be used for their sunscreen potential. In the present study some of selected medicinal plants *Azadirachta indica, Ocimum sanctum, Centella asiatica* and *Hibiscus rosa sinensis* have been evaluated for their sunscreen potential by spectrophotometric method. The In vitro method has been used for the study was rapid, convenient, safe and reliable and could be useful in preliminary evaluation of sun protective potential. The result of the study indicated all hydroalcoholic extract have sun protective potential and can be used in cosmetic as sunscreen agent. The comparative result indicated that *Azadirachta indica* hydroalcoholic extract has higher sun protection efficiency and *Hibiscus rosa sinensis* has lowest photo protection efficiency, The initial result may be useful in selection the plant for sunscreen effect while developing a cosmetic formulation.

Keywords: Sun protection, Plant extracts, Sun screen agent, Ultraviolet radiation.

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INTRODUCTION

Skin is one of the largest and prominent organs that came in to direct contact with outer environment. Every individual aspires to make their skin healthy and beautiful. From the ancient time human were using different kinds of natural substances to protect the skin from harmful agents of the outer environments. Apart from the other harmful agent's Ultraviolet radiation has found as most crucial agent to defile the skin function and appearance. The radiation emitted by the sun composed of varying wavelengths of ultraviolet radiations UVC (100-280 nm), UVB (290-320 nm) and UVA (320-400 nm). UVC is the most biologically damaging radiation, but it filtered and absorbed by ozone layer.[1] The radiation reaches at the earth surface basically composed of UVA and UVB, which is majorly responsible for sunburn, malignancies, ageing and other damaging effects on the skin. Various fixed oil, volatile oil, plant extracts plant derived sunscreen agent used in cosmetics that may absorb, reflect, or scatter UV radiations.[2] The Efficacy of sunscreen agents can be evaluated through Sun Protection Factor (SPF) the efficacy of a sunscreen is usually expressed by the sun protection factor (SPF), which is defined as the UV energy required to produce a minimal erythemal dose (MED) in protected skin, divided by the UV energy required to produce an MED in unprotected skin

$$SPF = \frac{\text{Minimal erythema dose in sunscreen-protected skin}}{\text{Minimal erythema dose in non sunscreen-protected skin}}$$

The minimal erythemal dose (MED) is defined as the lowest time interval or dosage of UV light irradiation sufficient to produce a minimal, perceptible erythema on unprotected skin.[3,4] The higher the SPF, the more effective is the product in preventing sunburn.

The *in vitro* SPFs were determined according to the method described.[5,6,7] The observed absorbance values at 5 nm intervals (290-320 nm) were calculated by using the formula[5]

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

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(λ)×I(λ) are constants, They were determined by Sayre *et al.*[8] and are showed in Table 1.

Apart from the main ingredients other material used in preparation of cosmetics may alter the sunscreen potential of the formulation

MATERIALS AND METHODS

Analytical grade chemicals have been used for the purpose of study, all the chemicals procured from Central Drug House (P) LTD, New Delhi. The glass wares used in

the study have borosilicate and ASGI mark. UV-VIS Spectrophotometer model UV-1700 Pharmaspec Shimadzu, Japan has been used for SPF determination.

Collection and Processing of Plant material

The leaves of *Azadirachta indica, Ocimum sanctum, Centella asiatica and Hibiscus rosa sinensis* has been procured from the medicinal herbal garden Bansal College of Pharmacy, Bhopal M.P. India, in the month of February. All collected plant materials were washed with tap water and shade dried for seven days. The dried plant material then pulverized using electric grinder the grounded plant material the sieved through sieve no 40 to get fine powder, The fine powder has been used for extraction with suitable solvents

Extraction of Plant Material

The hydro alcoholic extract of plant material has been prepared by maceration method. 70g of each powdered plant material has been taken extracted with 80% ethanol, the extract then filtered using whatman filter paper, and the filtrate has been collected. The filtrates were concentrated under reduced pressure and at the temperature 40°C using rotary evaporator. The concentrated extracts were placed in the desiccator to remove remaining solvent. The percentage yield of each extract was calculated.

Sample Preparation

The stock solution has been prepared by using 10 mg of each plant extract dissolved in 100 ml of ethanol to get 100 µg/ml of concentration and filtered through Whatman filter paper to get clear solution, three dilution 40µg/ml, 50µg/ml and 60µg/ml were made using stock solution. All the samples were scanned thrice for specified wavelength 200 nm to 400 nm using UV-Visible spectrophotometer (Model UV-1700 Pharmaspec Shimadzu). The base line correction has been made by using solvent used for extraction of plant material, then sample absorption has been measured by using one cm quartz cell where 80% ethanol solution were used as blank.[9] The absorption of *Azadirachta indica, Ocimum sanctum, Centella asiatica* and *Hibiscus rosa sinensis* leaves *extracts* were recorded**.**

***In vitro* SPF Determination**

The sun protection potential of various herbal extracts have been measured by rapid, reliable in vitro method. The definite concentration 40µg/ml, 50µg/ml and 60µg/ml of each plant extract were made from initial stock solution and then each extract was scanned between wavelength 290 to 320 at the interval of 5 for three times and average of these values are taken as absorbance of particular concentration of each extract, the absorbance value was multiplied with EE(λ) X I the constant shown in table number one, the summation of those multiplied with correction factor which was a constant 10.[10]

Table 1: Product function used in calculation of SPF

Sr. No	Wavelength in nm	EE(λ) X I (normalized)
1	290	0.0150
2	295	0.0817
3	300	0.2874
4	305	0.3278
5	310	0.1864
6	315	0.0839
7	320	0.0180
Total		1

RESULTS AND DISCUSSION

The percentage yield of different plant extract s used in the study was found as *Azadirachta indica* 5.8%, *Ocimum sanctum* 4.5%, *Centella asiatica* 3.8% *and Hibiscus rosa sinensis* 5.2%. The result indicated that *Azadirachta indica* has maximum extractable material in hydro alcoholic solvent out of these four plants selected for the study. The *in vitro* SPF screening method might be useful in sunscreen cosmetic product development, as an alternative to *vivo* SPF determination. In this study various plant extract had been evaluated by UV spectrophotometry. The SPF has been calculated by using Mansur mathematical equation.[5] The result of the study revealed that hydro alcoholic extracts of selected plant material have sun protective potential and can be used as sunscreen agent in cosmetics development *Azadirachta indica* has found to higher photo protective effect compared to other plant extract while *Hibiscus rosa sinensis* has shown lowest photo protective effect. These selected medicinal plants may give better result when used in combination.

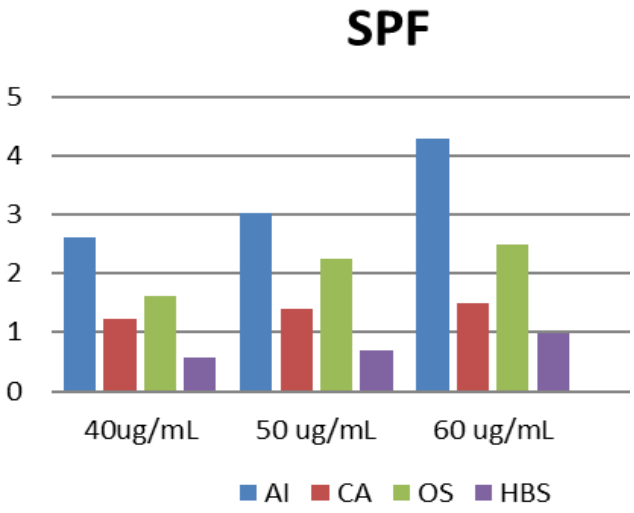

Figure 1: Graphic Presentation of SPF value of different extracts

Table 2: *In vitro* SPF value at concentration 40µg/ml

Sr. No	Wavelength in nm	EE(λ) X I (normalized)	AI (absorbance) 40µg/ml	CA (absorbance) 40µg/ml	OS (absorbance) 40µg/ml	HRS (absorbance) 40µg/ml
1	290	0.0150	0.3027	0.1418	0.1833	0.0604
2	295	0.0817	0.2817	0.1335	0.1677	0.0586
3	300	0.2874	0.2646	0.1261	0.1602	0.0574
4	305	0.3278	0.2494	0.1182	0.1559	0.0565
5	310	0.1864	0.2402	0.1125	0.1555	0.0552
6	315	0.0837	0.2389	0.1105	0.1532	0.0543
7	320	0.0180	0.2411	0.1095	0.1506	0.0531

Table 3: *In vitro* SPF value at concentration 50µg/ml

Sr. No	Wavelength in nm	EE(λ) X I (normalized)	AI (absorbance) 50µg/ml	CA (absorbance) 50µg/ml	OS (absorbance) 50µg/ml	HRS (absorbance) 50µg/ml
1	290	0.0150	0.3481	0.1682	0.2565	0.0802
2	295	0.0817	0.3259	0.1561	0.2344	0.0746
3	300	0.2874	0.3086	0.1453	0.2224	0.0698
4	305	0.3278	0.2927	0.1337	0.2159	0.0658
5	310	0.1864	0.2834	0.1266	0.2145	0.0649
6	315	0.0837	0.2792	0.1223	0.2159	0.0643
7	320	0.0180	0.2732	0.1206	0.2191	0.0641

Table 4: *In vitro* SPF value at concentration 60µg/ml

Sr. No	Wavelength in nm	EE(λ) X I (normalized)	AI (absorbance) 60µg/ml	CA (absorbance) 60µg/ml	OS (absorbance) 60µg/ml	HRS (absorbance) 60µg/ml
1	290	0.0150	0.5022	0.1734	0.2834	0.1031
2	295	0.0817	0.4664	0.1665	0.259	0.0992
3	300	0.2874	0.4381	0.1575	0.2455	0.0983
4	305	0.3278	0.4121	0.1478	0.2373	0.0972
5	310	0.1864	0.3977	0.1372	0.2389	0.0964
6	315	0.0837	0.3955	0.1312	0.2358	0.0947
7	320	0.0180	0.3923	0.1281	0.2346	0.0931

Table 5: Spectrophotometric values of SPF at different concentration

Sr.No.	Extract	SPF 40µg/ml	SPF 50µg/ml	SPF 60µg/ml
1	AI	2.598	3.015	4.291
2	CA	1.217	1.389	1.488
3	OS	1.609	2.255	2.477
4	HRS	0.565	0.691	0.974

AI- *Azadirachta indica,* CA- *Centella asiatica,* OS- *Ocimum sanctum* HRS- *Hibiscus rosa sinensis*

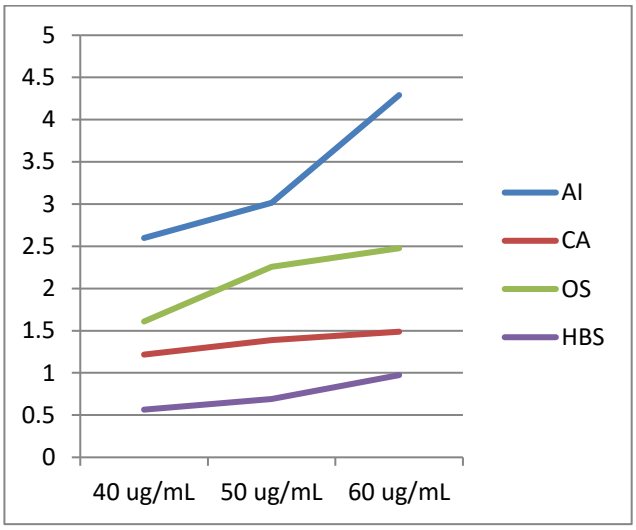

Figure 2: Line diagram for SPF value of different extracts

The result of the study revealed the concentration dependent photo protective effect. Increased in the concentration of plant extracts increases the sun protective effect all the plant extract shown the similar pattern of increasing concentration dependent photo protective potential. They might give synergistic effect while we use in appropriate combination. The plant selected for the study had already proven for their medicinal and cosmetic effect, this additional protective effect might be useful in selecting those plants for cosmetic purpose.

CONCLUSION

Herbs and plant materials used since ancient time for all human needs. The curiosity and necessities of human tends to exploration of new substance from natural treasure, which may help up to get suitable and better alternative for already used substances. In the present study we studied the selected medicinal plant for their photo protection potential they could be used as better alternative for the development of suitable sunscreen cosmetic formulations.

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