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FORMULATION, IN-VITRO EVALUATION AND UV PROTECTIVE STUDY OF POLYHERBAL SUNSCREEN GEL

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ABSTRACT

The present study was designed for the preparation of sunscreen gel with different combination of herbs in it. Herbs like Neem (Azadirachta indica), Aloe vera (Aloe barbadenisis) and Beet root (Beta vulgaris) were added. These plants are well known for their therapeutic values in traditional medicine. Hydroalcoholic extraction of the plant parts was performed. Carbopol 940 was used as the gelling agent and the prepared gel was then evaluated for its colour, odour, pH, spreadability, phase separation, etc. UV protective study was also performed by UV-Spectrophotometer at the range of 200-400nm. The maximum absorption for the gel and the extraction was found between 220-300nm.

KEY WORDS: Sunscreen gel, Azadirachta indica, Aloe barbadenisis, Beta vulgaris, UV protective study

INTRODUCTION

Cosmetics arise from a greek word kosmeticos which means adorn. These are materials that are intended to beautify or improve the appearance of the skin. In other words cosmetics can be defined as those materials that may be applied to the skin, hair and nails for the purpose of covering, colouring, softening, cleaning, nourishing and protection[1].

Sunscreens are used as a protective agent for the skin. These products prevent the skin from the deleterious effects of sun like sunburns and suntan[2]. When the skin gets exposed to the sun there are both beneficial and harmful effects. When the skin gets exposed to a moderate period of time, it helps in stimulation of the blood circulation and also helps in the formation of haemoglobin[3,4]. It also helps in the formation of vitamin D by activating 7-

dehydrocholesterol. Sunscreen preparations help in providing protection against sunburn. They also help in absorbing the portion of erythema on the skin caused by radiation energy of the sun, in winter high proportion of UV- radiation are reflected than in summer[5,6]. The solar septum radiation of the sun is divided into five regions: Ultraviolet C or UVC (from 100nm to 290nm), Ultraviolet B or UVB (from 290nm to 320nm), Ultraviolet A or UVA (from 320nm to 400nm), visible range or light (from 380nm to 78nm) and infrared (from 780nm to 106nm)[7]. Skin is the external barrier of the body both physical and immunological. The main function of the skin is to provide protection from dust, sunburn, microorganism, etc[8]. It also helps in sensory reception, excretion and thermoregulation.

The skin consists of three main layers such as epidermis, dermis and sebaceous gland. Epidermis is the outermost layer of the skin which helps from the UV-radiation and it acts as water proof. Various herbal and synthetic formulations are available to block the radiation of the sun and prevent from skin damages[9]. The plant source that is used in this sunscreen gel are neem, beet root and aloe vera.

Ideal Properties of Sunscreen Gel

1. Sunscreen gel should be capable of absorbing wavelength at the range of 280-320nm
2. They should be stable to withstand heat, light and perspiration
3. They should be non-toxic.
4. No irritation should be caused on skin
5. They should not be readily absorbed by the skin
6. These products should be readily soluble in suitable vehicle used in the preparation

MATERIALS AND METHODS

Selection of plant material

The specimen for the preparation of sunscreen gel was collected from the medicinal garden of Sri Ramachandran University, Tamilnadu and also collected from the local market. These plant material were washed, cleaned and ground using domestic mixer.

Extraction method

Fresh beet root and aloe vera were extracted with hydro alcoholic method of extraction and the same method was used to extract dried neem leaf powder.

Preparation of gel

To a few ml of water, methyl paraben and propyl paraben were dissolved completely. Carbopol 940 was added to the paraben solution and stirred well using mechanical stir. To this glycerine and triethanolamine were added and stirred[10]. The extracts were added to the above mixture and stirred continuously until a uniform mixture was obtained. Sodium hydroxide was used to adjust the pH between 6.8 -7 [Table -1].

Table-1: Formulation of Gel

S.No	Ingredients	Part used	quantity	Uses
1	Extract of aloe vera	The whole plant	1%	Soothing, moisturing, healing and used against sun burn.
2	Extract of neem	Aerial parts of plant	1%	Treatment of eczema, psoriasis.
3	Extract of beet root	Fresh succulent root	1%	Antioxidant and skin beautifies
4	Carbopol 940	-	2%	Gelling agent
5	Methyl paraben	-	0.1%	preservative
6	Propyl paraben	-	0.1%	Preservative
7	Triethanolamine	-	2%	Neutraliser
8	Propylene glycol	-	2%	Humectant
9	water	-	Quantity ufficient	vehicle

EVALUATION OF GEL[11,12]: [Table-2]

Organoleptic Evaluation: Organoleptic evaluation such as colour, appearance and odour was evaluated manually.

Spreadability: Two glass plates were selected. The gel was spread on one side of the slide and the other slide is place on top of it like a sandwich. The slides are fixed allowing the upper slide to slip off. The time required for the slide to get separated is calculated using the formula $S = W * \frac{L}{T}$

Where, S= Spreadability

L= length of the glass plate.

W=Weight tied to upper plate.

T= Time taken for the two plates to get separated.

pH: 1g of the gel was dissolved in 10ml of water and pH was noted using pH meter.

Viscosity: Viscosity of the gel was found out using Brookfield viscometer with spindle type.

Consistency: The consistency of the product was evaluated manually.

Grittiness: The gel was spreaded on the palm to find if any gritty particles are present.

Washability: The gel was applied on the hand and was washed by keeping the hand under running water.

Determination of Sun Protection Factor[13,14]:

By *In-vivo* method: The efficacy of the sunscreen is usually expressed by Sun Protection Factor, which is defined as the UV energy required producing a minimal erythemal dose in protected skin, divided by the UV radiation required to produce minimal erythemal dose in unprotected skin.

$$SPF = \frac{\textit{Minimum erythemal dose on sunscreen protected skin}}{\textit{Minimum erythemal dose on non sunscreen protected skin}}$$

By *In-vitro* method: Determination of the SPF factor by *invitro* method is selected. The absorbance were observed at 5nm intervals from 290-320nm and is calculated using the formula$SPFspectrophotometric = C.F * \sum_{290}^{320} EE(\lambda) * I(\lambda)\, Absorbance(\lambda)$

Where, C.F=Correction factor.

E.E= erythermal effect spectrum.

I= Solar intensity spectrum

The higher the SPF factor, the greater the efficiency of the product.

Screening of UV Protective Activity

50g of the gel was taken and was dissolved in isopropanol and water at 50:50 ratio. The sample was taken in 1cm quartz cuvettes and was placed in the UV spectrophotometry and the spectrum was recorded from 400-200nm[15]. The same nm was used to find the spectrum of the extracts.

Table-3: Screening of UV Protective Activity

S.NO	Wavelength(λ)	E.E*I
1	290	0.015
2	295	0.0817
3	300	0.2874
4	305	0.3278
5	310	0.1864
6	315	0.0839
7	320	0.0180

S.No	Absorbance(λ)	C.F	E.E*I	SPF
1	0.9752	10	1	9.752
2	0.8002			8.002
3	0.7857			7.857
4	0.7547			7.547
5	0.7382			7.383
6	0.7019			7.019
7	0.6925			6.925

RESULT AND DISCUSSION

Table-2: Evaluation of Gel

S.NO	PARAMETER		OBSERVATION
1	Organoleptic	Colour	Dark pink
		odour	aromatic
2	Spreadability		14.48g.cm/sec
3	pH		6.8
4	viscosity		1692cps
5	consistency		Good
6	washability		Easily washable
7	grittiness		No gritty particles

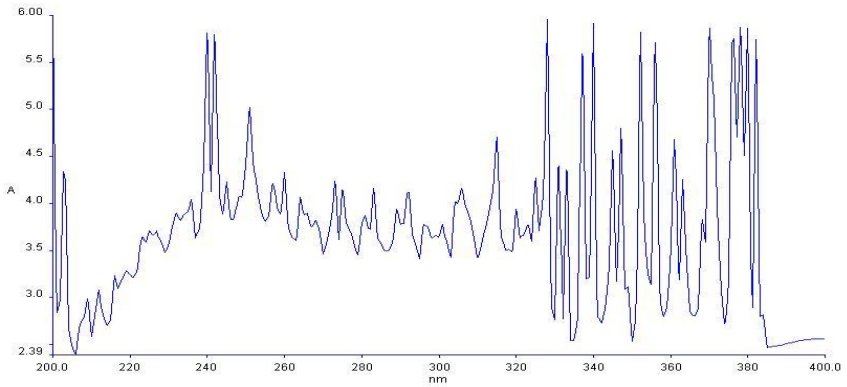

Fig- 1:UV Spectrum of Extract of *Aloevera*

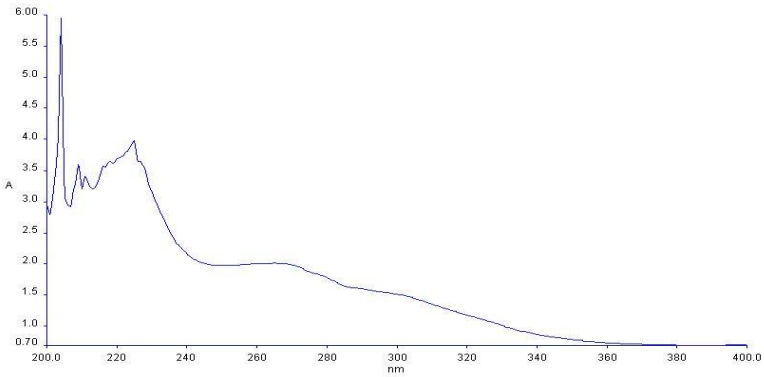

Fig- 2:UV Spectrum of Extract of *Beta*

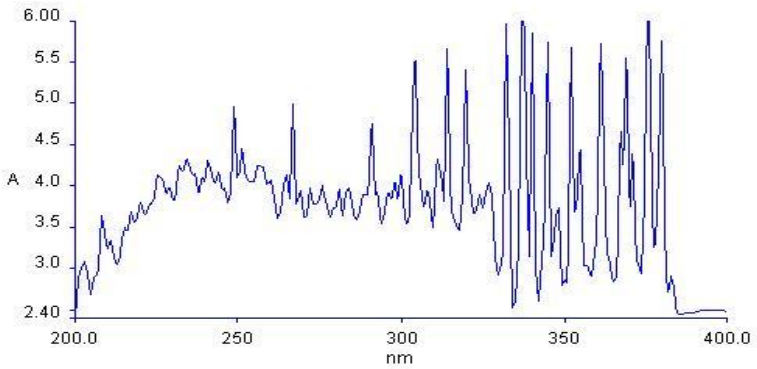

Fig- 3:UV Spectrum of Extract of neem

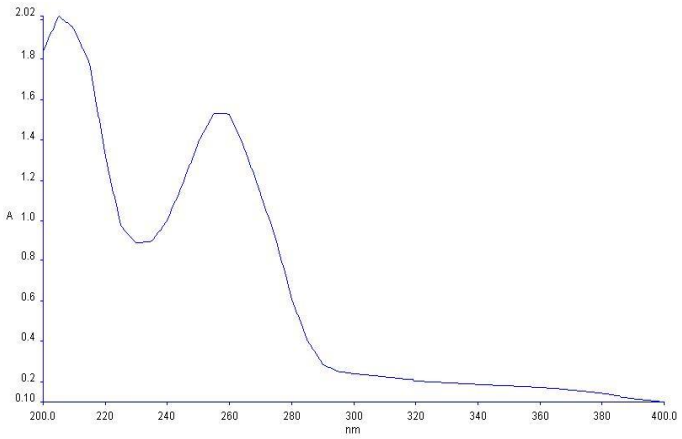

Fig- 4:UV Spectrum of GEL

CONCLUSION

Sunscreen in the UVA range does not have good photostability whereas sunscreen in the range of UVB offers good photostability. Results of our product show that it lies in the UVB range thus confirming UV protective factor. The ingredients used in the gel are easily available and the evaluation parameters performed showed better results. The present study reveals that UV spectrometry is a acceptable, economic, reproducible and rapid method for the evaluation of herbal sunscreen.

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