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RESEARCH ARTICLE

FORMULATION AND EVALUATION OF HERBAL SUNSCREEN CREAM

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ABSTRACT

The aim of present research work was formulation, evaluation and determination of Sun protection factor of polyhebal sunscreen cream containing oil of *Daucus carrota, Simondsia chinensis,Triticum astevum,Olea europaea.* On chronic exposure to sun light it causes dilation of blood vessel results in erythema,oedema,suntan, prematuared skin ageing and may increase the risk of skin cancer. Herbal phytoconstituent sunscreen agents either reflect or absorbed UV radiation before reaching to the skin. In this study sun protection factor of formulation was determined by in vitro method spectrophotometrically, two formulations F1 and F2 were prepared by using different concentration of above four herbal oil .they were evaluated for stability,irritation, consistency, homogeneity and pH. Results showed that both F1 and F2 has good stability, homogenicity, good consistency, no irritation occurred and no evidence of phase separation. When compared with marketed formulation it showed good sunscreen activity specially F1 formulation

KEY WORDS: *Daucus carrota, Simondsia chinensis,Triticum astevum,Olea europaea,* sunscreen

INTRODUCTION

The skin is one of the largest organs in the body in surface area and weight [1].Sun rays adversely affect the skin, harmful effects of solar radiation on the skin are premature aging or cutaneous cancer ,basal cell carcinoma, sunburns, malignant melanomas [2]. Solar light consists of different radiations range are UVA in the 320- 400, UVB-290-320 and UVC- 100-290 nm range respectively. Since long time of period cosmetics products are apply on the body for the purpose of nourishing, to reduce hyper pigmentation and skin wrinkling, cleansing, beautifying, protection or altering appearance and enhancing the beauty.

The herbal phytoconstituents or herbal extracts act on this particular area and produce antioxidant effect, relieving erythema, healing, softening, rejuvenating and sunscreen effect. The photoprotective phytoconstituents such as silymarin, geinstein, curcumin, resveratrol, tea polyphenols, , quercetin,flavonoids,glycerrhinitic acid and ascorbic acid which are used for the development of herbal cosmetic formulation.

Daucus carrota contain high concentration of B-carotene which is precursor of vit.A,it also contain vit.B1,B2,B5,B6,B9 and Vit E and vit C which has good antioxidant activity which prevent wrinkle and gives anti ageing property[19,20,21,22,23]

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Simmondsia chinensis has been widely used for its antinflamatory, hair conditioning,sunscreeneffect,antibacterial,antifungal,antioxidant,antageing purpose[16,17,18].
Olea europaea contain Vit.E, Vit.K, thiamine, flavons, flavonols, which act as a good antioxidant,antinflammatory,antageing,protectiveeffectonskin,photoprotective[24,25,26,27,28,29].
Triticum astevum contain Vit.C,Vit.E,Vit.B1,B2,B3,B6,B12 etc. Which is used in many skin problems, acne,antioxidant,antiageing [30,31,32,33].
The purpose of these study to develop herbal sunscreen cream by mixing carrot seed oil,wheat germ oil,jojoba oil and olive oil in different concentration to produce multipurpose effect on skin with potential sunscreen effect.

Sun protection Factor- The efficacy of a sunscreen is usually expressed by the sun protection factor.Sun protection factor is defined as UV energy which is required to produce a minimal erythema dose(MED) on protected skin, divided by the UV energy required to produce a MED on unprotected skin

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

It is necessary to standardize the methods which are used to determine the SPF of the sunscreen products.SPF of topical sunscreens against solar ultraviolet radiation exposure can be determined in vivo or in vitro[3,4].

1.1 *In Vitro* Determinaton of Sun Protection Factor-

There are two methods -

1) **Transpore Tape method-**
   It is a surgical tape manufactured by 3M company SPF is determined by using the PerkinElmer LAMBDA 1050 which is equipped with a 150 mm integrating sphere will be use to collect the scatter transmission data for sunscreen which is placed on a tape substrate. Testing of sunscreen on a tape model of human skin which is use to calculate the SPF value is more convenient and economical than testing on human skin. There were different brands of surgical tape were measured (in trans-mission) to determine which was the best brand representation of human skin. By using surgical tape sunscreen testing allows to be performed on a substitute for human skin, which is much safer than testing the product on actual skin.
2) **Spectrophotometric evaluation-**
   This method which involve the measurement of absorption or the transmission of UV radiation through sunscreen formulation. in which the absorption characteristics of the sunscreens agents are determined on spectrophotometric analysis of dilute solutions of sunscreen [5,6,7,8] Mansur et al. (1986), developed a very simple mathematical expression which substitutes the *in vitro* method which is proposed by Sayre et al., (1979), Sun protection factor calculated by using the following equation and utilizing UV spectrophotometry

$$\text{SPF} = CF \; X \sum_{290}^{320} \text{EE}(\lambda) \text{X} 1 \; (\lambda) \; \text{Abs} \; (\lambda)$$

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Where: EE (l) – erythemal effect spectrum;
I (l) – solar intensity spectrum;
Abs (l) - absorbance of sunscreen product
CF – correction factor (= 10).

The values of EE x I are constants.
This were determined by Sayre et al. (1979), and are showed below in Table 1

TABLE 1. - Normalized product function which are used in the calculation of SPF (Sayre et al., 1979)

Wavelength (λ nm)	EE x I (normalized)
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180
Total	1

Where EE – erythemal effect spectrum; I – solar intensity spectrum
Material and Method-
Carrotseed oil,wheatgerm oil,olive oil and jojoba oil
Instruments- Instruments used are pH meter, UV-spectrophotometer, stability chamber

1.2 Formulation of Herbal Cream[9,10,11]:

Table 2: Formulation of Herbal Sunscreen

Sr. No.	Ingredients	Quantity in Grams		Use
		Formulation I	Formulation II	
1	Wheat germ oil	1.5 %	2%	Sunscreen Agent
2	Carrot seed oil	0.25 %	0.5%	Sunscreen Agent
3	Olive oil	0.25%	0.5%	Sunscreen Agent
4	Jojoba oil	0.25	0.5%	Sunscreen Agent
5	Cetosteryl alcohol	5 %	5 %	Emulsifier
6	Stearic acid	2 %	2 %	Emollient, Co-emulsifier
7	Cetyl alcohol	1 %	1 %	Emollient, Co-emulsifier
8	Poly Ethylene Glycol 200	2%	2%	Emulsifier
9	Carbopol 940	0.5 %	0.5 %	Gelling Agent
10	Disodium EDTA	0.02%	0.02%	Chelating Agent
11	Sodium methyl Paraben	0.3 %	0.3 %	Preservative
12	Propyl Paraben	0.06 %	0.06 %	Preservative
13	Triethanolamine	0.5 %	0.5 %	Surfactant
14	Distilled water	qs to 100	qs to 100	Vehicle

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Procedure:

Step I: Aqueous Phase Preparation:

Disodium EDTA, Sodium Methyl Paraben and Triethanolamine weighed accurately and dissolved in Deionized Water; meanwhile, Carbopol was added to swell using a homogenizer and heated up to 80° C.

Step II: Oil Phase Preparation:

Sodium propyl paraben, Stearic acid, Cetyl alcohol, Polyethylene glycol, Cetostearyl alcohol and respective quantities oils; carrot seed oil, wheatgerm oil, jojoba oil and olive oil weighed accurately and mixed and heated at 80° C.

Step III: Mixing Phase:

Oil phase was added to aqueous phase at 80°c with continuous stirring for 20-25 min and then it was homogenized till uniform emulsion formed. It was then poured into the wide mouth container and stored at temperature not exceeding 37° C.

1.2 Evaluation of sunscreen cream-

Determination of pH-pH of cream was determined by using standard buffer solution. About 0.5 g of the cream was weighed and dissolved in 50.0 ml of distilled water and its pH was measured[14].Results are shown in table no.6

Irritancy test: Mark an area up to (1sq.cm) on the left hand dorsal surface. The cream was applied to the specified area and time was noted. Irritancy, erythema, edema, was checked if any for regular intervals up to 24 hrs and reported[14]

Homogenicity- Homogenicity measured by visual appearance and touch. . Results are shown in table no.3

Thermal Stability - In this a 20 mm broad and 5 mm stripe of cream were spread on the internal wall of the chamber of 100 ml capacity, in its total heights. Kept the beaker for 8 hrs in humidity chamber at 60-70% RH and temperature 37 ±1°C. To pass the test there should not be any oil separation in the cream[14].The results are shown in the table no.5.

Appearance-Appearance of cream is measured by visual inspection by its color. Results are shown in table no.3

In-vitro determination Sun Protection Factor of formulated creams :

Procedure:

1 gm quantity of formulated cream was weighed, transferred to 100 ml volumetric flask and diluted to volume with ethanol. Further, it was kept for ultra-sonication for 5 minutes and filtered through cotton filter, discarded the initial 10 ml. Afterwards 5 ml aliquot was transferred to 25 ml volumetric flask and the volume was adjusted with ethanol. The absorption spectra of samples in solution were obtained in the range of 290-450 nm using 1 cm quartz cell and ethanol as blank.The absorption data obtained in the range of 290-320 nm every 5 nm interval and 3 determinations were made at each point [15]. Results are shown in table no.7 and 8.

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2.2 Result and discusion:

2.2.1 Physical Parameters:

Table 3. Determination of physical Parameters

Formulation	Appearance	Colour	Homogeneity
I	Cream like	Yellowish white	Uniform and Homogeneous
II	Cream like	Yellowish white	Uniform and Homogeneous
Base	Cream like	White	Uniform and Homogeneous

Table 4. Determination of subjective properties:

Parameter	Formulation		
	I	II	Base
Consistency	Good	Good	Good
Texture	Smooth	Smooth	Smooth
Irritation, Erythema, Edema	No	No	No

Table 5. Determination of Thermal Stability

Formulation	I	II
Observation	No Phase Separation	No Phase Separation
Inference	Thermally Stable	Thermally Stable

Table 6. Determination of pH

Formulation	I	II
pH	6.6	6.7

2.3: SPF Determination of Cream Formulations

Table7 SPF Determination of Formulation I

Wavelength (nm)	EE (λ) × I (λ)	Absorbance (λ)	EE (λ) × I (λ) × Abs (λ)
290	0.1864	2.9140	0.543169
295	0.0817	3.4743	0.283850
300	0.2874	1.0346	0.29734
305	0.3278	1.1393	0.37346
310	0.0150	3.324	0.04986
315	0.0839	2.8033	0.23519
320	0.0839	2.8856	0.24210
	Total = 1		Total- 2.024969
			SPF=20.02

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Table 8. SPF Determination of Formulation II

Wavelength (nm)	EE (λ) × I (λ)	Absorbance (λ)	EE (λ) × I (λ) × Abs (λ)
290	0.3278	1.0413	0.341338
295	0.0817	3.675	0.30024
300	0.2874	0.9246	0.265730
305	0.0150	3.2733	0.049099
310	0.1864	3.1486	0.586899
315	0.0180	2.6106	0.213547
320	0.0180	3.0563	0.0550134
	Total = 1		Total- 1.8118664
			SPF = 18.11 = 18

Table 9. SPF Determination of Marketed Formulation

Wavelength (nm)	EE (λ) × I (λ)	Absorbance (λ)	EE (λ) × I (λ) × Abs (λ)
290	0.0150	3.324	0.05136
295	0.0817	3.675	0.30024
300	0.2874	1.0346	0.29734
305	0.3278	1.1393	0.37346
310	0.1864	2.8140	0.52452
315	0.0839	2.8033	0.23519
320	0.0180	2.6106	0.04699
	Total = 1		**Total=1.829**
			SPF=18.29

CONCLUSION-

The production of free radicals in the body causes oxidative stress and oxidative photo damage of macromolecules and plasma membrane components in the skin. Which further leads to premature aging of the skin and characterized by the rough skin textures and wrinkles. Sun Protection Factor is the quantitative measurement of the effectiveness of the sunscreen formulation. All this four oil has good sunscreen activity and can be considered as active sunscreen agent and antiageing agent or can be incorporated into other sunscreen formulations as an additive to enhance the activity. From the above discussion it is concluded that on combining all the four oil in different ratio**,** it increase the efficacy of sunscreen activity of herbal oils as compared to single oil In this regard we mixed the carrot seed oil, wheatgerm oil,olive oil and jojoba oil in different ratio to get multipurpose effect such as whitening, antiwrinkle, antiaging and sunscreen effect on skin. ß-carotene is the most abundant and most efficient precursor of vitamin A which is present in Daucus carota oil. ß-carotene is a radical scavenger, quenching singlet oxygen and free radicals without damaging to cells and tissue. Hence it used as UV protection of skin. ß-carotene, Vit E, Vit A and proteins, vitamins (including B1, B2, B3, B6, C, and folic acid) and minerals and other nutrient present in carrot oil wheat germ oil, olive and jojoba oil are capable to nourished and these nutrients beneficially may work synergistically to soothe, heal, moisturize and regenerate the skin and increase cell turn-over and regeneration in

the outer layers of the skin, making it effective for diseases and skin conditions related to epithelium damage. They act as antioxidant to protect the skin from sun damage and their ability to help even the skin tone and act as an active anti-aging ingredient. From the results obtained it is evident that the prepared herbal creams, spatially F I formulation have desirable Sun Protection effect. From the above it concluded that this herbal sunscreen cream has good promising sunscreen effect.

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