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To Formulate and Evaluate Herbal Sunscreen Lotion

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ABSTRACT

The aim of herbal sunscreen lotion is to provide effective sun protection while utilizing natural ingredients derived from plants. The primary goal is to create a sunscreen product that reduces the harmful effects of ultraviolet (UV) radiation on the skin, including sunburn, premature aging, and the risk of skin cancer. The Objectives are Sun Protection: The main objective of a herbal sunscreen lotion is to provide a high level of sun protection by blocking or absorbing the UV rays. It should prevent both UVA and UVB radiation from reaching the skin and causing damage. Natural Ingredients, Moisturization, Eco-friendly and Sustainable. Sunscreen reflect, absorb and scatter both ultraviolet A and B radiation to provide protection against both type of radiation. Using sunscreen lotion can help to protect the skin from premature aging and damage that may lead to skin cancer. The observational study was herbal sunscreen lotion showed good spreadability, good consistency, homogeneity, appearance, pH, Ease of removal and no evidence of phase separation. The prepared herbal sunscreen lotion was safe to use for skin. The result of present study attempts to develop sunscreen lotion possessing broad spectrum of anti UV radiation effectiveness with reduce concentration of chemical UV filters from the extracts of bioactive products such as a Butterfly pea flowers (Fabaceae) and Aloe vera (Liliaceae).

Keywords: Herbal Sunscreen, SPF (sun protection factor), Skin burn, Asian pigeonwings, Aloevera gel, Ultraviolet radiation.

INTRODUCTION

A substance that helps protect the skin from the sun's harmful rays. Sunscreens reflect, absorb, and scatter both ultraviolet A and B radiation to provide protection against both types of radiation. Sun is source of life and energy. But recent studies accepts sun as main culprit of deleterious effects including acute effects (e.g., sunburn and drug-induced photo toxicity) and chronic risks of frequent sun ray exposure like sunburn, crack, melanoma and pigmentation, cancer and immune suppression. Sun rays are most harmful environmental factor which affects skin, cause sun burn, skin cancers and photo ageing. Due to these harmful effects of UV radiations there is need to develop sunscreen formulation to heal, prevent sun burn, suntan, skin cancer and premature skin ageing and to increase level of Sun Protection Factor [1].

The goal of sunscreen formulation is to block UV rays and increase the level of protection from the UV-rays. The key components of UV protection are flavonoids, phenolic compounds or herbal oils due to their UV rays absorption capacity in UV-A region and their antioxidant activity. Cell mutation, DNA damage, hormone alteration and eczema like allergic reaction are some adverse effects of the synthetic sunscreen agents. Sunscreen formulations available in market don not have properties like wound healing, anti-inflammatory, cooling and antiageing. Again free radical mediated skin damages cannot be cured until and unless free radical scavengers are not available in photo protective products [1].

The human body's photoprotection capacity Paradoxicall, when the skin is stimulated by ultraviolet radiation, the skin's self-protection mechanism is 2-fold. First, the swelling of the epidermis by UVB radiation increases protection by 3 to 4 times. Second, increase in the synthesis of melanin (tanning) induced by UVB and UVA radiation, gives the skin 2 to 3 times more protection. Sunscreen Cosmetics for Photoprotection The use of

sunscreen as photoprotecting agents for UV protection is becoming very popular. Sunscreens are used to aid the body's natural defense mechanisms to protect against harmful UV radiation from the sun. Its function is based on its ability to absorb, reflect or scatter the sun's rays. The Sun protection factor (SPF) of a sunscreen is calculated by comparing the amount of time needed to produce sunburn on sunscreen protected skin to the amount of time needed to cause sunburn on unprotected skin. Higher SPF sunscreens offer greater protection from sunburn. Thus, prevention of premature ageing of skin and defense against possible skin cancer may be acquired by employing sunscreen cosmetics [2] .

In the United States, the Food and Drug Administration (FDA) states that any cosmetics with sun protection property must comprised of one or more active ingredients chosen from a regulatory list. These ingredients include protective chemicals and ultraviolet (UV) filters which must be listed on sunscreen labels. Before sale to consumers, the finished product must prove its protective ability in a test conducted on human volunteers. Similar rules govern sunscreens around the world. If a product label implies in any way that the product protects from the sun, then it is a sunscreen [3].

Applying a sunscreen to skin changes the way the body reacts to the sun's rays. In a way, sunscreens are like products which are to be applied on skin to enable it remain healthy and protective. If the sunscreen product contains a herbal antioxidant, it should be applied just before exposure to the sunlight and after every two hours depending on the activity of the person Swimming, excessive perspiration and drying off with a towel are some of the actions which may minimize the effectiveness of a sunscreen product. Experimental measurements of SPF are determined by applying the product in significant quantities (2 mg/cm2 of skin). In practice, it has been found that consumers actually apply lower quantities than this. This means that the effective SPF will be less than the figure indicated on the product label and protection from UVB radiation and sunburn is likely to be reduced. Thus, using formulations with SPF higher than 15 is probably advisable for those who need better photoprotection [3].

Benefits of Herbal Cosmetics for Photoprotection: A number of people with sensitive skin, such as those suffering from skin hypersensitivity don't want to use chemical sunscreens due to concern about skin exposure to unknown chemicals. Although a variety of hypoallergenic cosmetic products have been introduced for customers with sensitive skin, there are still limited options in sunscreen agents. Now, however, researchers have claimed that cosmetics having herbal components are more suitable for hyperallergic skin because they are less irritant and more easily adjustable to skin. Topical cosmetic formulations are the most preferred treatments asked by patients and are also often most prescribed by family physicians and dermatologists for sun burn. Patients feel more comfortable using topical therapies because they have milder side effects, are easier to use, are generally less expensive and are more readily available. Herbal cosmetics must have one or more active sunscreen agent with antioxidant properties in order to achieve good photoprotection effect. The concept of complementary or alternative medicine is increasingly becoming more widely accepted and there is a corresponding rising interest in herbal remedies. Recently, the role of herbal drugs, herbal products and certain phytochemicals in the control of ageing has been shown [3].

MATERIALS AND METHODS

Materials

The plant material in the formulation were collected form Nutraved xpotim enterprises 336, Shyam nagar NX-A, MR-10, Indore (MP). Stearic acid obtained from Thermo fisher sci ind.pvt. Ltd. Mumbai, Cetostearyl alcohol and Benzyl alcohol obtained from genuine chemical co. Mumbai, Hydroxypropyl methylcellulose & Zinc oxid obtained from LOBA Chemie. Mumbai, Glycerin & Citric acid obtained from SDFCL. Mumbai.

Instrument

Instruments used for analysis were UV Spectrophotometer: UV 1700 Shimadzu, Japan Brookfield Viscometer: LVDV-I spindle prime, Brookfield Engineering Laboratories Inc. U.S.A, PH meter (systronic, India), Micro centrifuge: REMI RM-12 CDX, Deep freezer [RQF 650, Remi, India]

Extraction of plant material

For butterfly pea flower extract Take a 3 to 4 flower in 180ML of hot water for 15 minutes to get the best result. Strain the liquid and discard the leaves. The deep blue water is then ready to be used sunscreen lotion.

Method of Formulation

F1 Formulation:

Take accurate quantity of aloe vera gel & rose water and mix it well. Then added gradually coconut oil & Vitamin – E Capsule. These all the ingredients were mixed together vigorously using spatula for about 15 to 20 minutes and then slowly added the butterfly pea flower extract and mix it until the uniform lotion is ready.

F2 / F4 Formulation:
Accurate quantity of Cetostearyl alcohol, zinc oxide, stearic acid, glycerine, hpmc and coconut oil (F2) / olive oil (F4) were weighed and melt it in China dish. Accurate quantity of water taken in beaker and after that 1.5 gram of citric acid was added to water & stirred. The water solution was heated up to a temperature 80 °C to 85 °C. After that melted Cetostearyl alcohol zink oxide, stearic acid, glycerine, hpmc, coconut oil (F2) / olive oil (F4) mixture & benzyl alcohol were slowly poured into the water solution a little at a time staring constantly. Stirring was a continuous until a smooth & uniform paste was obtained. After that cool that prepared sunscreen. The weighed the quantity of Aloe Vera gel, butterfly pea flower extract and vitamin-E were added & stirred well until all the ingredients mixed uniformly. Finally rose water was added.

F3 Formulation:
Accurate quantity of Zinc oxide, glycerine, & coconut oil were weighed & melt it in China dish. Accurate quantity of water taken in beaker & after that 1.5 gram of citric acid was added to water & stirred. The water solution was heated up to a temperature 80 °C to 85 °C. After that melted Zink oxide, glycerine, coconut oil mixture & benzyl alcohol were slowly poured into the water solution a little at a time staring constantly. Stirring was a continuous until a smooth and uniform paste was obtained. After that cool that prepared sunscreen. The weighed the quantity of Aloe Vera gel and butterfly pea flower extract were added & stirred well until all the ingredients mixed uniformly. Finally rose water was added.

Table 1: Ingredient & Formulation Quantity

INGREDIANTS	QUANTITY			
	F1	**F2**	**F3**	**F4**
ALOE VERA GEL	5 gm	5 gm	5 gm	5 gm
BUTTERFLY PEA FLOWER EXTRACT	4 ml	6 ml	6 ml	5ml
COCONUT OIL	2 ml	2 ml	2 ml	-
OLIVE OIL	-	-	-	2 ml
ROSE WATER	2 ml	3 ml	3 ml	3 ml
VITAMIN – E CAPSULE	2(800mg)	1(400mg)	-	1(400mg)
CETOSTEARYL ALCOHOL	-	2 gm	-	2gm
ZINC OXIDE	-	1.2 gm	1.2gm	1.2 gm
STEARIC ACID	-	4 gm	-	4 gm
COCO BUTTER	-	-	3	-
GLYCERINE	-	4 ml	4 ml	4 ml
HPMC	-	4 gm	-	4gm
BENZYL ALCOHOL	-	0.5 ml	0.5 ml	0.5 ml
CITRIC ACID	-	1.5	1.5	1.5
WATER	q.s	q.s	q.s	q.s

EVALUATION STUDY

PH Measurement:
1 g of cream was dispersed in 9 ml of distilled water to determine the pH at 27°C using the pH meter.

Determination of viscosity:
Procedure: Viscosity of the formulation was determined by Brookfield Viscometer at 25 rpm, using spindle no. 64.

Spreadability:
The parallel plate method is most widely used method for determining the spreadability of semisolid preparations. A modified laboratory apparatus was used to evaluate spreadability. The setup consists of two glass slides placed on a tripod stand on which excess of cream (3g) was applied in between two glass slides.

The upper slide is movable and the lower slide was firmly fixed to the stand. 100 g weight was placed on them for 5 minutes to compress the cream to uniform thickness and the excess cream was scrapped off from the edges.

Then 50 g weight was added to one side of the slide and the slide is pulled till it covers a distance of 10 cm. The time in seconds required to separate two glass slides by 10 cm was taken as a measure of spreadability. A shorter interval indicates better spreadability. The spreadability was calculated by using the formula.

$$S=m.l/t$$

Where,
S=Spredabilit,
m=Weight tied to upper glass slide,
l=Length of glass slide,
t=Time taken to separate them.

Determination of thermal stability:
The cream was transferred into glass bottle with the help of spatula and tapped it to settle to the bottom. Filled up to two third capacity of bottle, plug was inserted and tightened the cap. The filled bottle was kept in the incubator at 450C for 48 hr.

Determination of in vitro SPF:
1.0 g of cream formulation and commercial cream was weighed, transferred to 100 ml volumetric flask, diluted to volume with ethanol and water (40:60) then ultrasonication for 5 minutes after that filtered through Whatman No. 1 filter paper and collect the filtrate by rejecting the first 10 ml of filtrate. 5.0 ml of aliquot was taken in 50 ml volumetric flask and diluted to volume with ethanol and water (40:60). Subsequently 5.0 ml of aliquot was transferred to 25 ml volumetric flask and the volume completed with ethanol and water (40:60). The absorbance values of each aliquot prepared were determined from 290 nm to 320 nm at 5 nm interval, using ethanol and distilled water (40:60) solution as a blank. The readings were taken in triplicate and the determinations were made at each point. The obtained absorbance values between 290 and 320 nm were multiplied with the respective EE (λ) values. Their summation was taken and multiplied with the correction factor (10) to obtain the SPF values. Data were expressed as ± standard error mean

Table 2: Determination of in vitro SPF

Wavelength (nm)	EE(λ) X I(λ) Employed	Absorbance (A)	EE(λ) X I(λ) X Absorbance (A)
290	0.0150	3.105±0.03	0.046575
295	0.0817	2.871±0.01	0.234560
300	0.2874	2.651±0.01	0.761897
305	0.3278	2.416±0.02	0.790998
310	0.1864	2.238±0.01	0.417163
315	0.0837	1.981±0.01	0.165809
320	0.0180	1.724±0.01	0.031032
Total:			2.448034
SPF:			24.48

Determination of fairness activity
This study was an open prospective, non-comparative phase III clinical trial. Cream was given to Ten subjects (5 male and 5 female), aged between 18 to 45 years for 4 weeks to carry out the subjective evaluation on the basis of their feedback. All the volunteers were followed –up at weekly intervals for a period of 4 weeks and the symptoms score evaluation was done during each follow-up visit. Response to fairness cream was evaluated on a 5- point visual analogue scale (0-Nil, 1-Mild, 2-Moderate, 3-Good, 4-Excellent).

Homogeneity:
The formulations were tested for the homogeneity by visual appearance and by touch. Appearance: The appearance of cream was judged by its colour, pearlscence and roughness and graded.

Removal:
The ease of removal of the cream applied was examined by washing the applied part with tap water.

Table 3: Physicochemical parameter

Sr. No.	Parameters	Observation			
		F1	F2	F3	F4
1	Colour	Sky blue	Sky blue	Sky blue	Sky blue
2	Odour	Characterstics	Characterstics	Characterstics	Characterstics
3	Spreadability	Not Good	Good & uniform	Not Good	Good & uniform
4	PH	8	7.1	7.8	7.3
5	Viscosity (cps)	400	927	506	930
6	Thermal stability	Separation of phases	No separation of phases	Separation of phases	No separation of phases
7	Consistency	Not good	Good	Not good	Good
8	Wash ability	✓	✓	✓	✓

RESULT & DISCUSSION:

F1 Formulation:
This formulation doesn`t give a pleasant odour and smooth texture and the formulation was not a proper homogeneous and not pass the evaluation test.

F2 Formulation:
Passed the evaluation study and prepared formulation was in slightly sky blue colour and it has pleasant odour and smooth texture as well as stable.

F3 Formulation:
Failed the evaluation test and it's not stable, separation of oil & water phases & not homogeneous.

F4 Formulation:
Passed the evaluation study and prepared formulation was in slightly sky blue colour and it has pleasant odour and smooth texture as well as stable.

Product F2 and F4 passed the evaluation test and the other hand product F1 and F3 failed the evaluation test. The results are demonstrated in Table 3. The SPF value produced by formulated herbal sunscreen lotion was 24.48. The results are demonstrated in Table 2.

The value of SPF obtained by formulations was very appreciating when we compare with that of other herbal extracts as reported by various authors. The pH of the lotion was found to be 7.3 and it is good for skin. The viscosity of was lotion was 927 cps, revealing the easy spreadibilty of lotion. The results are demonstrated in Table 3. The dye test confirms that formulated cream was o/w type emulsion lotion. The homogeneity test confirms the uniform distribution of extracts in lotion. When formulation were kept for long time, it found that no change in colour of lotion. The emolliency, slipperiness and amount of residue left after the application of fixed amount of lotion. The formulated lotion exhibited non greasy effect, after application of lotion on the skin. The lotion was easily removed by washing with tap water.

CONCLUSION

The herbal cream exhibited SPFs i.e., 24.48, this may be due to the high amounts of phenolic compounds and flavonoids are present in extracts. It is concluded that the herbal sunscreen lotion has high amount of phenolic and flavonoids, due to synergistic action after combining the different extracts of plant, it produces high SPF value. The pH of prepared lotion was nearer by skin pH, and lotion produces homogeneous, emollient, non-greasy and easily removed properties after the application. These studies suggest that herbal sunscreen lotion is more stable and also it may produce synergistic action.

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