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Research Article

Formulation and Evaluation of Herbal Sunscreen Cream

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ABSTRACT

The aim of present study is to formulate and evaluate the herbal sunscreen cream by using natural substances obtain from plant which are having high antioxidant activity and high UV rays absorption capacity. This cream can decrease the intensity of UV radiation and thus can prevent the risk of sun induced skin cancer. The present study attempt to develop sunscreen cream, possessing broad spectrum of anti-UV radiation effectiveness with reduced concentration of chemical UV filters, from the extract of bioactive products such as Banana peel (Musaceae), Terminalia Arjuna (Combretaceae). The antioxidant compound from commercial banana were studied one of the antioxidant, gallocatechine, was isolated from the banana peel extract, which shows strong antioxidant properties. The research work provides stabe natural photo protective formulation with antioxidant potential high SPF and most important UVA/ UVB Protection the prepared sunscreen cream gives antioxidant as well as wound healing, anti-inflammatory properties in one formulation. The effectiveness of the product was evaluated using Sun Protection Factor (SPF). The evaluation of cream was done on different parameters like PH, viscosity, spreadibilty and stability were examined. The prepared cream exhibited highest SPF Value 50. The prepared cream shows good consistency, homogeneity, appearance, PH, easily remove and no evidence of phase separation. The prepare sunscreen cream was easy and safe to use for skin.

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Introduction:

Sunscreen are the formulation which are used to protect the skin from harmful effect of sun including acute effects like sunburn , photo toxicity caused by drugs , photo aging or chronic risk or long term effects like immune suppression , skin cancer, pigmentation. 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. (Balogh TS, An bras dermatol,2011)

The decrease in the intensity of UV Radiation reaching the skin through sunscreen may reduce the risk of sun including cancer. Now a day people showing there interest towards herbal cosmetics so there is need to develop herbal sunscreen which is effective against sunburn and skin cancer and protect the skin from harmful UV rays. The UV spectrum is divided into three groups based on wavelength UVC (100-290 nm) ,UVB (290-320 nm), and UVA (320-340 nm). UVA is further subdivided into UVA2 (320-340 nm) UVA1 (340-400nm). Solar UV radiation reaching the earth surface approximately consist of 90-99 % UVA and 1-10 % UVB. The key component of UV protection are flavonoids, phenolic compound and herbal oils. (COLIPA 2006; Verschooten et al. 2006; Faurschou and wulf 2007)

Now a day one cosmetic product category sunscreen have gain wide popularity due to additional health benefits apart from beautification. Skin aging has become a critical factor as an indicator of beauty and of health in all over the world. For this the UVA radiation

is the main concomitant cause of skin photosensitization and photoxicity.

During the market survey, it is observed that there are many sunscreen formulations available in markets wether it is synthetic or natural which are used in protection of skin from UV rays.various formulations have different sun protection activity on basis of their efficacy of UV rays absorption but maximum formulations are of high cost and most of sunscreen formulation are prepared by incorporating synthetic molecules with potential toxicity and even carcinogenesis.(Saraf S, Kaur CD et al. 2010)

Recently, the preapar sunscreen possessing broad spectrum of anti-UV radiation effectiveness with reduced concentration of chemical UV filters and bioactive product have been the focus of several research due to ecological issues for safe utilization. Hence there is need to develop effective and safe sunscreen product which can give solution to sunburn, wounds , cracks, wrinkles, premature ageing and antioxidant ingredients to help in protection of long term damaging effects of sunrays mediated free radicals.

Most commonly herbs used in sunscreen formulation are curcuma longa, aloe vera almond, olive, green tea, jojoba and cucumber such natural herbs helps to protect skin from harmful UVA or UVB radiation without any side effect. (Katiyar SK, Elment CA 2002)

Polyphenolic compound exhibits a wide numbers of pharmacological properties such as anti-alergic, anti-inflammatory, hepatoprotective, vasoactive and antiocidant due to their difference in-vivo action mechanism. And structural similarities between polyphenolic and flavonoids and organic UV filters they exert photoprotective activity and additionaly antioxidant. (Movileanu L, Neagoe I, Flonta ML, 2000) The prepair formulation of sunscreen are prepaired from using extract of banana peel and bark of terminalia arjuna .the waste of banana peel is rich in dietary fibre , flavonoids and another phenolic in addition to carbohydrates , cellulose , minerals such as potassium and sodium. Flavonoids and phenolic are bioactive compound that useful as antioxidant. (Nurjanah S, Bogor Fakuitas 1991). Terminalia arjuna bark contain phenols, flavonoids, tannin, saponin, alkaloids, glycosides, phytosterols and carbohydrates. Terminalia arjuna was selected as a potential bioactive agent due to their phytochemical compositions possessing considerable content of polyphenolic compound (shahriar M, akhter S, hossa MI, 2010) and banana peel is used as key ingredient in this sunscreen formulation as it has skin protectant action against UV rays and boosts the activity of conventional sunscreen.the effectiveness of sunscreen formulation was evaluated by sun protection factor (SPF).

Materials and Methods:

Plant material:

The plant materials used in formulation (banana peel) were collected from the whole sale supplier of herbal crude drugs Nashik, India

The bark of arjuna are collected from herbal crud drug Nashik, India.

Instrument:

The instrument used for analysis of formulation were Brookfield viscometer, pH meter, hot air oven, freezer, spectrophotometer for determination of SPF.

Preparation of crud extract:

Banana peel extract -Banana peel powder (50gm) macerated using ethanol (75 %) for 24 hours at room temperature

Terminalia arjuna extract- The dried powder of terminalia arjuna are passes through sieves number 80 and 50 gm of powder are macerated with 75% of ethanol

Development of formulation:

The cream bases were prepared via emulsification process an oil phase containing lipophilic substances and an aqueous phase containing hydrophilic substance were separately heated in a water bath to 80 C afterwards melted phase are gradually added into the oil phase with constantly stirring until the mixture was congealed at the room temperature. Accurate quantities of water was measured and taken in a200 ml beaker. Accurate amount of triethanolamine was added and stirred. The water solution was heated upto a temperature of 80C after water reached required temperature , melted cetyl alcohol , zinc oxide , hydroxyl propyl methyl cellulose , stearic acid propyl paraben and poured this base into water solution with continuous stirring until smooth and uniform cream was obtained.then add required amount of glycerin and stirred the cream continuously and set aside to cool. Then weight accurate quantity of banana peel extract and Terminalia arjuna extract (as per table 1) were added and stirred until all ingredient mixed properly and lastly rose oil added.

Evaluation of formulated sunscreen cream:

Physiochemical parameter:

The physiochemical parameters considered for the study include appearance, color, pH, volatile and non-volatile, ash value, layer thickness and rheological studies such as viscosity, spreadability, stability, extrudability, rancidity which shown in table no 2.

Physical parameter:

Appearance color and homogeneity are determined. Result shown in table no 2

Subjective properties

Consistency feel on application and irritation parameters are determined and results are shown in table no 2.

Spread ability

Two glass slides of standard dimensions were selected. The formulation was over one of the side. The other side placed on the top of the cream such a that the formulation sandwiched between the two slide in an area occupied by a distance of 7.5 cm , alongside 100 gm weight was placed uniformly to form a thin layer. the weight was removed and the excess of cream adhering to the slides was scrapped off. The spread ability is calculated by using formula S= M*L/T Where S=spread ability, L=length of glass slide, M=Weight tied to the upper slide and T=Time.

Extrudability :

The cream formulation was filled in the standard capped collapsible aluminum tubes and sealed by crimping the ends. The weight of the tubes was recorded. Which shown in table 2

Rancidity:

This test is performed by using the Phloroglucinol solution. The rancidity is due to the oxidation of the fats and oils; during oxidation free fatty acids are libreated. These free fatty acids react with the Phloroglucinol solution and gives pink colour. This indicates rancidity of the product. Which shown in table 2

PH determination:

The PH of creams was in the range of 6.5 to 7 which is shown in table No2- and this is completely safe for human skin.

Table 1: formula for development of trial batches of herbal sunscreen formulation

Ingredients	F I (in grm)	FII (in grm)	FIII (in grm)
Banana peel extract	0.4	0.8	1
T. arjuna extract	0.3	0.8	0.5
Zink oxide	3	3	2
Cetyl alcohol	2	2.5	3
Stearic acid	1	1.5	2
HPMC	1	1.5	3
Propyl paraben	2	2	1
Triethanola mine	0.5	0.5	0.5
Water (ml)	qs	qs	qs
SLS	1	2	1
Glycerin	3	5	2
Rose oil	qs	qs	qs

Viscosity

Viscosity of cream was determined by the Brookfield viscometer. The result are shown in table 2

Centrifugation test:

During centrifugation studies, all three formulations were centrifuged at 3500- 13500 rpm at interval of 10 minutes the result of centrifugation test is given in table no 2

Thermal stability:

In this test oil separation from the cream is observed at 70 to 80 % RH and 37 ^{0}C in humidity chamber there is no phase separation so this shown that sunscreen formulation thermally stable.

Irritancy test:

Mark an area on the left hand dorsal surface. The cream was applied to the specified area and time was noted. Irritancy was checked if any for regular intervals up to 24 hrs and reported.

Efficacy analysis:

Efficacy of sunscreen formulation was determined by *in-vitro* method. SPF stand for sun protection factor and is the system used to worldwide to determine how much protection a sunscreen gives , applied to the skin at a thickness of 2mg /kg^2 the test workout how much UV radiation it takes to cause barely detectable sunburn on a given person with and without sunscreen applied.

In-vitro method used with the help of spectrophotometer. In this case, the actual transmittance of the sunscreen is measured by, along with the degradation of the product due to being exposed to sunlight. In this case, the transmittance of the sunscreen must be measured over all wavelength in the UV-B range (290-350nm), along with a table of how effective various wavelength are causing sunburn and the actual intensity spectrum of sunlight

Mathematically, the SPF is calculated from measured data as,

SPF = CF $\sum$EE(λ) × I(λ) × A(λ) 320 290 (3) Whereas, CF= Correction factor; EE= Erythemogenic effect; I= Intensity of solar light of wavelength; A= Absorbance

Result and Discussion:

Three herbal sunscreen formulations are prepare as per shown in table 1 by using Terminalia arjuna extract and banana peel extract. The result of physiochemical parameter such as color, appearance, ash value shown in table 2.

Table no. 2: Result of various pharmaceutical evaluation parameters

Parameters	Formulation I	Formulation II	Formulation III
Appearance	Cream like	Cream like	Cream like
Colour	brown	Reddish brown	Reddish brown
Consistency	Not good	Good	Good

Homogeneity	Uniform and homogeneous	Uniform and homogeneous	Uniform and homogeneous
Irritation	No	No	Mild irritation
Extrudability	Fair	Excellent	good
Spread ability	93.05± 0.23	98±0.40	97.2±0.17
Viscosity (cps) at 50rpm	31.02±0.60	33.10±0.48	33.41±0.21
Ph	7.1±0.21	7±0.11	6.9±0.38
Rancidity	No pink colour , no rancidity	No pink colour no rancidity	No pink colour, no rancidity
Thermal stability	Phase separation , thermally not stable	No phase separation, thermally stable	No phase separation, thermally stable
Centrifugation test	No phase separation (stable)	No phase separation (stable)	Minute phase separation (Unstable)
SPF by UV-spectrophotometer	15.56	50.40	28.47

Conclusion:

The present research work formulation and evaluation of herbal sunscreen cream using extract of T. arjuna and banana peel. Three herbal sunscreen formulation F1, F2 , F3 were prepare by varying the composition and perform evaluation tests. The results of physiochemical parameters and SPF showed that formulation F2 is more stable than F1 and F3 and having high SPF value.

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