



“Formulation Development And Evaluation of Herbal Sunscreen Lotion”

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ABSTRACT

The sunlight consists of harmful radiations which affect the skin. To protect our skin from Ultraviolet radiation sunscreen formulations are used which either absorbs by scatters or reflects the radiation. Sunscreen is defined as substance that protects the skin from excessive exposure to the ultraviolet, radiation of the sun. Sunscreen is use for sun protection because of their ability to block UV-induced sunburn (the sun protection factor – SPF) It helps to prevent sunburn and reduce the harmful effect of the sun such a premature skin aging and skin cancer. The present study attempts to develop sunscreen lotion, possessing broad spectrum of anti-UV radiation effectiveness with reduced concentration of chemical UV filters, from the extracts of bioactive products such Aloe Vera (Liliaceae), Curcuma longa L. (Zingiberaceae), Green tea(Camellia sinensis), Pomegranate seed oil (Punica gramatum)and Carrot Seed oil (Daucuscarota). The effectiveness of the product was identified by using different parameters. Curcumin was selected as potential bioactive agents due to their phytochemical compositions as it has anti-inflammatory and antioxidant properties and Aloe Vera is used as key ingredient in various sunscreen lotions as it has skin protectant action against UV rays and gives soothing and cooling action. The sunscreen lotions were prepared using six different formulations F1, F2 and F3.Evaluation of formulation was also done by physicochemical studies, pH determine, spread ability and viscosity.

INTRODUCTION

A sunscreen is a photo protective agent against direct ultraviolet (UV) radiation and is used to protect the skin from the harmful effects of the sun. Sunscreen, also known as sun cream or sunblock, is used for sun protection because of its ability to block UV-induced sunburn. It helps to prevent sunburn and reduces the harmful effects of the sun, such as skin carcinoma and premature skin aging. The goal of sunscreen formulation is to block UV rays and increase the level of protection from them. The UV spectrum is divided into three groups based on wavelength:




Ranges of UV Rays

UV-A	320-400
UV-B	290-320
UV-C	100-290

The efficacy of sunscreen is usually expressed by the Sun Protection Factor (SPF), which is defined as the UV energy Required to produce a Minimal Erythema Dose (MED) on protected skin divided by the UV energy required to produce a MED on unprotected skin. The SPF number on a package can range from as low as 2 to as high as 100. These numbers Refer to the product’s ability to sunscreen or block out the sun’s burning rays, as if SPF number is 15, then it blocks 93% of UV-B rays, SPF 30 blocks 97% of UV-B rays, and SPF 50 blocks 98% of UV-B rays. To overcome the effects caused by UV exposure, sunscreen is used to protect the skin from those harmful effects. Natural Sunscreen, also called herbal sunscreen, is the best because it causes less skin irritation, fewer side effects, it gives a Synergetic effect, acts as an anti aging agent, natural anti-inflammatory and antioxidant effect and the main thing is it Reflects the heat energy and has less chances of generation of heat by this it causes less side effects. Natural sunscreens contain active minerals such as titanium dioxide or zinc oxide, which act by sitting on top of the skin to Deflect and scatter damaging UV rays away from the skin. They are often referred to as “physical blockers.” To develop Sunscreen lotion, we used bioactive products such as Curcumin longa (Zingiberaceae), Aloe Vera (Liliaceae), Green Tea, carrot seed oil,

Pomegranate oil, in different concentrations. Curcumin was selected as a Potential bioactive agent due to its anti-inflammatory and antioxidant properties. Aloe vera was used for its soothing and Cooling action. Carrot seed oil has antioxidant, antiseptic and antifungal properties.

Ingredient used in Herbal Sunscreen Lotion

Sr. No	Biological Name	Origin	Photo	Uses
1	Aloe vera extract <i>Aloe barbadensis miller</i>	It grows mainly in the dry regions of Africa, Asia, Europe, and America.		Anti-inflammatory, Moisturizing, Ant aging, Antiseptic effect.(Wikipedia 2021)
2	Turmeric <i>Curcuma longa</i>	Originating 4000 years ago in the Vedic culture in India.		Antiseptic, Prevent from sunburn. ^[9]
3	Pomegranate Seed Oil <i>Punica granatum</i>	Indigenous to iron commonly cultivated in the americas.		Anti inflammatory /Anti aging

4	Carrot seed oil <i>Daucus carota</i>	Indian, Greek, Roman, Egypt.		Anti-Inflammatory, Anti- bacterial, Moisturizes Dry Skin. ^[12]
5	Green Tea Extract <i>Camellia sinensis</i>	Originated in China		Moisturising Regulate sebum production

Material and Methods

Preformulation Studies

The herbal ingredients i.e., curcumin powder extract, carrot seed oil, pomegranate seed oil were purchased from a whole sale supplier of natural crude drugs. These crude herbal drugs were identified by using different parameters for example physical parameters, chemical tests and chromatographic studies etc.

Collection of plant

The fresh and healthy leaf of aloe vera was collected from nursery. Leaf was washed with tap water to remove dust particles and impurities.

Instruments

Instrument used were pH meter, Brookfield viscometer, furnace, and magnetic stirrer.

Preparation Of Crude Extracts:

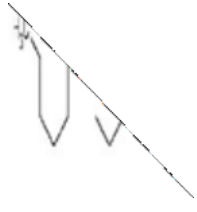
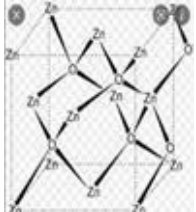
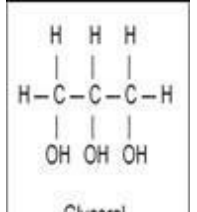
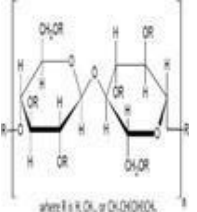

Preparation of curcumin extract: By Maceration Method

For the extra pure curcumin longa (Zingiberaceae) we have, for preparation, an extract of 40gm was weighted and Dissolved in 150ml of 95% ethanol, then filter it.

Preparation of Aloe Veraextract:

For this, we used fresh aloe vera leaf from the plant. We cut off one of the outer leaves from the base of the plant once the Leaf has peeled. The natural aloe vera gel is obtained, then we grind it and filter by Muslin Cloth and add preservative (optional).

Ingredients Used in Herbal Sunscreen Lotion

NAME	Cetyl alcohol	Zinc Oxide	Glycerine	HPMC	Stearic acid
Molecular formula	C ₁₆ H ₃₄ O	ZnO	C ₃ H ₈ O ₃	C ₅₆ H ₁₀₈ O ₃₀	C ₁₈ H ₃₆ O ₂
Molecular Wt.	242.44g/mol.	81.38g/mol.	1261.4g/mol.	1261.4g/mol.	284.4g/mol.
Solubility	Ether, Acetone	Dil. acids	Water	Water	Alcohol, phenyl, ccl4
Boiling Point	344°C	2,360°C	290°C	1102°C	361°C
Melting Point	49.3°C	1.975°C	17.8°C	1.39°C	69.3°C
Viscosity	53 cP	10 cP	1.412 Pa.s	4000 mPa.s	9.79 mPa.s
Odour	Waxy	Odourless	Odourless	Odourless	Pungent, Oily
Uses	Lubricant	Protecting from UV radiation, Anti-microbial.	Natural moisturizer	Prevents damage from sunburn	Lubricant
Chemical Structure					

Formulation of Herbal Sunscreen Lotion

Weigh accurately steric acid, acetyl alcohol, zinc oxide, glycerin, HPMC (Hydroxypropylmethylcellulose), and the required. Amount of water (50ml) into a beaker, then add 4-6ml of triethylamine (Oil phase) into the water phase at an equal Temperature range and thoroughly mix. This water phase is heated up to 75 to 80 degrees. When the water phase reaches the above weighed material, i.e., zinc Oxide, steric acid, acetyl alcohol, HPMC, and glycerine, they are added and stirred continuously until a smooth and uniform. Lotion is formed. In another beaker, take the triethylamine solution (75 to 80 degrees) and pour this mixture into the above Phase, which is the water phase, and mix it uniformly. Set it aside for cooling. After the above lotion cools down, add a Weighed amount of aloe vera extract, prepared curcumin extract, Green tea extract, carrot seed oil, pomegranate oil. Add all the ingredients and mix them continuously until you get the proper lotion. There are 3 formulations (F1, F2, F3 F4) that were prepared using this same formula.

Composition of Various Sunscreen Formulations

Sr no	Ingredients	F1	F2	F3
1	Cetyl alcohol	1.08.	1.08	1.08
2	Zinc oxide	6.5	6.5	6.5
3	Steric acid	2.1	2.1	2.1
4	Glycerin	1.66	2.3	2.5
5	HPMC	5.4	5	5.16
6	Carrot seed oil	1.6	1.6	1.6
7	Aloe Vera extract	2.4	2.1	2.1
8	Pomegranate seed oil	2.1	2.1	2.1
9	Curcumin	1.08	1.08	1.11
10	Triethylamine	1.08	1.11	1.08

Evaluation formulation

Physiochemical Studies This parameter for physiochemical studies colour, pH, volatile, non-volatile content, viscosity spreadability. The parameters were assessed using the Bureau of Indian Standard (BIS), the World Health Organization (WHO) Recommendation. The viscosity profile of each formulation was determined using Brookfield viscometer at 10 to 100 rpm at Room temperature with 10ml of samples. Multimer’s methodologies were used to assess stability and layer of thickness.

Batch	Colour	PH	Viscosity 50 rpm	Viscosity 70rpm	Viscosity 90rpm	Spreadability
1	Peach	7.8	5880	4206	3276	98±0.5
2	Orange	7.4	3872	2771	2142	98±0.9
3	Dark orange	7.7	824	582	453	98±0.7

PH determination

The sunscreen lotion may have a pH range between 5 to 9. For measuring the pH, the direct solution is not taken. For that, the formulation is diluted up to 10% by using distilled water and then the pH is determined by using an instrument, i.e., pHmeter. For that, the pH range is adjusted to 7 by using pH buffer solution and the pH of all the formulation batches is Measured.

Viscosity

The viscosity of the given formulation of sunscreen lotion is measured by using a Brookfield viscometer. An accurate Spindle (T shaped) is selected and the viscosity is measured at 100 rpm and the result is shown in table number.

Spreadability

Stability tests were achieved at different conditions for emulsions to explore the effect of these conditions on the storage of Emulsion. These tests were performed on sample kept at $8^{\circ}\text{C} \pm 2^{\circ}\text{C}$, $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Colour, phase separation And liquefaction of emulsion were observed at various time intervals during 28 days.

Determination of SPF

SPF was determined in the samples in which the previous assay of organoleptic characteristic evaluation was performed, as Well on days 1, 2, 5, 8, 12 and 15. To do so, samples were prepared according to the method proposed by Dutra et al. (2004). In this manner, 0.5 g of each sample was mixed with an appropriate amount of distilled water to obtain a final Concentration of 0.2×10^{-4} g/ml. Briefly, samples were dispersed in 100 ml of distilled water and were homogenized by Ultra-sonication for 5 min. The obtained dispersion wa filtered with a filter paper and the first 10 ml was rejected. Then 2 Ml of filtered solution was adjusted to 50 ml using distilled water. The absorbance of each sample was determined by Spectrophotometry in the range of 290–320nm (UVB), with 5nm intervals, using distilled water as blank. A fresh sunscreen Sample (not submitted to temperature effect) was used as control, in order to establish initial SPF. Three replicates of each Group wereperformed. The SPF of each sample was determined with the data obtained by spectrophotometric analysis, mansur equation.

Result and discussion:

Four formulation F1, F2, and F3 were prepared. All the formulation contain different concentration of the ingredients. The result of physicochemical properties such as color, pH, viscosity and Spreadability, are summarized in the table P H of formulation ranges from 9.42 to 5.89that complies with the skin p H

The viscosity of the formulated lotion at 100 rpm in given in table.... It showed 14.5 to 20.7 at 100 rpm indicating good rheology during handling.

Summary and Conclusion

The study attempted to develop herbal sunscreen lotion extract of curcumin longa, aloe Vera and pomegranate oil, carrot oil, green tea are examined their efficacy for preventing sunburn. This study shows that formulation F3 having curcumin was found to be more stable i.e., proving a better sunscreen lotion. As the formulation are contains all herbal ingredients, that less harmful for the skin.

The present study was designed for the preparation of herbal sunscreen lotion with different concentrations of the natural ingredients. The formulations F1, F2, F3, F4, were prepared by different composition and evaluated by physicochemical studies, pH determines, spread ability and viscosity, by determining all four formulations, we finalized F3 a by identifying their different parameters, like viscosity, pH, spread ability etc.

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