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FORMULATION AND EVALUATION OF POLYHERBAL SUNSCREEN LOTION CONTAINING WATERMELON RIND, VETIVER AND TURMERIC EXTRACTS

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ABSTRACT

The present study focuses on the formulation and evaluation of sunscreen lotion incorporating extracts of watermelon rind, vetiver root and turmeric. The sunscreens plays a major role in blocking the UV- Shafts and mitigating harmful effects caused by it. Therefore, application of sunscreen is considered as one of the trendiest method to get rid of skin cancer, photoaging, sunburn, erythema etc. The sunscreen lotion is made, various plant components are extracted which is having antioxidant, anti-inflammatory, cooling properties. Evaluation is done by using parameters like pH, SPF, spreadability, washability and feel.

KEYWORDS: Watermelon rind, Vetiver, Turmeric, Sunscreen Lotion, Photoaging, UV- Shafts.

INTRODUCTION

Human skin is constantly subjected to ultraviolet (UV) radiation from sunlight, making it vulnerable to several dermatological disorders such as erythema, premature aging, hyperpigmentation, sunburn, and skin malignancies.[1]

Ultraviolet radiation is broadly classified into three categories based on wavelength.

- UVA (320–400 nm)
- UVB (290–320 nm)
- UVC (200–290 nm)

Among these UVA and UVB reaches the earth's atmosphere and exert harmful effects on the skin while UVC is effectively filtered by the ozone layer. Overexposure to these radiations leads to oxidative stress, inflammation, and damage to cellular DNA and thereby emphasizing the need for effective photoprotective measures.[2]

Sunscreen formulations are widely employed as a protective strategy against the deleterious effects of UV radiation. These formulations functions by absorbing, reflecting, or scattering UV rays, thereby reducing their penetration into the skin. The effectiveness of sunscreen products is commonly expressed in terms of Sun Protection Factor (SPF), which indicates the level of protection provided against UVA and UVB radiation.[3] In addition to photoprotective efficacy, an ideal sunscreen formulation should possess appropriate pH, viscosity, good spreadability, stability, aesthetic appeal and good skin compatibility.

In recent years, there has been growing interest in the development of herbal sunscreen formulations due to the presence of naturally occurring antioxidants and bioactive compounds in plant materials. Such formulations are considered safer and more environmentally friendly compared to synthetic sunscreens. Therefore, the present study was undertaken to formulate and evaluate a sunscreen lotion containing watermelon rind extract, vetiver essential oil, and turmeric extract. The prepared formulation was assessed for various physicochemical properties and in-vitro SPF to determine its suitability as an effective sunscreen lotion.

MATERIALS AND METHODS

Watermelon rind, contains vitamin C, vitamin B, fibres and potassium. The rind is rich with antioxidant compound called citrulline. Citrulline also act as anti-ageing propertie in the cosmetic industry by regulating

collagen and improving skin suppleness.[4]

Vetiver essential oil, essential oils is very popular in aromatherapy and has many medicinal properties. The very soothing and cooling effect of this essential oil calms and pacifies all sorts of inflammations.[5]

Turmeric, main active constituent of turmeric is curcumin. Protective effect of curcumin against ultraviolet A irradiation-induced photoaging in human dermal fibroblasts is very evident.[6] Curcumin protects from skin injury caused by UV radiations. Curcumin suppresses ultraviolet (UV) induced skin carcinogenesis and activate the nuclear factor erythroid 2-related factor 2 pathway.[7]

Zinc oxide, an inorganic compound with the chemical formula ZnO.[8] It is a physical sunscreen agent that provides broad-spectrum protection against both UVA and UVB radiation by reflecting and scattering ultraviolet rays. It is safe and very suitable for sensitive skin.

Stearic acid, also considered to be a safe ingredient for the skin. It is non-comedogenic and non-irritating, which means that it is unlikely to clog pores. Overall, stearic acid is a beneficial ingredient in sunscreen lotion. It helps to moisturize the skin, emulsifies the sunscreen, thicken the lotion, and provide a barrier against the sun's harmful UV rays.[9]

Cetostearyl alcohol, an emulsion stabilizer and thickening agent. It improves texture and spreadability of sunscreen lotion and prevent its phase separation.

Glycerine, in topical preparations acts as a humectant that forms a layer on the skin's surface to protect the skin. glycerine can maintain the stability of the preparation in the long term and bind the components contained in the dosage form.

Jojoba oil, derived from the *Simmondsia chinensis*, is effective as a moisturizer for dry skin conditions like eczema, psoriasis, and dry skin. It contains myristic acid, a natural plant chemical that provides sun protection and also has antioxidant properties.[10]

Almond oil, act as emollient and nourishing agent. It is rich in vitamins and fatty acids. It also prevents dryness and irritation.

Sandalwood oil, primarily used for dry skin conditions caused by moisture loss and skin inflammations. It's chief constituent is santalol (≥90%) that provide soothing, cooling and moisturizing activity.[12]

Vitamin E, tocopherol is used in sunscreen lotion as a strong antioxidant that helps to protect the skin from UV rays-induced free radical damage. It enhances photoprotection, reduces inflammation, and helps prevent photoaging.

Phenoxyethanol, act as preservative that prevents microbial growth.

Triethanolamine, is stabilizer and surfaceactive agent.

METHODOLOGY

- **Extraction of citrulline from watermelon rind.**
- **Extraction of vetiver essential oil from vetiver root.**
- **Extraction of curcumin from turmeric**

Extraction of citrulline from watermelon rind

Watermelon rind was collected, cleaned and cut into small pieces of 2×1 cm. watermelon rind was dried in a hot air oven at 60 °C for 24 hours. The dried sample was collected and soaked in 70% ethanol for 3 days. Then it was filtered and filtrate was subjected to evaporation in the thermostatic water bath. The extract was collected and stored in refrigerator.

Figure No. 1: extraction of watermelon rind

Extraction of vetiver essential oil from vetiver root

Ethanolic extraction: Ethanol extraction of *vetiveria zizanioides* (about 30 g) was carried out by using a Soxhlet apparatus which was connected to a round flask containing 500 ml of ethanol. The extraction was carried out at boiling temperature of ethanol for 5 hours. After extraction, ethanol was removed by evaporation at the boiling point.

Figure No. 2: extraction of vetiver root.

Extraction of curcumin from turmeric

Ethanolic extraction: Dried powdered rhizomes of *Curcuma longa* (20g) were added to 250 ml beaker along with 100ml ethanol, kept aside for 24 hours. The sample were filtered under aseptic condition and were stored in refrigerator.

Figure No. 3: extraction of turmeric.

PREPARATION OF SUNSCREEN LOTION

Table no. 1: Formulation table.

INGREDIENTS	F1	F2	F3
Citrullus lanatus extract	2mg	2mg	2mg
Vetiveria zizanioides extract	1.5ml	1.5ml	1.5ml
Curcuma longa extract	0.1mg	0.1mg	0.1mg
Stearic acid	2mg	2mg	2mg
Cetostearyl alcohol	2mg	2mg	2mg
Glycerine	2ml	3ml	4ml
Jojoba oil	2.5ml	2.5ml	2.5ml
Sandalwood oil	1ml	1ml	1ml
Almond oil	3ml	3ml	3ml
Zinc oxide	3mg	4mg	5mg
Vitamin E	0.5ml	0.5ml	0.5ml
Phenoxyethanol	0.5ml	0.5ml	0.5ml
Distilled water	q. s	q. s	q. s
Triethanolamine	q. s	q. s	q. s

Step 1: Preparation of Aqueous Phase

- Heat distilled water to 70-75^{o} C and add glycerine.
- Add watermelon rind to the extract and heat up to 70-75^{o} C.
- Mix well until fully dissolved.

Step 2: Preparation of oil phase

- In another beaker, add jojoba oil, sandalwood oil, almond oil, vetiver essential oil, curcumin, stearic acid and cetostearyl alcohol.
- Heat to until 75-80^{o} C.
- Add zinc oxide gradually with continuous agitation.

Step 3: Emulsification

- Slowly add the oil phase into the aqueous phase with continuous stirring.
- Maintain constant mixing for 10–15 minutes until a uniform emulsion forms.

Step 4: Cooling & incorporation of actives

- Cool the mixture to 40 °C.
- Add Vitamin E and phenoxyethanol.
- Adjust pH to 4.5 – 5.5 using triethanolamine.

EVALUATION TESTS

Physical Evaluation

Colour: The formulation's colour was manually verified and noted. Appearance: Visual inspection was used to assess the formulation's appearance.

Odour: The formulation's aroma was assessed by putting the preparation to the hand and feeling the scent.

Consistency: A manual check was performed on the product's consistency. Homogeneity: The formulation's homogeneity was assessed through touch and look.

Determination of pH

The pH of sunscreens was determined using a digital pH meter. pH was measured after 1 g of the formulation was dissolved in 100 ml of newly prepared distilled water for

2 hours. The purpose of this study was to guarantee that the pH of the produced sunscreen lotion is similar to the pH of the skin after 24 hours of use.

Determination of Viscosity
Viscosity was measured using the Brookfield viscometer with the appropriate number of spindles chosen. 50 g of preparation was kept in a 50 ml beaker until the spindle groove was dipped and the rpm was adjusted. The viscosity of sunscreen was determined at 5, 10, 20, and 100 rpm.

Spreadability
The spreadability of sunscreens determined their therapeutic efficiency. The appropriate amount of sunscreen was applied between two slides, and under specific load directions, and the two sides took the time in seconds to slide off. Spreadability was defined as the amount of time it took to separate two slides in less time.

The formula for calculating it is.
S = M × L/T
Where, M = weight tied to the upper slide L = length of glass slide
T = time taken to separate the slides

Washability
This test is carried out by simply washing applied sunscreen lotion with water.

Irritancy Test
Mark an area (one sq. cm) on the left hand dorsal surface. The lotion was applied to the specified area and time was noted. Irritancy, erythema, oedema was checked if any for regular interval up to 24 hours and reported.

Stability Testing
Stability testing of prepared formulation was conducted at room temp, studied for 7 days. And then the formulation was kept both at room and elevated temperature and observed for 20 days for all the evaluation parameters.

Determination of SPF
A UV Visible spectrophotometer was employed to assess the in-vitro effectiveness of herbal sunscreens. A 0.10 percent (w/v) solution of herbal sunscreen lotion in ethanol was prepared by dissolving 0.050 g of herbal sunscreen lotion in 50.0 ml of ethanol. Between 290 and 320 nm, samples of each herbal sunscreen were analysed at intervals of 5 nm. SPF was determined using the formula provided below
$SPF = CF \times \Sigma [EE(\lambda) \times I(\lambda) \times Abs(\lambda)]$
Whereas, CF = Correction factor.
EE = Erythemogenic effect.
I = Intensity of solar light of wavelength A = Absorbance

OBSERVATION

Physical evaluation

Table No. 2: Physical evaluation.

Physical parameters	F1	F2	F3
Colour	cream	**cream**	cream
Appearance	good	**great**	good
Odour	characteristic	**characteristic**	characteristic
Consistency	loose	**smooth**	thicker
Homogeneity	homogeneous	**homogeneous**	homogeneous

Evaluation test

Table No. 3: Evaluation test.

Formula	F1	F2	F3
pH	5.8	6.2	5.9
Viscosity at 10 rpm	188	200	179
Spreadability	23.4	26.33	21.6
Washability	Easy removal	Easy removal	Easy removal
Irritancy test	No irritation	No irritation	No irritation
Stability	Stable	Stable	Stable
SPF Value	7.71	15.08	11.13

RESULTS
The sunscreen lotion formulation was evaluated for its sun protection factor (SPF). The SPF was determined by measuring the amount of UV radiation that was blocked by formulation. The sunscreen lotions SPF was a high of 15 was good. It has good spreadability and it is easily washable and non-irritant to the skin.

DISCUSSION
The most noticeable immediate advantage of available sunscreen lotion is the protection against sunburn caused by UVR exposure. The clear advantage is the avoidance of sunburn, which may decrease the likelihood of both non-melanoma and possibly melanoma skin cancers due to the intensity and occurrence of sunburn.

The research aimed to create a sunscreen lotion utilizing extracts from watermelon rind, vetiver root, and turmeric, and assessed their effectiveness in preventing sunburn. The proposed UV spectrophotometric technique is

straightforward, quick, utilizes inexpensive reagents, and is applicable for in vitro evaluation of SPF values in various cosmetic products.

Plant extracts, due to containing wide range of phenolic acids, flavonoids and high molecular weight polyphenols usually cover the full range of UV wavelengths. The phytochemical investigation revealed the presence of flavonoids. tannins, phenolics, glycosides, terpenoids in *Citrullus lanatus*, *Vetiveria zizanioides*, *Curcuma longa* showed strong-to-moderate absorption of UV radiation along the whole ranges. Overall, the provided sunscreen lotion is safe and very effective way to protect the skin from UV induced radiations.

CONCLUSION

The present study successfully formulated and evaluated a sunscreen lotion containing watermelon rind extract, vetiver essential oil and curcumin. The formulation exhibited acceptable physicochemical properties such as pH, spreadability, viscocity, and appearance, indicating formulation stability and acceptability. The presence of natural phytoconstituents including flavonoids, phenolic compounds, sesquiterpenes, and curcuminoids contributed to significant antioxidant and photoprotective activity. The synergistic action of these bioactive components provide effective UV protection along with anti-inflammatory and skin-soothing benefits. Overall, the developed sunscreen lotion demonstrates potential as a safe, effective, and eco-friendly alternative to synthetic sunscreens, warranting further in-vivo studies and long-term stability evaluation for commercial application.

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