



FORMULATION AND EVALUATION OF HERBAL SUNSCREEN

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Abstract

Today's fast-paced lifestyle has a negative impact on our health due to pollution and harsh synthetic chemicals; therefore, nature has provided us with its timeless, noteworthy herbal elements. UV radiation is the main cause of sunburn and is also linked to dangerous skin cancer. Atopical substance called sunscreen helps protect skin from UV rays by reflecting or absorbing part of the sun's UV rays. It may help avoid sunburn and lessen the negative effects of the sun, like skin cancer and early aging. The current study presents the formulations and assessment of topical photoprotectives that include additional photo-protective polyphenols as well as antioxidant, anti-malignant, antifungal, antiaging, moisturizing, and wound healing properties. Skin conditions like sunburn and the associated symptoms of extended exposure have been linked to ultraviolet radiation. Because of their capacity to absorb, reflect, and scatter UV light, sunscreens have been shown to be helpful in lowering the prevalence of skin conditions such as sunburn, skin aging, and immunosuppressive reactions. It has been established that ultraviolet light can lead to skin conditions such as sunburn and the associated symptoms of extended exposure. According to reports, sunscreens' capacity to absorb, reflect, and scatter UV light helps to lower the prevalence of skin conditions such as sunburn, skin aging, and immunosuppressive reactions.

Introduction: -

The effectiveness and safety of sunscreens are crucial for the environment and human health. The short list of substances that can be used as active components in sunscreen products is alarming, especially in light of the growing public scrutiny of ingredient lists. A number of well-reported studies have been conducted in the last several years about the possible risks that sunscreens containing small molecules pose to aquatic life and human health. The sunscreen monograph published by the US Food and Drug Administration (FDA) as of June 2021 only included 16 UV filters (the active chemicals in sunscreens) that were permitted to be used in cosmetic items. These comprise four organic compounds that absorb in the UV-B and short-wave UV-A (315–340 nm) regions, eight organic compounds that primarily absorb in the UV-B region (280–315 nm), and only two organic compounds that primarily absorb in the full UV-A region (315–400 nm), which includes both short-wave and long-wave UV-A. Up to 95% of UV light that reaches

the Earth's surface is UV- A; hence, filters that offer UV-A coverage are very crucial. Excessive exposure to UV radiation can cause oxidative injury and impairment of the antioxidant system. Since skin is the largest and outermost part of the body, photo damage to this most sensitive part of the body can result from direct sun exposure. The UV region of the electromagnetic spectrum is the main source of solar radiation and can cause effects to the skin, immune system, and eyes. Sunscreen's ability to prevent photostamp damage makes UV protection deservedly very popular. Applying sunscreen preparation topically helps to increase the level of Sun Protection Factor while also healing, preventing, or resisting the damaging effects of sunburn, suntan, sun cancer, and premature skin aging. Plants possess antioxidant effects due to the presence of flavonoids and phenolic compounds. These bioactive ingredients are capable of absorbing UV light. Additionally, it neutralizes the free radicals that UV radiation causes to be produced in the skin. The flavonoids work by chelating or scavenging substances in the body. 4) A variety of active ingredients are present in *Tinospora cordifolia* (Family Menispermaceae), including polyphenols, alkaloids, steroids, flavonoids, and glycosides. The active ingredients in the plant have been extracted from its many components, such as its root, stem, and entire body.

Ingredients: -

- 1) Zinc oxide powder



Fig: -1 Zinc Oxide powder

History indicates that zinc compounds were probably utilized by early humans as a paint and as a topical, therapeutic ointment. It's unclear, though, what composition they employed. A passage from the 500 BC Indian medical literature Charaka Samhita describes a salve for open wounds and eyes that is most likely zinc oxide. Additionally, the FDA authorized the use of zinc oxide (ZnO), one of two inorganic "filters" that block UV-A and UV-B radiation. ZnO is frequently used to block UV-A and UV-B radiation, respectively.

2) Olive oil



Fig: -2 Olive oil

It is a fat derived from the olive fruit. Olive oil is made up of triglyceride esters of oleic acid and palmitic acid along with traces of squalene, sterols, (phytosterols, and tocosterols), and also consists of polyphenols like esters of Tyrosol and hydroxyl tyrosol including oleocanthal and oleuropein. Some flavonoids and lignans are also present. Olive oil has been used as a home remedy for skin care. Squalene is utilized as an antioxidant, and moisturizer, and in topical sunscreen preparation, it is a convenient vehicle to carry other substances.

3) Coconut Oil: -



Fig: -3 Coconut oil

It is a tropical plant that grows and is cultivated numerously by Indonesian people. It contains fatty acids and is reported to possess antioxidant properties photoprotection, and other medicinal activities like anti-bacterial, skin barrier repair, anti-aging, wound healing, and moisturizing in atopic dermatitis treatment

4) Aloe Vera: -



Fig: -4 Aloe Vera

Aloe vera is one of the medicinal plants that are heavily used in the pharmaceutical industry, especially in cosmetics. The aloe plant that is cultivated in Indonesia to supply this industry is *Aloechinensis Baker*. This research is to determine the effects of Aloe vera gel extract on the effectiveness of sunscreen lotion. The steps taken included Aloe vera gel extraction, flavonoid absorption test, sun protection factor (SPF) value measurement, pH test, viscosity test, homogeneity test, and organoleptic evaluation. The extract was added to the base sunscreen formulation at five different concentrations.

5) Rose water: -



Fig: - 5 Rose water

It is extracted from the rose by liquid-liquid extraction. One of the most important factors is that they have a good source of antioxidant activities and also be used for beautifying purposes for their sterling sunscreen.

In Silico and In Vitro Sun Protection Factor (SPF) determination: -

The sunscreen formulation's efficacy can be identified by calculating the sun protection factor (SPF), which is defined as the UV energy required to produce a Minimal Erythral Dose (MED) in protected skin, divided by the UV energy required to produce a MED in unprotected skin.

SPF = $\frac{\text{Minimal erythral dose in sunscreen protected skin}}{\text{Minimal erythral dose in non-sunscreen protected skin}}$

The minimal erythral dose (MED) is defined as the lowest time interval or dosage of UV light irradiation sufficient to produce minimal, perceptible erythema on the unprotected layer of skin. In Vitro SPF values of oily formulations containing vegetable oils and/or organic UV filters were calculated spectrophotometrically and observed absorbance values at 5 nm intervals (290-320 nm) were calculated spectrophotometrically by using the formula:

$$SPF = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

Where,

CF = Correction Factor (10)

EE (λ) = Erythral Effect Spectrum

I(λ) = Solar Intensity of Radiation with wavelength λ

Abs(λ) = Absorbance of the sunscreen product at wavelength λ

EE \times I = Constant Value

Formula for herbal sunscreen

Sr. No.	Name of Ingredient	Quantity
1	Zinc oxide	10 gm
2	Olive oil	5 ml
3	Coconut oil	5 ml
4	Aloe vera	-
5	Rose water	5 ml

Development of Formulation STEP- 1

Firstly, take Zinc oxide in a beaker after that add Olive oil, Coconut oil, in measured quantities and heat up to 75°C.

STEP- 2

Add Rose Water and Aloe Vera in another beaker in measured quantity. Heat the mixture up to 75°C.

STEP- 3

Mix both the mixture and stir gently until a smooth cream is formed at room temperature.

• Evaluation Parameters

-Physical Parameters

Appearance, color and homogeneity are determined.

-Evaluation of herbal sunscreen

Appearance	Smooth
Color	Pale Yellow
Consistency	Good
Texture	Smooth
Irritation	Non
pH	7.3
Rancidity	No Pink color
Spread ability	Good

1) Sun Protection Factor Determination

SPF of formulated creams were calculated by the application of equation:

$$SPF = CF \times \sum EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

The formulation prepared was scanned under UV Spectrometer and the obtained absorbance for 290 to 320 nm. These values are multiplied with $EE \times I$ value and the obtained values are multiplied by the correction factor 10.

2) Rancidity

Rancidification is the process of complete or incomplete oxidation or hydrolysis of fats and oils when exposed to air, light, or moisture or by bacterial action, resulting in an unpleasant taste and odor. Rancidity 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 liberated. These free fatty acids react with the Phloroglucinol solution and give pink color indicating the rancidity of the product. 10ml of cream was taken then added 10 ml of concentrated Hydrochloric acid and 10 ml of Phloroglucinol solution and shaken for one minute. The cream should have passed the test if no pink color develops.

3) Viscosity

Viscosity is an important parameter in the evaluation of the cream. Viscosity governs many properties of the cream such as spreadability, pouring ability of the cream from the container, etc. The viscosity of formulation was determined by using Brookfield Viscometer and Viscosity was found to be in the range of 28000-32000 cp. The Viscosity is determined by using the following formula:

Viscosity = Dial Reading \times Factor. For LV-4 at 6 RPM Factor is 1M (1000) Table

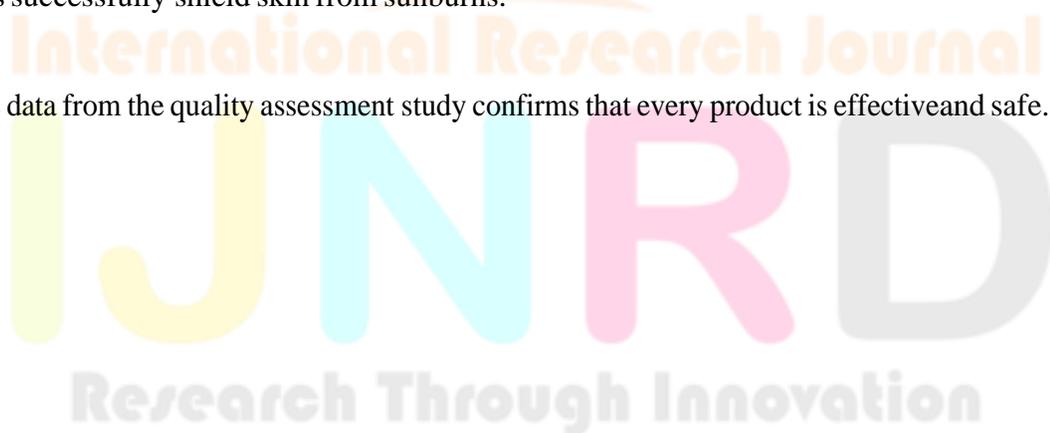
4) PH Determination

PH denotes "Potential of Hydrogen" and is a scale used to specify the acidity or basicity of an aqueous solution. Acidic solutions are measured to have lower pH values than basic or alkaline solutions. The cream in general has a pH of 6 to 9.

Result and Discussion: -

Our study's findings showed that 71% of the chosen herbal sunscreens are stable in both the UVA and UVB ranges, and 100% of them are photostable in the UVB range. According to a subjective study using in vivo SPF assessment, 98% of sunscreens successfully shield skin from sunburns.

The majority of the data from the quality assessment study confirms that every product is effective and safe.



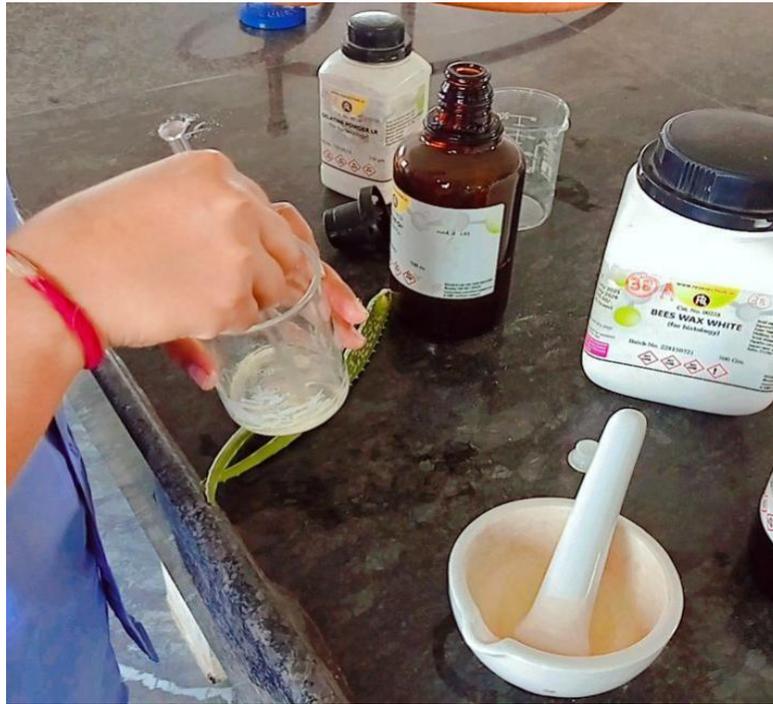


Fig 6: - Final product of Sunscreen

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