



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## Formulation And Evaluation Of Herbal Sunscreen

Geeta vaman bhople, Sanap.A.S.,and Dr.Prachi Udupurkar . Kishori College of Pharmcy,Beed Dr.Babasaheb Ambedkar Technological University,Lonere

**Abstract**— The sunlight consists of harmful radiations which affects the skin. The Ultraviolet radiations are of 3 types Ultraviolet A, Ultraviolet B and Ultraviolet C. This article gives a detailed review on different types of Ultraviolet radiation. To protect our skin from Ultraviolet radiation sunscreen formulations are used which either absorbs scatters or reflects the radiation. The harmful effects on skin like photo aging, skin cancer, DNA damage are explained. The present review explains the various types of sunscreen formulations and the agents used for the purpose of sun screening. The agents are of two type's physical and chemical sun screening agents. The physical agents which block the sun light and the chemical agents which absorb the sunlight are listed and explained. To know the efficacy of the formulation sun protection factor calculation is done. The equation used to calculate the Sun Protection Factor value is explained in detail. The ultraviolet spectroscopic method is employed to calculate the Sun Protection Factor. The proposed method is found to be easy and rapid for the calculation of Sun Protection Factor values in the in vitro studies. The herbal formulation is more advantageous than the chemical formulation because of its fewer side effects. Few herbal sun screen agents are listed and explained its activity.

**KEYWORDS:** UV radiations, Sunscreen agents, Sun Protection Factor, Herbal sunscreens

### INTRODUCTION

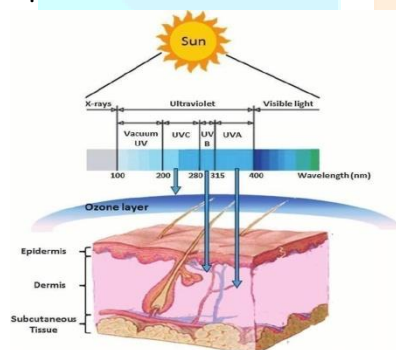
Sunscreens are those agents which absorbs, scatter or block UV radiation It controls the deleterious effects like premature aging which can lead to sagging, wrinkling, hyperplasia associated with UV radiation. The active ingredients used in Sunscreen preparation are divided into Organic and Inorganic filters based on the mechanism of action and chemical composition. Organic filters absorb the UV radiation while Inorganic filters protect skin by scattering and reflecting UV radiation This agents are found as over-the-counter products in supermarkets and pharmacies, even it is sold by physicians in USA directly, in Italy by hospitals and in Australia by Cancer charities and Cancer control Organisation .The largest organ of the body is skin which covers 15% of the total body mass of an adult. Integument is an outer covering of skin which is derived from the Latin word integere. The skin not only varies from one individual to other but it varies because of the geographical location and with respect to colour, texture, thickness of the skin layers and adrenal structures like sweat glands, sebaceous glands, hair follicles

Skin structure consists of mainly three layers:

- (a) Epidermis,
- (b) Dermis
- (c) Hypodermis and their

functions are different from one another. It mainly protects from pathogens, UV light, chemical and injury because of its structure made up of intricate network which acts as a barrier. It also regulates the temperature and amount of water released into the external environment. Sunlight is an electromagnetic radiation of continuous spectrum which is divided into three main spectrum of wavelength:

- (a) Ultraviolet
  - (b) Visible
  - (c) Infrared
- Ultraviolet (UV) radiation is further divided into three ranges (a) UV-A (320-400 nm), (b) UV-



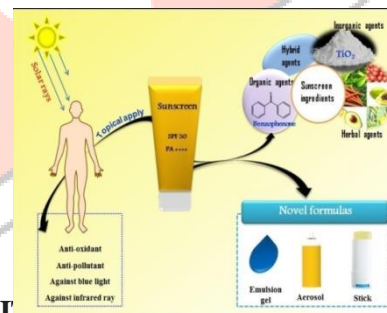
**Fig.Skin**

(b) UV-B (280-320 nm), (c) UV-C (200-280 nm) among which UV-A has highest wavelength and less energy, UV-C has high energy and shorter wavelength while UV-B remains in the mid-range. Around 80-90% of UV-A and 1-10% of UV-B reach the earth's surface while UV-C gets absorbed to earth's atmosphere. UV-A can penetrate to deeper layer dermis and it can damage DNA by indirect photosensitizing reaction by production of reactive oxygen species. UV-B reaches to epidermis layer and it is absorbed by DNA which results in molecular rearrangements forming photoproducts like cyclobutane dimers and pyrimidine (6-4)

pyrimidine (6-4 photoproducts) as shown in Figure 1 and UV-C gets absorbed to ozone layer of earth's stratosphere, exposure is a main reason for age-related changes such as development of skin cancer because of skin's anatomic location at external part of body. To overcome this problem, Sunscreen Agents are used.

### Ideal properties of Sunscreen products:

1. Sunscreen should absorb a broad range of UV spectrum for protecting the skin from UV rays.
2. There should be no chemical breakdown which will result into decrease in efficacy or increased toxicity or irritation because of by-products.
3. It should have suitable properties while formulating with cosmetic base and it should
4. penetrate the skin easily.
5. For effective results, frequent re-application of sunscreens should not be required.
6. At low concentration, it should be effective. It should not cause irritation, sensitization



### LI Yangmyung Ma, et al. (2021):

With the global sunscreen market expected to reach \$24.4 billion worldwide by 2029, this demonstrates the increasing awareness of the damaging effects of sunlight. Sunscreen has been gradually evolving, and new photoprotective ingredients are continuing to be produced in response to growing scientific evidence on the effect of solar radiation on the skin. This literature review aims to provide an updated view of the history of sunscreens. A literature search was conducted with the keywords "Sunscreen,

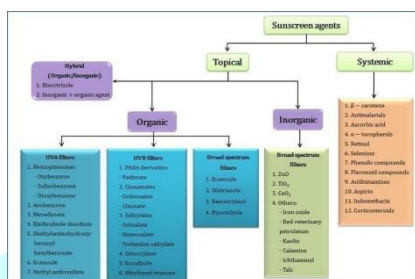
history, regulation, ultraviolet A, ultraviolet B, visible light” from PubMed, Medline, and onlinerearch engines.

**Leslie K Dennis, et al ..(2003):**

Originally developed to protect against sunburn, sunscreen has been assumed to prevent skin cancer. However, conflicting reports include claims that sunscreen increases risk for melanoma.

### Classification of Sunscreen:

Classification of sunscreen agents is based on the composition and mechanism of action is shown in Sunscreen agents works by different method by blocking, reflecting and scattering the Uv radiation.



**Fig.classification of sunscreen agents**

### 1. Organic sunscreens

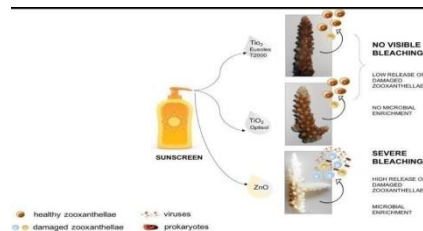
These are generally aromatic compounds linked with a carbonyl group. They are broadly classified into three categories based on the range of protection; UVB (290–320 nm) and UVA (320–400 nm) and broad-spectrum sunscreens that cover the entire spectrum (290–400 nm) (Gard, 2009). Examples of organic sunscreens covering UVB include (PABA) and its derivative padimate O, salicylates including octisalate and homosalate, cinnamates including octinoxate and cinoxate, octocrylate, benzsulidone and dibenzoyl menthanes. UVA filters include benzophenones; oxybenzone and sulisobenzene, avobenzone and meradimate, Methyl anthranilate and ecamsule. Broad spectrum organic filters that cover both UVA and UVB include besocetrisole, silatriazole among others.



**Fig. organic sunscreen creams**

### 2. Inorganic sunscreens

These are particles that scatter and reflect UV rays back to the environment. They act as a physical barrier to incident ultraviolet and UV light. The most commonly used particulate sunscreens are (titanium dioxide and zinc oxide). They are considered broad spectrum as they cover the entire ultraviolet spectrum. The inorganic sunscreens are also referred to as sun blocks, a term coined from their mechanism of photo protection.



**Fig.Inorganic Sunscreen**

### 3. Systemic sunscreens

These are sunscreens that are absorbed into the body and accumulate in the skin affording protection from the UV rays. Common examples under this category are .The use of systemic sunscreens for daily routine is minimal, as such the focus of this article is on topical sunscreens as these predominate in the market. Sunscreens act by preventing and minimizing the damaging effects of the ultraviolet sun rays following exposure to the sun. Sunscreens have been demonstrated to increase the tolerance of the skin to UV exposure.

### Mechanism of photo protection

mechanisms as detailed gives a pictorial perspective of the mechanisms of action stated. Scattering and reflection of UV energy from the skin surface. Mineral based (Inorganic sunscreens work primarily through this mechanism. They provide a coating that blocks sun rays from penetrating through the skin (Dransfield, 2000). Absorption of the UV energy by converting it to heat energy thus reducing its harmful effects and reduce the depth through which it can penetrate the skin. Organic sunscreens work primarily through this mechanism (Dransfield, 2000; Lademann et al., 2005; Manaia et al., 2013)

**Benefits of sunscreen**

1. Reduce risk of skin cancer
2. Protect against sunburn
3. Avoid inflammation and redness
4. Avoid blotchy skin and hyperpigmentation
5. Stop DNA damage
6. Prevent the early onset of wrinkles and fine lines
7. Lower skin cancer risk
8. Shields from harmful UV rays
9. Maintain the brightness of your natural complexion
10. Maintain the look and texture of your skin
11. Delays premature signs of aging
12. Reflects UVA and UVB rays
13. Works immediately when applied on the skin.

**Advantages.**

- Easily available
- No side effects
- No special equipment needed for preparation
- They are inexpensive
- Ingredients are easily available
- Renewable resources
- Be non toxic and non irritant
- Be neutral
- Be stable to heat
- Easy to manufacture

**Disadvantages**

- They are difficult to hide taste and odour
- Manufacturing process are time consuming and complicated
- Herbal drug have slow effects as compare to allopathic dosage form it also requires longterm therapy.

**Main role of ingredients used in****formulation**

Aloe vera is a good active ingredient to reach in Sunscreen arsenal. It has been proven to

both treat and prevent burns on your skin. The leaves of aloe vera and *A. Barbadosis* are the source of aloe vera gel. Aloe vera gel is used in cosmetics lotion for its moisturizing and revitalization. It blocks UVA and UVB rays and maintains skin natural moisture balance. It stops the sunburn and stimulates immune system intervention. Aloe vera gel can be used to help with the healing process of sunburn. It helps relieve pain and redness by reducing



inflammation. The gel also stimulates the production of collagen, which helps the healing process.

**Fig. Aloe vera**

**Butterfly pea flower:****Packed with antioxidant**

Butterfly pea flowers contain many antioxidants such as flavonoids, anthocyanin, and polyphenols. Your skin needs antioxidants to improve general health and elasticity. Antioxidants help to minimize fine lines and improve your skin and appearance. Butterfly pea flowers help calm itching and general irritation. The butterfly pea flower is used for rejuvenating the skin.

**Reduce redness**

Because of butterfly pea flowers' ability to soothe irritated skin, it also minimizes redness caused by acne, dryness, and general irritation. These nourishing properties are further enhanced when combined

with other nutrients that benefit skin health.

### Improve moisture retention

This helps increase skin turnover to naturally restore itself. moisture retention helps stop dryness and promote lipid balance.

### Improve the skin barrier

Because butterfly pea flower contain plant based antioxidants and antioxidants vitamin such as vitamins ,it help imrove skin barrier

### Suitable for all skin Type

Butterfly pea flower is a hidden skin ncare rockstar. It is gentle enough for use on all skin types,no matter what time of year it is.

### Coconut oil:

Coconut oil keeps the skin soft and smooth while preventing premature ageing of the skin . coconut oil for skin use as a moisturizer ,remove dead skin cells. coconut oil moisturizing dry skin including in people with condition such as eczema.promoting wound healing it have antibacterial,antifungal and antiviral properties which prevents free radicals from causing damage to the skin coconut oil has anti-inflammatory properties which reduce rednees on skin this can be helpful for both dry and oily skin conditions byreducing inflammation of the skin.

### Rose Water:

Rose water contain vitamin B. which often used in Sunscreen and sun product .it helps to bolster the effectiveness of SPF .rose water can be used to lighten the skin pigmentation .Rose water can remove oils and dirt from your skin by unclogging yours pores. It helps maintain pH level of your skin .It is hydrating and nourishing agent for skin and protect skin against harmful environmental aggressors, gulabjal has antioxidant levels that tackle free radicals and keep skin healthy and glowing.



Fig. Rose Water.

### Vitamin E

Vitamin E it provides extra protection against acute UVB damage and protect against cell mutation

caused by sun and pollution exposure. vitamin E it help cleanse your skin and removing the impurities from and help improve skin elasticity .vitamin E combination with lemon juice it help to whiten the skin. it is most commonly known for its benefits of skin health and appearance. it has antioxidant and anti-inflammatory properties.

### Fig. Vitamin E

### FORMULATION OF SUNSCREEN

#### Formulation of butterfly pea flower extract:

To make an extract of butterfly pea flower for herbal sunscreen ,steep about a dozen fresh or dried flower leaves in a cup of boiling water . After about 15minutes ,strain the liquid and discard the leaves . The deep blue water is then ready to be used in Sunscreen cream.

#### Butterfly pea flower contain



#### Formulation of sunscreen cream was prepared by following procedure

I have to take butterfly pea flower extract.then I have take aloe vera gel because it has proven to both treat and

Soluble minerals	8.94mg
Ash.	0.9mg
Crude protein.	41.27mg
Soluble carbohydrates.	29.18mg

prevent burns on skin. Then added rose water in mixture rose water provide cooling effect.then gradually add coconut oil and vitamin E.all the ingredients were mixed vigorously using spatula for about 20-30min and placed

#### List of ingredients used in formulation



### Final Product

### Evaluation of sunscreen cream for suncreening activity Effectiveness of sunscreen:



The effectiveness of sunscreen is usually expressed by sunscreen protection factor (SPF), which is the ratio of UV energy required to produce a minimal erythemal dose in protected skin to unprotected skin. A simple, rapid and reliable in vitro method of calculating the SPF is to screen the absorbance of the product between 290-320nm at every 5nm intervals. SPF can be calculated by applying the following formula known as Mansur equation.

#### SPF

$$\text{spectrophotometric} = CF \times EE \times I \times \frac{\text{Abs}(\text{wavelength})}{\text{Abs}(\text{wavelength})}$$

Where CF=correction factor, EE=erythemogenic effect of radiation with wavelength, Abs= spectrophotometric absorbance values at wavelength. The value of EE×I constants.

#### PH of the cream:

The pH meter was calibrated using standard buffer solution. About 0.5 of the cream was weighed and dissolved in 50.0ml of distilled water and its pH was measured.

#### Homogeneity:

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

#### Removal:

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

#### After feel:

Emolliency, slipperiness and amount of residue left after the application of fixed amount of cream was checked.

#### Type of smear:

types	Description	SPF.	Character
1.	Always burn easily. And never tans	More than 8.	Sensitive
2.	Always burn and tan. minimally	6-7	sensitive
3.	Burn moderatory and tan gradually.	4-5	normal
4.	Burn minimal and always tan well	2-3	normal
5.	Barely burn and tan profusely	2	insensitive
6.	Never burn and become deeply pigmented	none	insensitive

After application of cream, the type or film or smear formed on the skin were checked

#### Types of skin and SPF

#### Observations

Sr.No	Parameters	Observation
1.	Colour	Light Blue
2.	Odour	Characteristics
3.	Spreadability	Good And Uniform
4.	Ph	6.2

#### Result

To be effective in preventing sunburn and other skin damage, a sunscreen product should have a wide range of absorbance during the storage and

Aloe vera.	5 gm
Rose water.	2ml
Butterfly pea flower Extract.	4gm
vitamin E.	2gm
coconut oil.	2ml

handling of cosmetic formulation spreadability and viscosity are the prime parameter which affects the formulation acceptability. The formulated cream exhibited no redness, inflammation and irritation. When formulation were kept for long time, it found that no change in colour of cream. The cream was easily removed by washing with tap water.

#### Conclusion

The study attempted to develop herbal sunscreen cream using extract of butterfly pea flower and examined their efficacy for preventing sun burn.

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