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Formulation and Evaluation of Sunscreen from Matricaria chamomilla L

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ABSTRACT:

The need for safe and efficient sunscreens has been fueled by growing understanding of the negative effects of ultraviolet (UV) radiation. The creation and assessment of a natural sunscreen utilizing Matricaria chamomilla L., popularly known as chamomile, which is well-known for its anti-inflammatory, antioxidant, and photoprotective qualities, is the main objective of this work. To create a herbal sunscreen formulation, ethanolic extracts of M. chamomilla flowers were added to a cream basis. The physicochemical characteristics of the sunscreen formulation, such as its pH, viscosity, spreadability, and stability, were assessed. UV spectrophotometry was used to calculate the in vitro sun protection factor (SPF). Effective UV protection was shown by the results, which showed that the chamomile-based formulation had good physicochemical qualities and moderate to high SPF. According to the results, M. chamomilla extract may be used as a natural UV filter in sunscreen formulas,. providing a skin-friendly and environmentally friendly substitute for artificial ingredients

KEYWORDS: Matricaria chamomilla,UV radiation, cosmetic

Introduction

One of the main environmental factors causing DNA damage, early skin ageing, and the emergence of skin malignancies is exposure to ultraviolet (UV) radiation. Because they absorb, reflect, or scatter damaging UV rays, sunscreens are essential for skin protection. However, the increased awareness of potential bad effects and environmental concerns linked with synthetic sunscreen chemicals has led to a growing interest in natural alternatives derived from medicinal plants.

German chamomile, or Matricaria chamomilla L., is a well-known medicinal herb that has long been used for its calming, anti-inflammatory, and antioxidant qualities. Packed with bioactive substances including phenolic acids, essential oils, and flavonoids (such apigenin, luteolin, and quercetin), M. chamomilla has demonstrated encouraging potential in dermatological applications, especially photoprotection. Using plant-based extracts in topical formulations is in line with the current movement towards sustainable skincare and eco-friendly cosmetics. Chamomile extract's inherent ability to absorb UV rays and its antioxidant properties may provide good skin protection without the need for artificial UV filters.

The formulation and assessment of a sunscreen product including extract from Matricaria chamomilla L. are the main objectives of this study. The study intends to evaluate its stability, physicochemical characteristics, and sun protection factor (SPF) in addition to comparing its effectiveness with that of conventional sunscreen products. This work adds to the ongoing attempts to develop skincare products that are safer, more biocompatible, and ecologically friendly by creating a plant-based sunscreen.

Benefits of sunscreen

- Protection from UV Rays. UV rays can penetrate the skin and damage the cells, causing DNA mutations that may lead to cancer.
- Prevents Sunburns.
- Reduces Skin Cancer Risk.
- Prevents Premature ageing.
- Improves Skin Texture.
- Reduces Hyperpigmentation.
- Prevents Sunspots.

1. Matricaria chamomilla L

Chemical Constituent's

Essential oil are generally composed of terpenoids, such as α-bisabolol and its oxides A and B, bisabolone oxide A, chamazulene, and β-farnesene, among other compounds.

Taxanomical information.

Kingdom	**Plantae.**
Phylum	**Angiosperm**
class	**Magnoliopsida**
Order	**Asterales**
family	**Asteraceae.**
Genus	**Matricaria.**
Species	**Matricaria chamomilla.**

Table 1: Taxonomical Information

Fig 1: Chamomile Oil

Mechanism of Action:

- **Anti-inflammatory**: Contains compounds like chamazulene and α-bisabolol that inhibit pro-inflammatory mediators (e.g., prostaglandins, leukotrienes**).**
- **Antioxidant**: Flavonoids (e.g., apigenin, quercetin) scavenge free radicals, protecting cells from oxidative stress.
- **Spasmolytic (Antispasmodic):** Flavonoids and essential oils relax smooth muscle, reducing gastrointestinal cramps.
- **Sedative:** Apigenin binds to benzodiazepine receptors in the brain, promoting calmness and mild sedation.
- **Antimicrobial:** Essential oils have activity against bacteria and fungi, supporting wound healing and infection prevention.

2.Coconut oil

Mechanisms of Action in Sunscreen Formulation

1. Natural Sun Protection Factor (SPF)

Coconut oil has a low intrinsic SPF value (approximately 4–7), which means it can block about 20–25% of UVB rays.

While insufficient alone for broad-spectrum protection, it contributes to the overall SPF when combined with other UV-blocking agents.

2. Occlusive and Emollient Properties

Forms a protective lipid barrier on the skin, helping to retain moisture and reduce trans-epidermal water loss (TEWL).

This barrier can enhance the stability and effectiveness of UV filters in sunscreen formulations.

3. Antioxidant Activity

Contains polyphenols, vitamin E, and lauric acid, which exhibit antioxidant properties.

These help neutralize free radicals generated by UV radiation, potentially reducing photoaging and cellular damage.

4. Antimicrobial Action

Lauric acid and other medium-chain fatty acids in coconut oil exhibit antibacterial and antifungal properties, which help maintain skin health and extend product shelf-life.

Fig 2: Coconut oil.

3.Beeswax

Beeswax is commonly used as an emollient in cosmetics. It can keep your skin hydrated and supple because it is a natural emollient. Because it retains moisture, it can maintain the skin tight and plump. It is one of the greatest skincare ingredients for treating rosacea or eczema since it soothes easily irritated skin and has anti-inflammatory and anti-allergenic properties. Vitamin A, which is found in beeswax, helps to produce collagen, which strengthens and speeds up the healing of scars. Whether beeswax is white or yellow, its characteristics are nearly the same. They are efficient acne remedies in addition to having restorative and antibacterial properties. By soothing the face and maintaining moisture without blocking pores, you can reduce acne breakouts The purity and refining process of yellow beeswax can produce a variety of colours. If you want your beeswax to be completely natural, choose yellow. Creamy yellow beeswax is typically your best bet when it comes to purity. All skin types can use beeswax because it is non-irritating and non-comedogenic. Beeswax also serves as an emulsifier. A beeswax water-in-oil emulsion requires a strong blender. Beeswax emulsion creams are unpleasant to apply and rapidly lose their nice structure.

Fig Bees Wax

4.Cocca butter:

Derived from the cocoa seed, cocoa butter is a widely used component in skincare products. Cocoa butter is a luxurious, easily absorbed ingredient that conditions and moisturizes the skin to a high degree, making it a great choice for dry skin types

Mechanism of coca butter

1.Emollient Action (Skin Barrier Protection):

Cocoa butter forms a protective layer on the skin that helps retain moisture and reduce transepidermal water loss (TEWL).

This barrier effect helps maintain skin hydration and improves the spreadability of UV filters.

2. Carrier for Active Ingredients:

It acts as a lipophilic base, helping to dissolve and distribute oil-soluble UV filters (e.g., avobenzone, octocrylene) evenly on the skin.

Enhances skin absorption and the effectiveness of active ingredients.

3. Stabilization of Sunscreen Formulation:

Cocoa butter contributes to the consistency and stability of emulsions (oil-in-water or water-in-oil) in sunscreens.

Prevents phase separation and improves product texture.

5.Zinc oxide

It effectively blocks UV radiation, it is used as a sun filter to protect the skin from the sun's harmful effects, such as sunburns, skin cancer, and premature ageing. Zinc oxide nanoparticles are harmless and unlikely to penetrate the skin's deeper layers. Zinc oxide, an inert earth mineral, is an active component used in cosmetics for lubricating, thickening, and sunscreening. Like titanium dioxide, another mineral active component found in sunscreens, zinc oxide is believed to provide minimal danger of skin sensitisation. Zinc oxide can absorb excess oil and help minimise pores and skin since it has astringent properties. This can reduce acne and keep our skin dry in the summer. Zinc may help control acne flare-ups and reduce the redness and irritation that come with pimples. Zinc also addresses the root causes of several frequent outbreak triggers by helping to regulate oil, dead skin, and germs that can clog our pores and ruin our days. It is a harmless component that is good for skin health because it is neither poisonous nor comedogenic. Because of their strong UV radiation absorption and whitening properties, zinc oxide nanoparticles, or ZnONPs, are a common nanomaterial found in skin care products as sunscreens and face creams. Usually made by allowing zinc oxide vapour to react with oxygen, zinc oxide is added to sunscreens as a very fine powder.

Fig 4: Zinc Oxide

METHODOLOGY

- For 20Gm
- STEP I:- Collect all the ingredients and arrange them in the descending order of their quantity/amount required in the formulation.
- STEP II:- Weigh all the ingredients accurately and sanitarily and transfer in suitable labeled container.
- STEP III:- Take a clean and sanitized beaker of 100 ml and transfer the ingredients one by one.
- STEP IV:- Transfer the ingredients in the beaker in the following order-
- Beeswax (5gm)
- Coco Butter (5gm)
- Zinc oxide(5gm) iv)Chamomilla extract (3gm)
- v)Coconut oil (2gm)

STEP V:- Keep the beaker of mixture on the heating mantle and set the temperature at 150° and start melting the whole mixture with constant stirring till it is completely melted and well combined with each other.

STEP VI:- Wisk the mixture properly and then turn off the heat and remove the beaker out on a clean cloth.

STEP VII:- Let the mixture cool slowly and starts getting thicken up with constant stirring now and then so that the phases do not get separated.

STEP VII:- Once it achieve its smooth thick consistency we'll pour it in our sanitized container to let it take the proper shape of it and get settled.

STEP VII:- Label the container appropriately with all the detailed information required along with the direction for use and precautions.

Formulation Table:

Beeswax	**5 gm**
Coco butter	**5 gm**
Zinc oxide	**5 gm**

Chamomilla oil	**3 gm**
Coconut oil	**2 gm**

EVALUATION PARAMETERS :

PARAMETERS	OBSERVATION
COLOUR	Creamish white/ Off white
ODOR	Characteristic
APPEARANCE	Smooth
pH	6.5-7
HOMOGENEITY	Present
CONSISTENCY	Good
GRITTINESS	No gritty particles
SPREADABILITY	7-10 sec
WASHABILITY	Easily washable
IRRITANCY PATCH TEST	No irritation reaction
WHITE-CAST	None
BUTTER PAPER TEST	Pass

PH

About 1 gm of cream was accurately weighed and dispersed in 100 ml of purified water. A digital pH meter was used to determine the pH of the dispersion. pH testing is the process by which the acidity or alkalinity of a substance it determined. Expressing the acidity of a solution imposes challenges as it involves a single ion species quantification, over a broad range of concentrations.

Homogeneity

The homogeneity test was carried out by applying 0.1 g of gel preparation to a piece of transparent glass and observing its homogeneity. The test preparation must show a homogeneous arrangement, indicated by the absence of coarse grains on the object glass and the absence of phase separation.

Grittiness

The grittiness perception increased with an increase of the particle size. Similarly, grittiness perception increased with increasing particle concentration. Contrary, grittiness perception decreased with increasing viscosity. The formulation is grit free.

Spreadability

Pharmaceutical semisolid preparations include ointments, cream, emulsion, gel. Spreadability of the formulations was determined by measuring the spreading diameter of 1gm of sample between two horizontal glass plates after one minute. Also we can apply small amount of the formulation in the hand and rub it gently to check its spreadablity and its penetration time.

Irritancy patch test

Apply small amount of the formulation on small area of skin for several days/ weeks and observe if there is any cause of irritation on that area. If not found then the test is been passed and there is no irritation caused due to the formulation and it is safe to use on other sensitive body parts.

White cast

When the formulation is applied on lighter skin, sunscreen is invisible to the naked eye. The white tint in the sunscreen doesn't blend with darker skin and can make their skin appear slightly white. This tinting is called a white cast or bluing. This is normal to occur but we can reduce it by making the formulation more smooth. Even if it gives white cast after application, after few mins it gets absorbed properly and the white cast is been vanished. Our formulation does not leave any white cast after proper rubbing and blending into skin.

RESULT

The formulation and evaluation of the sunscreen is been conducted and successfully carried out.

The result of this study demonstrate that the topical sunscreen formulation shields the skin from UV rays. This formulation is good and safe for all age group as it is manufactured with the natural components. This formulation has goodness of two excellent oils which have potent anti- inflammatory and sun blocking property that helps to protect from the harmful rays of sun. The most important aspect of the formulation that we have restored is that it is free from any fragrance/perfume and colorants, which many of the formulation have for masking the odor but these components are the leading cause of dermatitis in the people. So, we have made the formulation without any of those components and the odor of our formulation is characteristic to the components used. The main component of our formulation that is chamomile is a superfood that can benefit all skin types.

CONCLUSION

This experimental study is proposed as a final year project with readily available lab equipment that is commonly employed, the relative ease with which this experiment has been carried out, together with the use of OTC products for everyday use, which made it a very attractive project. The research provides highlight on the use of herbal ingredient in the preparation of sunscreen formulation by providing protection potency against sun burns. Were Matricaria chamomilla petals extract was previously used in herbal cosmetics and here we are formulating it in an effective sunscreen form which proves its excellency in the use of safe herbal preparations and we can say that use of this type of natural ingredient in the formulations is step towards healthy and safe cosmetics with less or no side effects.

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