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A Review On formulation and evaluation of turmeric sunscreen

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ABSTRACT:-

This review focuses on the formulation and evaluation of sunscreen products incorporating turmeric (Curcuma longa) as a key active ingredient. Turmeric, renowned for its therapeutic properties, contains curcumin, a polyphenolic compound known for its antioxidant, anti-inflammatory, and UV-absorbing capabilities. The objective of this review is to explore the potential of turmeric in sunscreen formulations, addressing both the benefits and the challenges associated with its use. The review begins by highlighting the significance of natural sunscreens and the growing consumer demand for safer, non-toxic alternatives to conventional chemical UV filters. It delves into the photoprotective properties of curcumin, emphasizing its ability to absorb UV radiation and mitigate skin damage caused by sun exposure. Additionally, the review discusses curcumin's antioxidant capacity, which helps in neutralizing free radicals generated by UV rays, thereby protecting the skin from oxidative stress and photoaging. Despite its promising benefits, the incorporation of turmeric into sunscreen formulations presents challenges, primarily due to curcumin's poor water solubility and low bioavailability. The review examines various formulation strategies aimed at overcoming these hurdles, such as the use of nanotechnology, encapsulation in liposomes, and development of curcumin-phospholipid complexes. These approaches are evaluated for their effectiveness in enhancing the stability, skin penetration, and overall efficacy of curcumin-based sunscreens.

Keywords:- turmeric

Introduction :-

Turmeric, scientifically known as *Curcuma longa*, is a perennial herbaceous plant belonging to the ginger family, Zingiberaceae. Native to Southeast Asia, particularly India, turmeric has been used for thousands of years in traditional medicine, culinary practices, and religious ceremonies. The bright yellow-orange rhizome (root) of the turmeric plant is the primary part used for its medicinal and culinary properties.

Historical and Cultural Significance

Turmeric holds a significant place in ancient medicine systems such as Ayurveda and Traditional Chinese Medicine (TCM). In these traditions, turmeric has been utilized for its anti-inflammatory, digestive, and wound-healing properties. In India, it is a staple spice in cooking, providing the characteristic color and flavor to many dishes. Additionally, turmeric is often used in religious and cultural rituals, symbolizing purity, fertility, and prosperity.

Chemical Composition

The primary bioactive component of turmeric is curcumin, a polyphenol that accounts for its vibrant color and most of its therapeutic effects. Besides curcumin, turmeric contains other curcuminoids, volatile oils (like turmerone), and various nutrients such as vitamins and minerals. These compounds collectively contribute to turmeric's broad spectrum of health benefits.

Health Benefits

1. Anti-Inflammatory: Curcumin inhibits inflammatory pathways, making turmeric an effective remedy for conditions like arthritis and other inflammatory diseases.
2. Antioxidant: Turmeric has potent antioxidant properties, which help neutralize free radicals and reduce oxidative stress, potentially lowering the risk of chronic diseases.
3. Antimicrobial: The antimicrobial properties of turmeric can help fight infections and support wound healing.
4. Digestive Health: Turmeric stimulates bile production, aiding digestion and improving gut health. It is traditionally used to treat digestive disorders such as bloating and indigestion.
5. Cancer Prevention: Research suggests that curcumin can influence cancer growth and development by modulating various cellular processes, including apoptosis (programmed cell death) and angiogenesis (formation of new blood vessels).

6. Brain Health: Curcumin may enhance cognitive function and protect against neurodegenerative diseases by increasing levels of Brain-Derived Neurotrophic Factor (BDNF) and reducing inflammation in the brain.
7. Heart Health: Turmeric supports cardiovascular health by improving endothelial function, reducing inflammation, and acting as an antioxidant.

Culinary Uses

Turmeric is a versatile spice used in a variety of culinary applications:

- Spice Blends: It is a key ingredient in curry powders and other spice blends.
- Flavor and Color: Turmeric is used to impart a warm, earthy flavor and a golden color to dishes such as rice, soups, and stews.
- Preservative: Due to its antimicrobial properties, turmeric is also used as a natural preservative.

Modern Applications and Research

In recent years, turmeric has gained popularity globally, not only for its culinary uses but also for its medicinal properties. Modern scientific research has validated many traditional uses of turmeric and has spurred interest in its potential therapeutic applications. This has led to the development of various turmeric supplements and formulations aimed at enhancing the bioavailability of curcumin, which is naturally poorly absorbed in the body.

Fig -Turmeric

Review of Literature:

1. Arun Rasheed et al. (2022)- Prepared sunscreen lotions made from extracts of bioactive materials including Aloe vera (Liliaceae), Curcuma longa L. (Zingiberaceae), and Alpinia galanga Willd (Siamese ginger), which have a broad spectrum of anti-UV radiation efficiency with a lower concentration of chemical UV filters. The sunscreen lotions' SPF for normal skin (SPF 55 and SPF 20) and non-mutagenic, non-irritating properties were demonstrated by the results.
2. Lim HW et al. (2019)- Narla and Lim's review focuses on FDA regulation, environmental impact, and health implications of sunscreen use. It examines regulatory policies governing sunscreen ingredients, labelling, and claims, emphasizing the need for robust oversight to ensure product safety and efficacy.
3. Fears TR et al. (2016)- Fears' research focuses on the methodological challenges in studying sun exposure and skin cancer risk. It identifies pitfalls and challenges in the connection between solar radiation and skin cancer incidence, highlighting the need for rigorous study design and data analysis techniques.
4. Halliday GM, Damian DL et al. (2014)- In a high-risk population, the impact of consistent sunscreen use on melanoma risk is examined in this study. The results reinforce the significance of sun protection techniques in the prevention of skin cancer by indicating that regular use of sunscreen is linked to a lower incidence of melanoma.
5. Strutton GM et al. (2011)- This landmark trial provides compelling evidence supporting the effectiveness of sunscreen in reducing melanoma risk. It found a significant reduction in melanoma risk among participants who consistently used sunscreen compared to those who did not, highlighting the importance of sustained sun protection habits.

Aim And Objective

Aim:- A Review On the formulation and evaluation of turmeric sunscreen

Objective:-

The main objectives of the formulation are:

- Collection of all the required ingredients and herbal plants.

- Preparation of the herbal extracts.
- Extract the active ingredient from the herbal plant.
- Evaluation of the formulation.
- To create a sunscreen formula with herbal components.
- To create different formulas
- To carry out characterizing physiochemically.
- To attain the highest level of formulation stability.
- To maximize the benefits of UV protection

Material and Method

Methodology:-

S. no.	Ingredients	Quantity
1.	Zinc oxide	2 tbsp
2.	Aloe vera oil	1 tbsp
3.	Carrot oil	1 tbsp
4.	Almond oil	2 tbsp
5.	Desi ghee	1 tbsp
6.	Rosemary oil	6 drops

Procedure:

1. Ensure that all equipment and surfaces are clean and sterilized to prevent contamination.
2. Measuring Ingredients: Measure out the desired quantities of each ingredient based on the desired SPF level and consistency of the sunscreen. The ratio of zinc oxide to the other ingredients will determine the level of sun protection offered by the sunscreen.
3. Mixing the Ingredients: In a clean mixing bowl, combine the zinc oxide with the aloe vera gel, carrot oil, almond oil, ghee, and rosemary oil. Use a whisk or spoon to thoroughly blend the ingredients until they form a smooth and homogeneous mixture.
4. Adjusting Consistency and SPF: Depending on the desired consistency and SPF level of the sunscreen, you may need to adjust the ratio of ingredients. Adding more zinc oxide will increase the SPF of the sunscreen while adjusting the other ingredients can change the texture and feel of the product
5. Testing: Before using the sunscreen on your skin, perform a patch test to check for any allergic reactions or sensitivities to the ingredients. Apply a small amount of sunscreen to a small area of skin and wait for 24 hours to observe any adverse reactions.
6. Storing the Sunscreen: Transfer the sunscreen mixture to a clean, airtight container for storage. Store the sunscreen in a cool, dry place away from direct sunlight to maintain its effectiveness.

formulation Parameters :

Formulating and evaluating a turmeric-based sunscreen involves several key parameters to ensure the product is effective, stable, and safe for use. These parameters include the selection of ingredients, their concentrations, formulation techniques, and evaluation methods. Here's a detailed look at the critical formulation parameters:

1. Active Ingredient (Curcumin):
    - Source and Purity: High-quality curcumin extract from the rhizome of turmeric with verified purity and potency.
    - Concentration: Optimal concentration of curcumin to balance efficacy and safety, typically ranging from 0.5% to 5% depending on the formulation.
2. Solubility Enhancers:
    - Solubilizers: Use of solubilizing agents like ethanol, propylene glycol, or dimethyl sulfoxide (DMSO) to improve the solubility of curcumin.

- Nano-Formulations: Incorporation of curcumin into nanoparticles, liposomes, or micelles to enhance its solubility and bioavailability.

3. UV Filters:
    - Combination with Synthetic or Natural UV Filters: Use of additional UV filters (such as zinc oxide or titanium dioxide) to provide broad-spectrum UV protection.
    - Synergistic Effects: Ensuring that the combination of curcumin with other UV filters provides enhanced photoprotection.
4. Formulation Base:
    - Creams, Lotions, or Gels: Selection of an appropriate base for the sunscreen formulation, ensuring it is suitable for the target skin type (e.g., oily, dry, sensitive).
    - Emulsifiers and Stabilizers: Use of emulsifiers like lecithin or polysorbates to maintain the stability of the emulsion, and stabilizers like xanthan gum or carbomers to ensure consistency.
5. Antioxidants and Preservatives:
    - Additional Antioxidants: Inclusion of other antioxidants (like vitamin E or green tea extract) to complement the effects of curcumin and protect the formulation from oxidation.
    - Preservatives: Safe and effective preservatives (such as phenoxyethanol or parabens) to prevent microbial contamination and ensure product longevity.
6. pH Adjusters:
    - pH Balance: Adjusting the pH of the formulation to match the natural pH of the skin (around 5.5) using pH adjusters like citric acid or sodium hydroxide.
7. Sensory and Aesthetic Attributes:
    - Texture and Feel: Ensuring a pleasant sensory experience, with a non-greasy, smooth application.
    - Color and Fragrance: Maintaining a visually appealing color (turmeric's natural yellow) and incorporating natural fragrances to mask any strong odors.

Evaluation Parameters :

Once the formulation is developed, it needs to be thoroughly evaluated for its efficacy, stability, and safety. Key evaluation parameters include:

1. Sun Protection Factor (SPF) Testing:
    - In vitro and In vivo SPF Testing: Determining the SPF value through standardized in vitro (using UV spectrophotometry) and in vivo (human skin application) methods.
2. Photostability:
    - Stability Under UV Exposure: Assessing the stability of curcumin and other active ingredients when exposed to UV radiation to ensure prolonged efficacy.
3. Skin Compatibility and Sensitivity:
    - Patch Testing: Conducting patch tests to evaluate skin irritation or allergic reactions in volunteers.
    - Dermatological Testing: Ensuring the formulation is dermatologically tested for safety and hypoallergenic properties.
4. Physicochemical Stability:
    - Temperature and Humidity Stability: Testing the formulation under various temperature and humidity conditions to ensure it remains stable during storage and use.
    - Shelf Life: Determining the product's shelf life through accelerated stability testing.
5. Microbial Testing:
    - Preservative Efficacy Testing (PET): Ensuring the preservative system effectively inhibits microbial growth over time.

Conclusion

Formulating and evaluating a turmeric-based sunscreen involves careful consideration of multiple parameters to create an effective, stable, and safe product. The solubility of curcumin, selection of suitable UV filters, formulation base, additional antioxidants, and preservatives are crucial in the

formulation phase. Rigorous evaluation of SPF, photostability, skin compatibility, physicochemical stability, and microbial safety ensures the final product meets the desired standards and provides reliable sun protection benefits to consumers.

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