Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 15s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Recent Trends of Sunscreen Cosmetics Innovative Approaches in Sunscreen Development: Beyond UV Protection

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Cite this paper as: Monisha J, Rahul Das, Ragul C, Ramprasad B, (2025) Recent Trends of Sunscreen Cosmetics Innovative Approaches in Sunscreen Development: Beyond UV Protection. *Journal of Neonatal Surgery*, 14 (15s), 2231-2240.

ABSTRACT

While the sun is essential for vitamin D synthesis and overall health, it carries a great risk to skin if not managed properly. Ultraviolet radiation (UV), especially its UVA and UVB components, causes sunburns, premature aging and an extra probability of skin cancer. Conventional sunscreens, many exercised but in blocking UV rays, often rely on chemical filters that can raise issues over potential skin irritation, endocrine pathology and environmental burden. This research explores the development and efficacy of a novel Herbal Sunscreen Emulgel formulated with natural ingredients for broad-spectrum sun protection. The emulgel leverages the inherent sun-protective properties of various botanical extracts, offering a safe and eco-friendly alternative to traditional sunscreens. The current study looks into the composition and performance of an innovative Herbal Sunscreen made emulgel with natural components for a wider spectrum of solar coverage. Formulations incorporate the natural solar protective characteristics of different distinctive herbal extract, making them a healthy and natural sun-blocking alternative to conventional sunscreens and showcasing the globe of herbs.

1. INTRODUCTION

Sun: our life-giving star, a source of heat and a delicate, beautiful tan in summer. But it remains a fact that its rays have a bad effect on our skin – sunburn, rapid aging, and an increased chance of cancer [5]. Therefore, it’s difficult to find sun protection that suits your face and body: most chemical sunscreens are most effective, but the composition of those creams and lotions is harsh for sensitive skin and raises concerns about the safety or environmental implications [1].

This is where nature s strength comes into place. Our revolutionary Herbal Sunscreen Emulgel makes use of the protective and nourishing properties of herbarium extracts to compose a broad-spectrum sunscreen. But we never accept compromise! We focus the care of sun-bathed people on both their skin and the natural world in which we live.[2][4]

People have relied on the natural sun-protective character certain plants possess from long ago. This emulgel makes use of this experience, combining high-quality herbal ingredients such as Carrot seed oil, White Turmeric, Rosehip oil, Senna, Rose which shows properties like anti-inflammatory, antioxidant, and antimicrobial properties antiseptic vitamin C, Carotenoids, fatty acid, Flavonoids [3]. It not only shields the layer of skin overlaying dangerous UVA and UVB rays, but it’s also refreshing, non-sticky sensation and absorbs rapidly for easy wear.

Our Herbal Sunscreen Emulgel is perfect for those seeking:

- *Natural Sun Protection:* Embrace the power of plants for effective broad-spectrum sun defense.
- *Gentle on Skin:* Free from harsh chemicals and suitable for sensitive skin types.
- *Lightweight and Comfortable:* Enjoy a non-greasy formula that leaves no white cast.
- *Nourishing for Skin:* Soothing botanical ingredients keep your skin feeling healthy and hydrated.

Herbal Ingredients:

In this project we are using

1. White Turmeric: Also locally called as Poolankilangu in tamil. It’s botanical name is Curcuma Zedoria and it belongs to the family Zingerberaceae and genus curcuma. It consist of:

Curcuminoids: These are the main bioactive compounds which shows the properties like anti-inflammatory, antioxidant, and antimicrobial properties. Curcuminoids may help enhance skin texture, reduce wrinkles, and brighten the complexion.

Volatile oils: Curcuma Zedoria also contains volatile oils, which are responsible for distinctive aroma. These oils contain antibacterial and anti-inflammatory properties that may help soothe and reduce inflammation.

Carrot seed oil: Carrot seeds, or Daucus carota sativus, contain vitamin E, a potent antioxidant in addition to carotenoids. Vitamin E protects the skin from UV rays and other environmental strains enhances the layer of skin texture, and minimize the presence of wrinkles and fine lines. With a adequate SPF of 38 to 40, it protects your skin from sunburn and promotes a more even skin tone.

2. **Coconut oil:** Coconut palms are scientifically known as *Cocos nucifera*. It is the only living species in the genus *Cocos* and belongs to the Arecaceae family, often known as the palm family. It possess a poor sun protection factor of roughly 7 and different applications.
3. **Senna**: Botanical name is cassia senna L. the biological of senna is dried flowers of it. It belongs to Leguminosae plant family. It consist of active constituents like glycosides, aloe emodine, which shows properties Like antioxidants and anti-inflammatory agents, healing of wounds and also provides hydrating qualities.
4. **Rose hip:** Rose hip also known as rosehaw or rose hep. It is an accessory fruit, meaning it develops from the hypanthium of the rose flower after pollination, produced by various species within the genus Rosa. This genus belongs to Rosaceae family. It consists active constituents like vitamin C, Carotenoids, fatty acid, Flavonoids, Pectin which shows the properties lie antioxidants, lycopene and beta carotene, nourishment, anti-inflammatory, wound healing, hydration and moisturization.
5. **Rose**: Damask Rose- Paneer Rose. Scientific name is Rosa x damascene. Family: Rosaceae. Active constituents are Flavonoids, tannins, vitamin C, essential oils.

Before usings these natural plant-based materials in making the product, authentication is required for proof that these materials are only being used. And other chemicals are used like

2. MATERIALS AND METHODS

Collection and identification of plant material

After being washed off impurities with flowing water, the gathered plant materials were allowed to shade dry for two weeks before being collected and used for future research.

Extraction Method

1. **White Turmeric:**

Take the curcumin and blend it until cores powder or granules and fill it in a porous thimble and place it in the middle section then take 40% of 99.9% ethanol and 60% of water in round bottom flask and place the beaker, then fix the beaker at the heater and fix the meddle part and fix condenser at top and run it at 85°C for three Hr and then centrifuge it at 3000rpm for 30 min and filter it and collect it.

2. **Carrot Seed Oil:**

Take the carrot seeds and blend roughly with blender and then take round bottom flask add the seeds , then add take 40% of 99.9% ethanol and 60% of water in the flask, then fix the fix essential oil apparatus and seal the joints so that there is no leakage and heat it at 85°C until the oil are separated and collect the oils [we are using essential oil apparatus cause carrot seed oil are volatile in nature].

3. **Senna Extract:**

Senna petals were shadow dried for at least one week. We were using 99.9% ethanol about 40% and distilled water about 60%. Take 225-226 gm of Dried Senna petals were Taken in a beaker. Then 30ml of ethanol was introduced in the beaker. Then 40ml of Distilled water was added in the beaker. Steer thoroughly, until all the petals are soaked in the solvent. Cover it in an airtight container and keep it for rest for about 3-4 days. Monitor it by adding 10ml ethanol and 20ml distilled water and steer thoroughly and leave it undisturbed for about 2 weeks. Filter the extract with muslin cloth and send it for centrifugation process for attaining pure extract. After the sample went through centrifuge pure clear extract will be obtained and will further be used in formulation.

4. **Rose Extract:**

Rose petals were shadow dried for at least one week. We were using 99.9% ethanol about 40% and distilled water about 60%. 225-226 gm of Dried Rose petals were Taken in a beaker. Then 30ml of ethanol was introduced in the beaker. Then 40ml of Distilled water was added in the beaker. Steer thoroughly, steer until all the petals are soaked in the solvent. Cover it in an airtight container and keep it for rest for about 3-4 days. Monitor it by adding 10ml ethanol and 20ml distilled water and steer thoroughly and leave it undisturbed for about 2 weeks. Filter the extract with muslin cloth and send it for centrifugation process for attaining pure extract. After the sample went through centrifuge pure clear extract will be obtained and will further be used in formulation.

5. Carbopol was taken as 2gm in 75 mil and mixed thoroughly in magnetic stirrer and kept undisturbed 24Hr for smooth texture and introduced into the formulation.

PROCEDURE

Total six formulations are being made

Oil Phase:

Take required amount as asked of Polyethylene Glycol 200, Triethanolamine, Rosehip oil, Stearic acid and coconut oil in a beaker and heat it in water bath at 80° until it melts and dissolved.

Aqueous Phase:

Take Cetyl alcohol di-sodium EDTA, Methyl Paraben, and the obtained extracts of white turmeric, carrot seed oil, senna oil, and rose extract in a beaker and heat it in water bath at 80° until it melts and dissolved.

3. MIXING THE BOTH PHASES:

Add Carbopol in the mortar and the add oil phase in the Carbopol in the then slowly start mix with pestle, slowly start pouring the aqueous phase in the mortar slowly and mix until a uniform smooth creamy gel formation is not obtained. Cool the mixture while mixing to attain a nice texture then store it in a container. And evaluation tests are conducted.

FORMULATIONS: '

INGREDIANTS	F1	F2	F3	F4	F5	F6
Stearic Acid	2	2	2	2	2	2
PEG 200	1	1	1	1	1	1
Cetyl Alcohol	0.25	0.25	0.5	0.5	0.75	0.75
Carbopol	0.5	0.6	0.7	0.8	0.9	1
Disodium EDTA	0.1	0.1	0.1	0.1	0.1	0.1
Methyl Paraben	0.5	0.5	0.5	0.5	0.5	0.5
Triethanol amine	0.2	0.2	0.2	0.2	0.2	0.2'
Curcuma zedoria	3	3	3	3	3	3

Daucus carota sativus	3	3	3	3	3	3
Cassia senna	3	3	3	3	3	3
Rosax Damascena	2	2	2	2	2	2
Rosehaw	3	3	3	3	3	3
Distilled Water	RQ	RQ	RQ	RQ	RQ	RQ

EVALUATION OF EMULEGEL

Evaluation Tests:

- pH determination:

The emul-gel's pH may be checked at ambient temperatures utilizing a typical optical pH meter.

- **Dye test:**

It confirmed that the composition was a w/o type emulsion gel.

- **Appearance:**

The emul-gel's appearance was assessed based on color, pearlescence, and roughness.

- **Homogeneity:**

Visual and physical tests were performed on the formulations to ensure uniformity.

- **pH of the emul-gel: '**

The pH meter was standardized utilizing a standard buffer solution. The pH of approximately 0.5 g of emul-gel was determined after it was assessed and dissolved in 50.0 ml of clean water.'

- **Spreadability: '**

An appropriate quantity of sample is placed between two glass slides, and a weight of 100 grams is applied to the slides for 5 minutes. Spreadability can be expressed as,

S= m*l/t

Where, m = weight applied to upper slide.

1 = length moved on the glass slide.

time taken.'

- **Viscosity: '**

The viscosity of the solution was determined using a Brookfield Viscometer at 100 rpm and spindle number 7.'

- **Removal:**

The simple nature of removal of the applied emulgels was determined by washing the afflicted area with tap water.

- **After feel:**

Emollience, Slippery and residues remaining when applying a given amount of emulgel were evaluated.

- **Irritancy study:**

Mark a 1cm square area on the left dorsal surface. The emulgel was applied to the specified region, and the time was recorded. Irritation, erythema, and edema were recorded at regular intervals for up to 24 hours and noted.

4. RESULTS AND DISCUSSION

1. SPF activity of the sunscreen cream

The Sun Protection Factor (SPF) is a regularly used metric to assess the efficiency of sunscreen. A sunscreen cream with a broad absorption range of 290 to 320 nm is most effective at preventing sunburn and other skin damage. F1, F2 (30+) was particularly effective at blocking UV rays because of its high SPF value as compared to other treatments. The SPF values of F4, F5, and F6 were much lower due to non-uniformity.

The most common bioactive components from plants utilized in cosmetics are curcuminoids, carotenoids, and Vitamin E. These compounds can survive free radicals created by ultraviolet light. Flavonoids have three photoprotective properties: they absorb UV light, act as antioxidants, and influence many DNA signalling pathways [103]. It may also enhance skin texture and minimize the appearance of fine lines and wrinkles. With a natural SPF of 38 to 40, it protects your skin from sun damage while also promoting a more even skin tone.

2. **Evaluation of the sunscreen emulgel**

    1. Viscosity: Viscosity governs several of the item's qualities, such as pourability and spreadability from its container [102].
    2. The pH: The pH of emul-gel has been tested for insight the potential negative impacts of acidic or alkaline pH, which might cause skin irritations. Acidic or alkaline pH levels can annoy the skin cells and affect polymer absorption rates. For sunscreen, the emul-gel's pH ranges from 6 to 9.
    3. Homogeneity: The F1, F2, and F3 formulations resulted in a homogeneous distribution of extracts in the emul-gel, but F4, F5, and F6 created granules in the gel and were unable to properly mix. This has been confirmed by both visual appearance and touch. As a result, all formulations were very homogeneous.
    4. Microbial test: After 5 days of incubation, samples F1, F2, F3, and F4 showed no microbial growth, whereas F5 and F6 contained a small bacterial colony with very little growth.

5. CONCLUSION AND FUTURE PERSPECTIVES

Sunscreens are widely accepted as large contributors aid in protecting the skin from the harmful effects caused by sunlight exposure, with their effectiveness and safety being key factors for global public health. But sun filter molecules absorbed into the skin can lose their safety and effectiveness, and may be distributed systemically with unknown side effects. This emphasises the significance of carefully evaluating the penetration and toxicological consequences of UV filters in the human body. It is important to understand not only the behaviour of these philtres but also the actual effects of vehicles and other raw materials used in sunscreens to ensure their safety as well as effectiveness. Also, encapsulation techniques may alter sun filter retention and penetration in the skin, which should be considered. The flow through system includes a Franz diffusion cell, a dialysis bag, tape stripping, traditional in vivo procedures, and Raman spectroscopy. According to the reviewed literature, these methods can detect the permeability of sun philtres via the skin. To the knowledge of the authors, the permeation of various molecules has also been studied using other techniques, for instance, micro dialysis (Benfeldt and Serup, 1999; Holmgaard and Nielsen, 2009) and trans well diffusion plates (Boyden, 1962), with future sunscreen research and development potentially benefitting from application of such techniques. Besides that, people have been concerned with skin health as a whole as well as the environmental effects of using sunscreen. With increasing awareness of the need to protect the sun, both human health and the environment around it are also being recognised. These environmental impacts need further research, and methods to mitigate them also need to be examined. The authors state that they have no opposing financial interests or personal links that may have influenced the research given in this study.

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