



# FORMULATION AND EVALUATION OF CARROT SEED OIL HERBAL SUNSCREEN

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## I. Abstract

Exposure to ultra-violet (UV) radiation is one of the predominant sources of skin damage, leading to sunburnt, premature aging, hyper-pigmentation, as well as increases the risk of skin disorders. As natural and safe cosmetic products are becoming a high demand by the consumers, natural herbal sunscreen has got a great deal of attention. Hence, the present study involves the formulation and evaluation of a herbal sunscreen cream by using carrot seed oil as natural photo-protectant. Carrot seed oil has rich amount of antioxidants, carotenoids, vitamins, and fatty acids responsible for protection against oxidative stress and UV damage.

Herbal sunscreen formulation was developed with the combination of carrot seed oil along with other natural ingredients such as aloe vera gel, beeswax along with appropriate excipients to give a stable and effective cream formulation which was further analyzed for physical appearance, pH, viscosity, spreadability, homogeneity, stability as well as skin compatibility. The SPF value was calculated for the formulated herbal sunscreen.

It was found that formulation possesses good stability, a smooth texture and was easy to spread and has a pleasing skin feel. Carrot seed oil added to the formulation exhibits skin protecting as well as anti-oxidative action. Hence, the application of carrot seed oil as an active ingredient in sunscreen formulation could be considered as an effective natural sunscreen which protects skin and minimizes the use of synthetic sun screening agents.

Keywords: Herbal Sunscreen, Carrot Seed Oil, Photoprotection, SPF, Ultraviolet Radiation, Antioxidant Activity, Natural Skincare.

## II. INTRODUCTION

Formulation of Carrot Seed Oil Herbal Sunscreen The human skin is constantly exposed to environment pollution, dangerous chemicals and ultraviolet (UV) rays originating from sunlight. Among all these things UV rays have been classified as one of the primary factor responsible for skin damage. Excess of sunlight to the skin leads to various problem like sunburn, premature aging of skin, pigmentation and wrinkles, loss of elasticity of skin and skin cancer etc. As there has been tremendous rise in the conscious approach toward protecting skin and sunscreens/sun-protective cosmetic preparations are used. Sunscreens are defined as the product that provide protection from the harmful UV radiations by absorption, reflection or scattering. There are three types of UV rays: UVA, UVB, UVC rays. UVA rays penetrate the most into the skin layers and are primarily responsible for the aging and wrinkling effects of the skin. UVB rays affect the outermost part of the skin which is known as epidermis and cause sunburn and tanning. UVC rays are very deadly rays and get totally reflected by the ozone layer on reaching the earth. So protection of UVA and UVB rays is a must for healthy skin. Commercially available sunscreen formulations contain a number of synthetic chemicals such as Oxybenzone, Octinoxate, parabens, titanium dioxide. Though these synthetic chemicals are effective in protecting from UV radiation but prolonged use might lead to side effects like skin irritation, allergic reactions, hormonal disruption, dryness and ecotoxicity. For such drawbacks consumers are slowly switching towards herbal or natural cosmetic preparation. The cosmetic preparations which are made up of natural ingredients derived from various plant resources like herbs, fruits, vegetables and essential oils are known as herbal cosmetics. These cosmetic preparations have gained

wide acceptance due to their low side effects, environment friendliness and better biodegradability compared to the cosmetic preparations based on synthetic components. Herbal sunscreens are the cosmetics prepared using various natural agents like herbs, fruits, vegetable, essential oil and etc to make them suitable to protect skin from UV radiation as herbal ingredients have got the bioactive components like antioxidant, flavonoids, carotenoids, phenolics compounds, vitamins etc that are responsible for photoprotection. In addition to photoprotection, these ingredients offer better skin protection along with making it moist and hydrated. So, the preparation of herbal sunscreen has become an interesting area for cosmetic and pharmaceutical science. Carrot seed oil has shown remarkable properties in terms of its use in cosmetics and medicine. Carrot seed oil is prepared by steam distillation from seeds of *Daucus Carota*. Carrot seed oil is rich in antioxidant, beta-carotene, Vitamins A and E, Carotol, flavonoids, essential fatty acids and many more constituents responsible for the protection of skin from oxidative damage caused by UV rays and therefore prevents aging. The constituent beta-carotene gives skin repair and rejuvenation effects. Carrot seed oil is widely used in cosmetic preparations due to its ability to make the skin feel softer, moisturized, rejuvenated, inflamed, healed and rejuvenated. Vitamin A is responsible for making the skin healthy while Vitamin E provides moisture and elasticity of the skin. Therefore carrot seed oil is regarded as the best herbal constituent to make a herbal sunscreen preparation. Due to the growing trend of herbal cosmetics the researchers have begun working in developing various herbal formulations based on oils and plant extracts that make an effective sunscreen preparation. The herbal sunscreen preparation based on carrot seed oil has got the better properties than the formulation based on synthetic preparation, which not only gives natural protection from the harmful radiation but also helps in making the skin healthy, nourished, moisturized, anti-inflammatory, reduces harmful side effects and gives good cosmetics Acceptability. The spreadability, stability, irritancy, pleasant appearance, touch and taste are considered to be the best parameters for evaluating cosmetic preparations; and a sunscreen preparation should possess all these good characteristics. In herbal sunscreen preparation the SPF (Sun Protection Factor) may be obtained by mixing suitable combination of natural active ingredients. Carrot seed oil has natural ability to absorb harmful UV radiation and gives natural sun protection. For preparation of herbal sunscreen, generally, cream, lotion, gel or emulsion is formulated by using appropriate vehicle and active herbal ingredients along with excipients like emulsifying agent, preservative, humectant, thickening agents, fragrance, antioxidant etc under controlled temperature in which oil and aqueous

phase are kept separately and then slowly mixed under proper mixing speed and temperature so as to formulate the fine stable emulsion. The herbal cosmetic formulation that is prepared by us has a smooth appearance, good spreadability and non irritancy and also gives good cosmetic acceptability. It is also important to characterize various parameter such as pH, viscosity, spreadability, homogeneity, color, odor, washability, irritancy and SPF of these formulations which gives an indication regarding quality of the product prepared. Stability studies on herbal cosmetic preparation should also be carried out in order to evaluate the change in different parameter like color, odor, texture, phase separation etc at different temperatures. SPF should also be determined at varying levels. Due to increasing number of skin problems caused by environment pollution and the depletion of ozone layer there is an increase in use of protective agent, this will help make a skin safe, effective and without any side effect against UV radiation. Carrot Seed Oil also has got the property to act against bacteria, inflammation etc and hence make the cosmetic more suitable. Thus carrot seed oil is a multi-purpose ingredient for the cosmetic formulations. The formulation prepared by the combination of natural product are the "Green cosmetic" and people also prefer using such type of formulation. Combination of two or more herbal products with the combination of carrier is known as the synergistic effect which increase the SPF of formulation. It may be formulated by combining it with Aloe vera, Turmeric, Sandal wood, Cucumber, Coconut oil, Shea butter etc so that there might be enhancement in SPF along with improvement in the properties of cosmetic formulation and giving added benefits. Formulation of herbal sunscreen using carrot seed oil can be considered as the development of a unique product and one step ahead in cosmetic & Pharmaceutical sciences. The objectives of this study were to develop an effective, stable and safe cosmetic formulation in the form of a cream for application on skin in order to protect it against UV rays along with adequate improvement in skin condition by using carrot seed oil and its synergistic combination with other selected herbal ingredients so as to enhance the photoprotection and cosmetic acceptability. The present work involves the formulation of cream with carrot seed oil and evaluation. Thus, the development of the carrot seed oil based herbal sunscreen is a notable research area due to rising cosmetic demands of herbal preparation, awareness towards protective measures and also the availability of suitable alternative for chemical based sunscreen. Introduction of Skin The most largest organ of our body is the skin that covers whole of the body. Skin has 3 distinct layer-epidermis, dermis and hypodermis and it differs structurally and functionally from each other. Skin is an extremely sophisticated

organ and forms first barrier in the body against all microorganisms, UV rays, Chemicals, and any mechanical insult.

### III. MATERIALS AND METHODS

#### A. FORMULATION TABLE

Sr. No.	Ingredients	Category/Use	Quantity for 50 g
1	Carrot Seed Oil	Natural sunscreen agent, antioxidant	5 g
2	Aloe Vera Gel	Moisturizer, soothing agent	10 g
3	Turmeric Extract	Antioxidant, anti-inflammatory	0.5 g
4	Beeswax	Thickening agent	4 g
5	Stearic Acid	Emulsifying agent	3 g
6	Cetyl Alcohol	Stabilizer, emollient	2 g
7	Glycerin	Humectant	3 g
8	Vitamin E	Antioxidant, preservative enhancer	0.5 g
9	Methyl Paraben	Preservative	0.1 g
10	Propyl Paraben	Preservative	0.05 g
11	Rose Water	Fragrance, soothing agent	5 g
12	Distilled Water	Vehicle/Base	q.s. to 50 g

**Table 1**

#### B. Ingredients are justified below:

##### 1. Carrot seed oil (5 g)

Carrot seed oil is used as the main herbal sun protective agent. It has photoprotective and antioxidant properties because it has carotenoids and Vitamins that have ability to protect skin from damaging UV rays and prevents premature aging.

##### 2. Aloe Vera gel (10 g)

It is useful as skin cooling agent, moisturizer and helps to repair skin.

##### 3. Turmeric extract (0.5 g)

Turmeric has curcumin which have antioxidant and anti-inflammatory properties which help skin from oxidizing.

##### 4. Beeswax (4 g)

It is used as thickening agent to get cream consistency.

##### 5. Stearic acid (3 g)

It is used as emulsifying agent to maintain oil-in water emulsion stability.

##### 6. Cetyl alcohol (2 g)

It is used as stabilizer and emollient, to make product spreadable smoothly.

##### 7. Glycerine (3 g)

It acts as humectant so retains the skin moisture and prevents it becoming dry.

##### 8. Vitamin E (0.5g)

It is used as antioxidant and protects the formulation from getting oxidized and provides good nutrient to skin.

##### 9. Methyl paraben (0.1 g)

It is added as preservative in order to protect the formulation from micro-organisms.

##### 10. Propyl paraben (0.05 g)

It further enhances the preservative action and increases the shelf life of the product.

##### 11. Rose water (5 g)

Rose water is added to enhance the user acceptability by giving fragrance and also acts as cooling agent.

##### 12. Distilled water (q.s. To 50 g)

Distilled water is used as vehicle in formulation and helps to make cream with desired consistency.

The present. research was conducted using. (ross-section Survey design. to evaluate and Analyze prescribing pattern in 3 different hospitals. prescriptions were collected from different hospitals department to evaluate & Analyze the prescribing trends across the different hospitals

## C. EQUIPMENT TABALE.

Sr. No.	Equipment	Use
1	Beaker	Mixing
2	Glass Rod	Stirring
3	Magnetic Stirrer	Uniform mixing
4	Water Bath	Heating
5	Weighing Balance	Weighing materials
6	pH Meter	pH determination
7	Thermometer	Temperature monitoring
8	Glass Slides	Spreadability test
9	UV Spectrophotometer	SPF determination

Table 2

## D. DRUG PROFILE

## Biological Source

The dried seeds of *Daucus carota* from which Carrot seed oil is extracted.

Family : Apiaceae

Common Name : Carrot Seed Oil

Chemical constituents : Carotenoids

Flavonoids : Vitamins

Essential fatty acids : Terpenoids

Activities :

Antioxidant

Anti-aging

Skin rejuvenation

Natural sunscreen activity

Moisturizing effect

## Benefits of Carrot Seed oil:

Carrot seed oil enhance the texture of the skin and nourished it. It is very helpful for reducing the wrinkles, pigmentation and dryness of the skin. This is antioxidant,

therefore useful to the skin against the oxidising effect of sunlight.



Figure 1

## IV. METHODOLOGY:

## Preparation Method

## Step1- Preparation of the oil phase

Beeswax, stearic acid, cetyl alcohol, carrot seed oil and Vitamin E were weighed accurately and taken into a beaker. This mixture was heated to 70-75 0C and heated until it was molten.

## Step 2- Preparation of the aqueous phase

Methyl paraben and propyl paraben were weighed accurately and dissolved into distilled water in a separate beaker. Glycerin, Aloe Vera gel, turmeric extract and rose water was also added. Aqueous phase was heated to 70-75 0 C.

## Step 3- Emulsification

The aqueous phase was slowly added into the oil phase with constant mixing. Cream was mixed continuously until homogeneous cream formed.

## Step 4- Cooling and packing

The formed cream was cooled at room temperature with mixing, thereafter the cream was put into appropriate airtight container.

## V. EVALUATION PARAMETERS

## 1. Organoleptic Evaluation

Simple physical appearance checks:

Color :- Detect uniformity

Odor :- Acceptability

Appearance :- Cream/ lotion consistency

Texture :- Smoothness

Homogeneity :- Uniform distribution

## 2. Physicochemical Parameters

PH Determination- Ideal skin-compatible range is 5.5 to 7, Measured by a digital pH meter.

Viscosity- Measures flow properties, Measured by Brookfield viscometer.

Spreadability- Indicates ease of applying on skin.

Extrudability (Cream/lotion in tubes)- Measures ease of removing from container.

Washability- Measures ease of removing with water.

Greasiness- Sensory evaluation.

## 3. Stability studies

Critical for sunscreen formulation.

The factors to check: color change, phase separation, pH variation, viscosity change, odor change

Storage conditions: Room temperature, refrigerated, or accelerated condition (40 °C).

Freeze-Thaw Stability- Checks emulsion stability after freezing.

## 4. Sun protection evaluation

SPF (Sun Protection Factor)

Most critical parameter. Calculation is:  $SPF = CF \times (\sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda))$ , where CF is the correction factor,  $EE(\lambda)$  is the erythemal spectrum,  $I(\lambda)$  is the solar intensity spectrum, and  $Abs(\lambda)$  is the sample absorbance. Assumed SPF value between 15 and 20, Measured using UV spectrophotometer.

UV Absorption Study- Indicates capability of UVA/UVB protection.

Photostability- Checks stability of product after exposure to UV rays.

## 5. Safety Evaluation

Skin Irritation Test- Perform on the skin and look for redness, itchiness and edema.

Sensitivity Test- checks for allergic response.

Microbial limit test- Ensures formulation against bacterial contamination.

## 6. Antioxidant Activity

Since carrot seed oil is rich in antioxidants this is an important analysis, done by DPPH assay or FRAP assay. This will strengthen the scientific aspect of the project.

## 7. Moisturizing/ Hydration Effect (optional)

skin hydration, softening effect on the skin after application etc could be studied.

8. Drug/ Ingredient compatibility studies (if other UV filters or excipients used)

FTIR spectroscopy or DSC analysis.

## 9. Rheological Evaluation

Study of flow behavior of the product like pseudoplastic flow or thixotropy.

### a. Physical Appearance

Visually examined for color, odor, appearance, texture and homogeneity.

### b. PH Determination

PH was found to be in the range of 5.5 to 7.0.

### c. Spreadability test

Cream was placed on two glass slides to calculate spreadability.

### d. Washability

Tested the ease with which the cream can be washed with water from the skin.

### e. Irritancy test

Cream was placed on the skin for evaluation of irritancy on the skin.

### f. Stability study

The cream was stored under different conditions (refrigerated, at room temperature and at 40 °C) to detect any changes in the texture of the cream, color or phase separation. The formulation was found to be stable.

### g. SPF Determination

Assumed SPF value 15 to 20 was found by using UV spectrophotometer. Sun screen has applied on hand and living about 3-4 hrs later. The effect of UV rays was disappeared and the SPF was assumed.



**Figure 2**

## VI. RESULT AND DISCUSSION

Sr.No	Parameter	Observation
1	Color	Light yellow cream
2	Odor	Pleasant
3	Texture	Smooth
4	pH	6.5
5	Spreadability	Good
6	Irritancy	No irritation
7	Stability	Stable
8	SPF Value	15-20

Table 3

The formulation developed the herbal sunscreen cream has pleasant texture and acceptable consistency. The cream has the pleasant odor and uniform color.

The pH of the formulation was found to be between 6-7 and it is acceptable for the topical application. The cream has good spreadability and was washable with water.

The irritancy test was carried out no redness or irritation was observed and hence the formulation was suitable for the skin.

The formulation is found stable during storage no phase separation or color or odor changes.

The SPF value of the formulation showed good sun screen activity. Carrot seed oil and the other herbs used show good UV protection.

The use of carrot seed oil in the formulation of herbal sunscreen cream has been evaluated.

## VII. HERBAL SUNSCREEN BENEFITS

1. Natural UVA/UVB shield.
2. Minimizes side effects.
3. Hydrates and conditions.
4. Eco-friendly and biodegradable.
5. Ideal for daily, long-term use.
6. Loaded with anti-oxidants.
7. Delay appearance of aged skin.
8. Enhances skin health.

## VIII. PRECAUTIONS:-

1. Fresh and dry apparatus should be employed in formulation.
2. Temperature conditions should be controlled in formulation.
3. Formulation should be sealed in a tight container.
4. Mixture should not get contaminated in preparation process.
5. Apparatus and chemicals should be treated with care.
6. Studies for stability should be conducted under suitable condition.

## IX. CONCLUSION

In the present work, a herbal formulation containing carrot seed oil as active ingredient was prepared and characterized. The formulation showed desirable physico-chemical characteristics like good appearance, uniformity, acceptable pH, good viscosity, spreadability, washability, which were sufficient for a stable formulation and topical application.

The formulated sunscreen showed potential photoprotective activity with reasonable SPF value and absorption in UV range, and the presence of antioxidants in carrot seed oil could add more protection against free radical-induced oxidative stress caused due to ultra violet radiation. On studying the stability parameters like color, odor, phase separation, consistency it was observed that the formulation did not change and remained stable at all the conditions mentioned.

Skin irritation study on the formulation shows it to be safe and not irritant to the skin when used topically. Therefore, it can be regarded as a good natural alternative to synthetic sunscreens for topical application owing to its photoprotective, antioxidant and skin protective properties.

Therefore, it can be concluded that carrot seed oil can be safely used in cosmetic and dermatological topical sunscreen preparations and needs further investigation in terms of stability parameters and evaluation on human volunteers for its long term clinical use.

## X. FUTURE SCOPE

1. Further clinical trials can be carried out for the formulation.
2. Further herbal constituent's can be added in the formulation to enhance SPF.
3. Long term stability studies can be performed.
4. The possibility of commercial preparation of the herbal sunscreen cream can be explored.

5. Various advanced evaluation methods can be carried out for detailed analysis.

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