



**Research Article**

## **Formulation And Evaluation Of Herbal Sunscreen Cream Containing Daucus Carota As An Antioxidant**

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### ABSTRACT

Sunscreen creams play a crucial role in protecting the skin from harmful UV radiation. This study focuses on the formulation and evaluation of a novel herbal sunscreen cream using the natural ingredients carrot extract and olive oil. The cream's formulation was developed by blending these ingredients with other plant-based compounds, ensuring the cream's stability, UV protection efficacy, and safety for the skin. The study investigates the cream's SPF, UVA, and UVB protection, as well as its potential antioxidant and skin-nourishing properties. The results indicate that the carrot and olive oil herbal sunscreen cream exhibits promising UV protection and antioxidant capabilities, making it a potential natural alternative for sun protection. Further research is required to optimize the formulation and assess its long term effects on skin health.

### INTRODUCTION

Carrot are the domesticated form of the wild carrot, *Daucus carota* native to Europe and south western india. The plant probably originated In Persia and was originally cultivated for its leaves and seeds.

The most commonly eaten part of the plant is the taproot, although the green are sometimes eaten as well. The carrot is a biennial plant in the umbellifer family apiaceae. It is root vegetables that has worldwide distribution carrot are were first introduced in medical purposes and gradually use as food. The colour of the carrot flesh may be yellow, orange, red, purple or very dark purple.

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The first cultivated carrot were yellow and purple fleshed cultivars. Orange carrot today more popular were developed in the 15th and 16th centuries in central Europe. A rapid rise in the popularity of orange carrot was observed with the recognition of its high provitamin A content. Carotenoids and anthocyanins are the major antioxidant pigment found in carrot.

### DEFINITION OF ANTIOXIDANT

Antioxidant means "against oxidation". Any substance at low concentrations compared to that of an oxidizable substrate that significantly delays or prevents oxidation of that substrate is called as antioxidant. Antioxidants play vital role in



preserving the quality of food and maintaining health of human being.

### NEED OF ANTIOXIDANTS:

Oxidation reaction depending upon site of occurrences presents.

specific repercussions. If the site of occurrence is food system, then food deteriorates. When oxidation occurs in biological cell system, it causes damage or death to the cell.

**Oxidation:** It is a chemical reaction that can produce free radicals which damage the cells of organisms.

**Free radical:** Each molecule or fragment which can exist independently and contains one or two unpaired electron.

### What is Sunscreen?

Sunscreen, also commonly known as sun cream, is a lotion, spray, gel or other topical product that absorbs or reflects some of the sun's ultraviolet (UV) radiation on the skin exposed to sunlight and thus helps protect against sunburn. Skin lightening products have sunscreen to protect lightened skin because light skin is more susceptible to sun damage than darker skin. The sun rays consist of two types of harmful rays:

UVB rays are referred to as "burning" rays. They are the rays that cause us to get sunburns their effects can be immediate and harmful.

UVA rays are thought of as "aging" rays. These rays are responsible for most skin cancer, as well as signs of premature aging (like wrinkles and sun spots)! The scary fact about UVA rays is that they don't necessarily produce any visible redness on the skin, so we don't get any sign when they are bombarding us. Depending on the mode of action sunscreens can be classified into –

- 1) Physical sunscreens (i.e., those that reflect the sunlight).
- 2) Chemical sunscreens (i.e., those that absorb the UV light).

Sunscreens have traditionally been divided into chemical absorbers and physical blockers on the

basis of their mechanism of action. Chemical sunscreens are generally aromatic compounds conjugated with a carbonyl group. These chemicals absorb high-intensity UV rays with excitation to a higher energy state. The energy lost results in conversion of the remaining energy into longer lower energy wavelengths with return to ground state. Physical blockers reflect or scatter UVR. Recent research indicates that the newer micronized forms of physical blockers may also function in part by absorption.

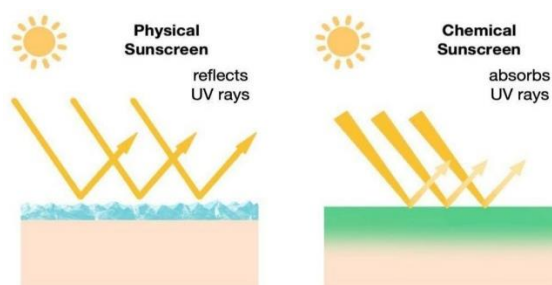


Figure no (1) diff. Between physical and chemical sunscreen

### CLASSIFICATION OF SUN RAYS:

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-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 of 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.

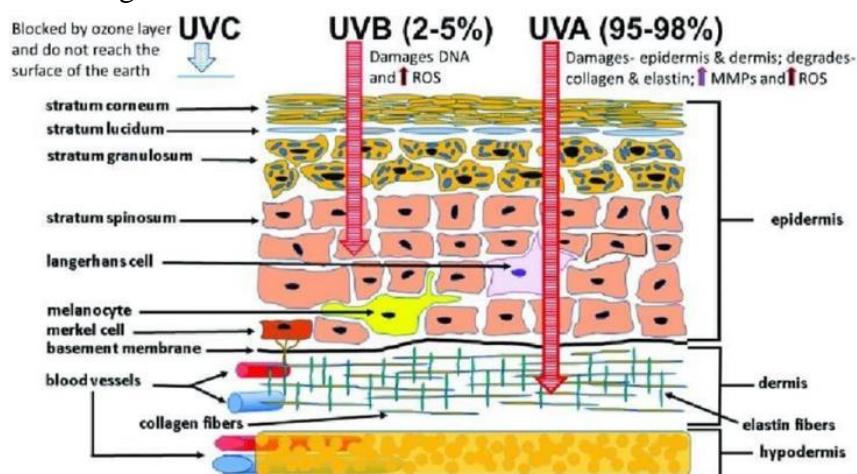


Figure no (2)

### Why herbal sunscreen ingredients.

There is evidence from regulatory agencies that though synthetic sun blocker have fast sun protective action but simultaneously it have potential risk associated with it. Results from CDC held in 2007 reported that mothers with high levels of oxybertzone in there bodies were more likely to give birth to underweight bases. According to TGA (Therapeutic Goods Administration) study there is evidence that Zinc oxide and Titanium oxide can induce free radical formation in the presence of light and this may damage normal cells. It is beneficial to use herbal ingredients as they do not provide allergic reactions, do not show any side effects, do not show any comedogenic effect. Herbal constituents can be easily incorporated in formulations. They are more effective, rich with its stability safety, purity, cost effectiveness, easily available and found in large variety of plants.

Physical blockers are effective at protecting against both UVA and UVB radiation. The two most common physical blockers are titanium dioxide and zinc oxide. These agents are the near ideal sunscreen as they are chemically inert, safe, and protect against the full UV spectrum. Their only drawback is their poor cosmetic appearance when applied to the skin. By decreasing the

particle size, micro sized or ultra fine grades have been developed, thereby reducing the whitening appearance. In some products, bright fluorescent colors have been added.

### Sun Protection Factor -

The SPF sunscreen stands for sun protection factor, a relative measurement for the amount of time the sunscreen will protect you from ultraviolet (UV) rays. UVB rays primarily affect the outer layer of the skin. the spisismis. They are responsible for sunburns and some surface-level skin cancers. The sun also emits UVA rays, which can penetrate into the lower level of the skin, called the dermis. UVA rays are typically associated with "tanning. However, the darker colour of the skin is a sign of damage to cells in the dermis, SPF numbers typically refer only to UVB rays, but some sunscreens can protect against UVA as well.

$$\text{SPF} = \frac{\text{Minimal erythema dose in sunscreen protected skin}}{\text{Minimal erythema dose in non-sunscreen protected skin}}$$

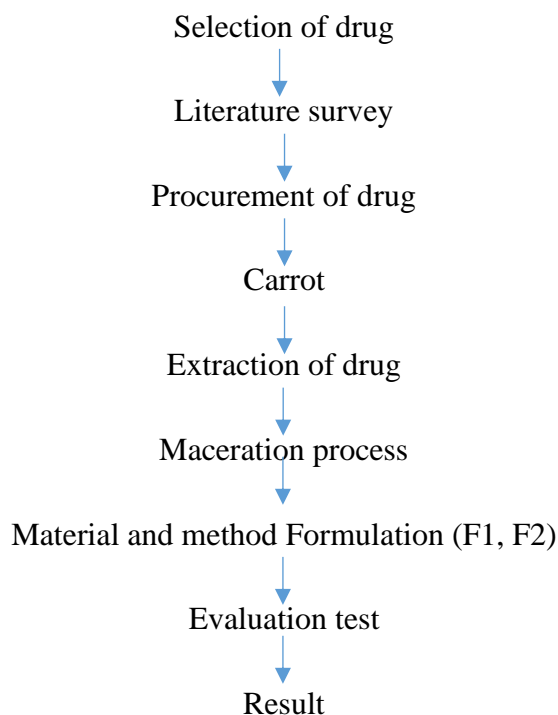
### Grading system for SPF:

Low: SPF2-15  
 Medium: SPF 15-30  
 High: SPF 30-50  
 Highest SPF > 50

### PLAN OF WORK



The present proposed research work is planned as follows:



## Literature and Review

### 1. Rajendra Jangde, et. al, [2011]

This review article details about various herbs commonly used in herbal sunscreen according to their principal constituents. This review provides information about what should be the characteristics of an ideal herbal sunscreen. According to this article FDA recently released its final orders concerning the labeling of sunscreen. This review gives information about SPF and protection from sunlight according to different ranges of SPF

### 2. Devanjali Bhattacharjee et. al, [ 2021]

This review article on the comparison of natural and synthetic sunscreen agents provides information about sunscreen agents protect the skin from UV rays by absorption, scattering and by blocking phenomenon. This article states that active ingredient of formulation is synthetic product which is divided into organic and inorganic filters which is used in market It has detail classification about sunscreen. This review

provides ideal properties about natural sunscreen product.

### 3. Priyanka Kantivan Goswami, Mayuri Samant et. al, [ 2013 ]

This article on Natural Sunscreen Agents is review on the various herbal sunscreen agents which contains natural constituents which can used in herbal cosmeceuticals for photoprotection from ultraviolet B radiation. Also it gives details about exposure of skin to UVB radiation has a destructive effect on keratinocytes by causing DNA damage. It states about how the ideal sunscreen compound has to meet a wide variety of specification.

### 4. Snehal S. Kulkarni et. al, [ 2014]

This review on Herbal Plants in Photo Protection and Sun screening action provides an overview on how harsh synthetic chemicals and pollution tremendously affecting our life today, hence, nature has endowed us with its everlasting treasure of herbal ingredients. This review basically emphasis on various herbal ingredients which have potential for photo protection. This review states that why we prefer herbal ingredients over synthetic ingredients.

### 5. Marijana Koskovic, Snezana Cupara et. al [ 2017]

This review on Sea Buckthorn Oil - A valuable Source For Cosmeceuticals gives information about SB oil ingredients and about its thorny shrub. This review is result of various research and studies of comprehensive material regarding nutritional composition, biological activities as well as uses of sea buckthorn as food, medicine, cosmeceuticals. And how it contributes in sun protection action.

### 6. Chanchal Deep Kaur et. al, [2010]

The aim this review article was to evaluate ultraviolet (UV) absorption ability of volatile and non-volatile herbal oils used in sunscreens or cosmetics and express the same in terms of sun protection factor (SPF) values. Sun protection

factor is a laboratory measure of the effectiveness of sunscreen; the higher the SPF, the more protection a sunscreen offers against the ultraviolet radiations causing sunburn.

### 7. Arun Rasheed et. al. [ 2012]

Natural substances extracted from plants have recently been considered as potential sunscreen resource owing to high ultraviolet ray absorption and antioxidant activity. The decrease in the intensity of UV radiation reaching the skin through sunscreens may reduce the risk of sun-induced skin cancer. The present study attempts to develop sunscreen lotions, possessing broad spectrum of anti-UV radiation effectiveness with reduced concentration of chemical UV filters, from the extracts of bioactive products such as *Curcuma longa* L. (Zingiberaceae), *Aloe vera* (Liliaceae) and *Alpinia galanga* Willd. The effectiveness of the product was evaluated using Sun Protection Factor (SPF).

### 8. Matteo Radice, Anna Baldisserotto et. al. [ 2017]

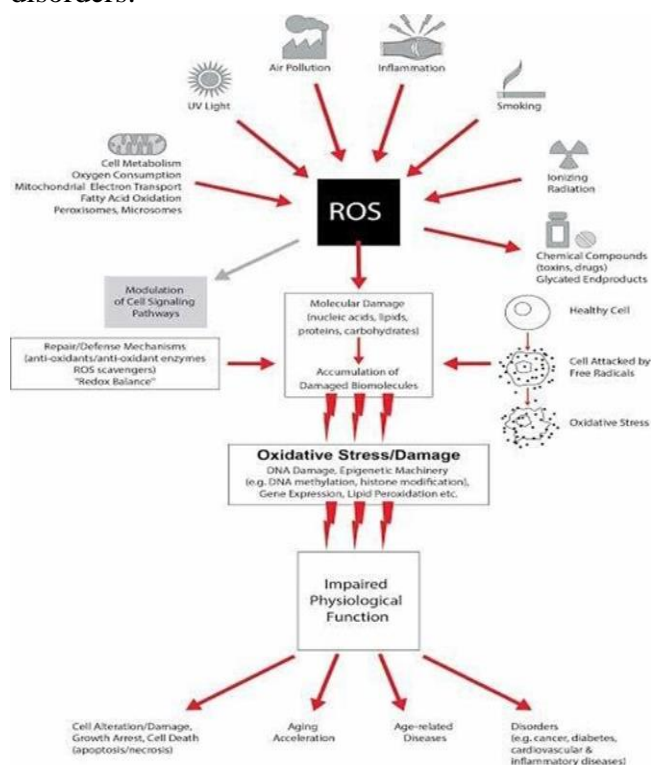
Sun protection is a complex topic, which involves various classes of compounds. The photoprotective effectiveness of a sunscreen involves many biological activities, such as ultraviolet (UV) radiation filter properties and antioxidant, anti-inflammatory, and antimutagenic effects. Formulation strategy is also a key factor. Several studies have examined the role of natural molecules as photoprotective compounds, and a considerable number of commercially available sunscreens contain herbal extracts but not as sun filters. Indeed, the process of evaluation of UV-filtering and photoprotective activity of herbal compounds presents certain specific difficulties and needs in vitro and in vivo studies.

### Pathophysiology Of Oxidation

Oxidation is a chemical process where substances lose electrons. In the context of pathophysiology, oxidative stress occurs when there's an imbalance between the production of reactive oxygen species

(ROS) and the body's ability to detoxify them or repair the resulting damage. ROS, such as superoxide radicals and hydrogen peroxide, can damage cellular components like proteins, lipids, and DNA. This oxidative damage is implicated in various pathological conditions, including inflammation, neurodegenerative diseases, cardiovascular disorders, and cancer. Mitochondria are significant sources of ROS during cellular respiration. Overproduction or impaired antioxidant defenses can lead to mitochondrial dysfunction, contributing to oxidative stress. Additionally, inflammation and environmental factors, like pollution or certain drugs, can further stimulate ROS production.

Cells have defense mechanisms, including antioxidants like glutathione and enzymes like superoxide dismutase, to neutralize ROS. When these defenses are overwhelmed, oxidative damage accumulates, potentially leading to cell injury and disease progression. Understanding the pathophysiology of oxidation helps in developing strategies to mitigate oxidative stress-related disorders.



## DRUG PROFILE

### Olive oil

**Synonyms:** oleum olive

**Biological source:** It is fixed oil expressed from of ripe fruit of olea europaea linne

**Family:** Oleaceae

**Uses:**

1. Emollient and soothing agent
2. used to soften the skin and
3. Nutrient, Demulcent, mild laxative
4. Used as vehicle for oily suspension for injections
5. Moisturizes the skin
6. Anti -Aging properties
7. Get rid of Wrinkles
8. Promote wound healing
9. Helps cleanse the skin
10. Reduce the signs of aging
11. Moisturizes the skin

**Chemical Constituent:**

Olive oil is composed mainly of the mixed triglyceride esters of oleic acid, linoleic acid, palmitic acid and of other fatty acids,[92][93] along with traces of squalene (up to 0.7%) and sterols (about 0.2% phytosterol and tocosterols).



Figure no. (4)

### Carrot

**Synonyms:** Daucus carota sativa, Daucus, cultivated carrot

**Kingdom:** plantee (plants) Class: Magnoliopsida

**Family:** Apiaceae

**Genua:** Daucus

**Chemical constituents:** Carotene, ascorbic acid, carotenoids.

**Uses:**

1. Antioxidant
2. Anticarcinogen and immunoenhancer.
3. Benefits of wound healing
4. Anti-diabetic
5. Dental health
6. Sun protection
7. Cardio and hepatoprotective benefits
8. Fertility benefits



Figure no (5)

### Sea buckthorns oil

**Synonyms:** hippophae rhamnoides

**Biological source:** It is a red- orange oil that comes from the pulp or seeds of the sea buckthorn plant.

**Family:** Elaeagnaceae

**Chemical constituent:**

Fatty acids: Linoleic,  $\alpha$ -linolenic, oleic, palmitic, stearic, vaccenic, palmitoleic, arachidic, eicosanoic, myristic, pentadecanoic, and margaric  
Vitamins: A, C, E, F, P, and B complex, Carotenoids, tocopherols, tacotrienols.

**Uses:**

1. Moisturises and nourishes the skin
2. Rich in antioxidants.
3. Supports skin regeneration
4. Anti-inflammatory properties.
5. Improves skin tone and texture
6. Eliminates small wrinkles
7. Treats sun radiation damage



Figure no (6)

**Observation:**

**Extraction of carrot:** By using simple extraction method

The carrot sample was collected from local market and was used for laboratory experiments. These were washed with distilled water to removed sands and dust particles from outer surface. Then adherent water was removed by dry cloth. After peeling the carrot samples were cut into small pieces with the help of sharp knife into cubical shapes. These slices were used for carotene. Carrot slices were extracted in water bath (30°C, 40°C, 50°C), shaking every 10 min, add 5ml sample was taken after a certain time interval for carotene concentration measurement by spectrophotometer.



Figure no. (7) Simple extraction method

**MATERIAL AND METHOD****Plant material**

Sr.no	Ingredients	Quantity	Uses / role
1	Cetosteryl alcohol	5 ml	Emulsifier
2	Na methyl paraben	0.3 g	Preservative
3	Na propyl paraben	0.06g	Preservative
4	Stearic acid	2 ml	Emollient
5	Cetomacrogal -1000	2ml	Emulsifier
6	Triethanolamine	0.5 g	Surface active agent
7	Disodium EDTA	0.02 g	Chelating agent
8	Cetyl alcohol	1 m[	coemulsifier
9	Olive oil	1 ml	Sofetting skin
10	Sea buckthorn oil	1 ml	Protect skin
11	Carrot extract	1 ml	Active ingredient
12	Dil. water	q.s	Vechile

**Formulation of sunscreen cream**

**Step 1:** Water phase was prepared by collecting deionized water (73%) and then (5%) water was remove aside from this for final volume makeup. Water soluble components disodium EDTA, sodium methyl paraben and triethanolamine were dissolved in deionized water: meanwhile carbopol was allowed to swell using a homogenizer and heated up to 80°C.

**Step II:** Oil phase was prepared by heating sodium propyl paraben, stearic acid, cetyl alcohol, cetomacrogal-1000, Cetosteryl alcohol, olive oil, sea buckthorn oil and ethanolic extract at 80°C.

**Step III:** Oil phase was added in water phase at 80°C with continuous stirring for 20-25 min. and then it was homogenized till uniform emulsion is formed the finished product has yellow color and consistency. It was then poured into the wide mouth container and stored at temperature not exceeding 37°C.

**EVALUATION TEST****Determination of pH:**

About 1 gm of cream was accurately weighed and dispersed in 100 ml of purified water. A digital pH meter (Digital pH meter MK VI) was used to determine the pH of the dispersion.



Figure no. (8) pH test

**Determination Spreadability test:**

About 0.5 gm of cream was placed in a circle of 1 cm diameter on a 20×20 cm glass plate, over which the second glass plate was placed. A weight of 500 gm was allowed to rest on the upper glass plate for 5 min and then an increase in the diameter of the cream due to spreading was noted.



Figure no. (9) spreadability test

**Determination of viscosity:**

Viscosity of formulated cream can be determined by using Brookfield Viscometer at 20rpm at room temperature of 25°C.

**Skin Irritation Test:**

The test will provide the potential of skin irritancy of the active ingredient and the formulated product, including the potential reversibility of the effects observed.



Figure no. (10) Irritation test

**Stability study of the cream:**

Stability study of the cream was carried out according to ICH guidelines. The cream sample was kept on the 5°C, Room Temperature and 40°C. The change in the physical appearance color, odor, etc and chemical changes such as a change in PH, viscosity checked and thus the formulation of the cream was



Figure no. (11) formulation of sunscreen

**CONCLUSION**

The formulation of carrot and olive oil-based antioxidants shows great potential in improving overall health and well-being . Based on the comprehensive evaluation, our herbal sunscreen demonstrates excellent efficacy and is a safe alternative for those seeking natural protection. On the basis of phytochemical screening the formulation is effective on future prospect.

**Result:**

Following table shows physiochemical parameters

Parameter	Olive oil	Sea buck-thorn oil
Appearance	Clear liquid	Clear liquid
Color	Yellowish	Yellowish
Odour	Characteristics	Characteristics
Texture	Clear	Clear

**Stability study of the cream:**

Test	F1	F2	F3
Colour	White	White	White
Odour	Aromatic	Aromatic	Aromatic
Consistency	Smooth	Smooth	Smooth
State	Semisolid	Semisolid	Semisolid
PH	6.10	6.08	6.08



Irritancy test	No irritation	No irritation	No irritation
Spreadability test	Spreadable	Spreadable	Spreadable

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