International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 31, Issue 12, December 2025 ijppr.humanjournals.com ISSN: 2349-7203

# Formulation and Evaluation of Herbal Orange Peel and Amla Extract Sunscreen Lotion

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Received: 25 October 2025 Revised: 05 November 2025 Accepted: 26 November 2025

**ABSTRACT:-**

Sunscreen lotion is sort of products that protect against the sun harmful rays by containing ultraviolet radiation (UV rays) which is divided into two types: ultraviolet radiation A ( UVA) and ultraviolet radiation B (UVB).[1] Radiation from Ultraviolet about 40% of sunlight is visible light (vis), 50% is infrared light (IR), and 10% is ultraviolet light.[3] The photoprotective effectiveness of sunscreen involves many biological activities such as ultraviolet radiation filter properties and antioxidant, anti-inflammatory, and antimutagenic effect. The incorporation of herbal material into sunscreen is one of the most effective and natural ways to protect against the sun as measured by the sun protection factor (SPF). Orange peel from citrus fruits industry has recently been found to have potential benefits for skin health. Orange peel contains flavonoid, limonoids, and carotenoids which posses antioxidant and anti-inflammatory properties. These compound protect the skin from oxidative stress and inflammation caused by environmental factors like Ultraviolet (UV) radiation and pollution. Using orange peel extract in cosmetics reduce the appearance of wrinkles, fine lines, and age spot. Amla (Phyllanthus emblica L.) Commonly known as Indian gooseberry is rich in vitamin c, polyphenols, flavonoids and tannins which possess potent antioxidant and photoprotective properties.

**Keywords :-** Sunscreen, SPF, UV radiation, Skin disease, Phytochemicals, Orange Peel, Amla, cosmetic, Extract.

**INTRODUCTION:-**

The use of sunscreen is necessary these days to protect our skin from the harsh ultraviolet rays. The herbal sunscreen is not only protect the skin from the effects of harmful UV rays but also eliminate the use of chemical sunscreen. Herbal sunscreen include natural oil such as almond oil,olive oil, rose oil, coconut oil and jojoba oiletc., which penetrate into the layers of the skin plunge the signs of early aging by hydrating the skin. Herbal ingredients such as green tea, amla, orange, turmeric etc. have shown properties such as absorbance of a broad spectrum of UV rays, antioxidant and anti- inflammatory effects. A sunscreen contains more than one ingredients some provide protection against UVA while some against UVB. Sunscreen are mainly rated and marketed by the sun protection factor (SPF) that measure the fraction of sunburn. More will be the SPF more will be protection. Earlier the value of SPF in the marketed sunscreen were use to be <1, but nowadays the trend is not same. The recent marketed sunscreen are having SPF ranging from 15-20 or even up to 50. The main aim of applying sunscreen is to protect skin from sun burn, and that looking in to the aim the value of SPF are maintained. If the SPF level is below 15 then the protection will be low, for average protection SPF should be from 15 to 29, for higher protection it should be from 30 to 49 and value above 50 is required for very high protection. In terms of percentage blockage of radiation the range of SPF varies from SPF 15 (93%blockage) to SPF 30 (screen about 97%) and SPF 50 (98% blockage of UVB). Herbal phytoconstituent like flavonoids, Terpenoids, antioxidant, amino acid and Glycoside are use in making herbal sunscreen.[2]

The compound in orange peel that give antioxidant properties include catechol, dimethoxy phenol, cyclohexane, coumarin, acetic acid, stigmastefol, sitosterol, and vitamin E. Orange peel has high level of antioxidant activity;an aqueous of powered orange peel revealed 71.2% antioxidant activity. Flavonoids and vitamin c are abundant in orange peel (110.4-127.70 mg/100 g of orange peel on a dry basis). [3]

Aloe vera is a well-known and ancient Liliaceae medicinal plant. This plant is a shrubby or arborescent perennial xerophytic Succulent with a pea-green color. Aloe-vera leaf extracts include a lot of polyphenol components and chemicals in them. Aloe Vera's 75 potentially active elements include vitamin supplements, minerals, carbohydrates, enzymes, lignin, saponins, Salicylic acids, and amino acids [29]. It has successfully treated sunburns, including both first and second-degree burns [29]. Aloe vera gel has been found to protect human skin from all harmful effects of rays. Due to its anti-inflammatory, Antibacterial, and wound-healing characteristics, aloe vera has long been used to treat digestive issues as well as skin injuries (burns, wounds, insect bites, and eczemas). The goal of research on this medicinal plant has been to confirm its historical Applications, understand its mode of

action, and pinpoint the chemicals that are responsible for these effects. The active Ingredients that have received the greatest research are acemannan, aloe-emodin, aloin, aloesin, and emodin [28] Aloe Vera contains both antimicrobial and antibacterial properties. It decreases the creation and secretion of immunosuppressive Cytokines such as interleukin-10, which are secreted by epidermis keratinocytes, and prevents a protracted type of Hypersensitivity when exposed to UV radiation (IL-10). [27]

**Statement of Problems and Hypothesis:-**

Exposure to ultraviolet (UV) radiation from the sun is one of the main cause of skin damage, premature aging and skin cancer. Commercial sunscreen often contains synthetic chemicals such as oxybenzone and octinoxate, which have been reported to cause allergies reaction and potential environmental harm, especially to marine ecosystems.

Orange (citrus sinesis) peel, commonly discarded fruit by-product is known to be rich in flavonoids, phenolic compounds and vitamin C all of which have antioxidant and photoprotective properties.

Orange peel extract provides significant UV protection and increase the sun protection factor (SPF) of a herbal sunscreen formulation making it an effective natural alternative to synthetic sunscreen ingredients.

**Aim :-**

To formulate and evaluate herbal sunscreen lotion using orange peel extract as the primary active ingredient for natural UV protection and skin nourishment.

**Objective :-**

1To determine the sun protection factor (SPF)

2. To assess the stability of the formulation

3. Herbal ingredients give non-irritative effect

4. To promote use of herbal ingredients as safe, eco-friendly, and cost-effective.

**Fig. Orange peel**

- *Synonym:*- citrus sinesis
- *Biological source:*- The orange peel is fresh or dried outer part of pericarp of citrus Aurantium Linn.
- *Family:*-Rutaceae
- *Part use:*- orange peel

- *Chemical constituents:*- vitamin C, Flavonoids (Narigin, Rutin, Hesperidin), Essential oils.

- *Application:*- Provide UV protection, Anti-aging skincare, used in masks or scrubs to brighten and protect skin due to vitamin C and natural acids.

**Fig. Amla fruit**

- *Synonym:*- phyllanthus emblica *(syn.*Emblica officinalis*)*

- *Family:*-Phyllanthaceae

- *Part use:*-Fruit

- *Chemical constituents:*- Vitamin c, polyphenols, Flavonoids, Tannins.

- *Application:*- Anti-Aging, reduce wrinkles, promote cell regeneration, enhance skin glow, Antioxidant.

**Phytochemical constituents:-**

Phytoconstituent are very much popular nowa days in cosmetic products as they not only prevent the exposure of harmful endogenous and exogenous agents but also protect from many skin disease.[25] Overexposure of Sunlight can lead to the skin cancer and photoaging, which results in appearance of fine lines, wrinkles, loose of the elasticity of skin and Hyperpigmentatio marked can appear.[5] Herbal extract can heal and soft the skin and also provide sunscreen effect.[6]

**1. Flavonoids:-**

These are the secondary metabolites found in the plants and have potential of blocking harmful radiation by absorbing the sunlight in the ultraviolet region, also have antioxidant property and they modulate several signaling pathways.[7] Flavonoids shows anti-mutagenic, anti-carcinogenic, antioxidative, anti-inflammatory action.[10] UV absorption spectrum of flavonoids has two maximum peaks of absorption, one between 240 nm and 280 nm and the other at 300-500 nm so, they can be used in formulation to block UVA and UVB radiation. The plant extract cinnamates and flavonoids is known for its potential to protect early aging caused by various external factors, antioxidant properties, absorption of UV rays, usefulness in cosmetics and action against the free radicals.

**2. Terpenoids:-**

Steroids, tocopherols, taxanes, artemisinin, ingananes and cannabinoids are consider as six main class of terpenoids. Many terpenens have biological activities ( against cancer, malaria, viral and bicterial disease and inflammation).[11] Cinnamates acid and it's derivative are found in plant- based food like whole grains, vegetables and fruits. 3phenylprop-2-enoic acid or tinzaparin or 3-phenylacrylic acid are the called as cinnamic acid. Other derivatives of this class are of cinnamyl alcohol, cinnamaldehyade and dihydrocinnamyl alcohol.[12] It's derivatives in cosmetic in UV protection. Provide protection against UV light ranging from minimum photoprotection.[13] It's decreases undesirable effect of sunscreen of this class.

**3. Antioxidant:-**

Amla is a fruit extract (1-o-Galloyl-D-glucise(Glucogallin), Glucogallin) have photoprotection efficacy due to it's inhibitory effect on ultraviolet radiation[14] It content Glucogallin so significantly responsible for the photoprotection efficacy and have strong antioxidant activities against the UV penetration and anti -aging.[14] Ascorbic acid this is also known as vitamin C. Ascorbic acid helps in adding protection against acute UVB damage. So it is also used in sunscreen for better protection and also sold as a diatory supplements. Also function as a an antioxidant.[15]

**4. Amino Acid:-**

The ultraviolet protecting system of lower marine organism and plants have cutaneous photochemical barrier that in human comprises of phitoscreen ( pheomelanin, melatonin, and some aromatic amino acids) and photo-sensitisers such as purines, and pyrimidines, retinoic acid, porphyrins, haemoglobin, eumelanin, flavin and aromatic amino acid such as tryptophan and it's analogues. [16]

**5. Glycosides**

Glycosides like avobenzone act as sun blocker. It blocks the UVA1 and UVA2 and UVB wavelength and limiting the impact of sun exposure on the skin. It is also safe in term of toxicity,but avobenzone only provide 30 minutes of protection in the sun because it break down quickly.[7] Liquorice (*Glycerrhiza glabra)* :The extract of G. glabra and it's main constituents has various potential activities also useful in cosmetic herbal formulations and dermatological product. Glabridin, glycyrrhizian is a measure constituents of liquorice that contains many properties and potentially beneficial in cosmeceutical formulation. The glabridin act as an anti-inflammatory, antioxidant and skin whiting agents. The root extract of G. glabra protect the skin against oxidative stressed injurious.[17]

**6. carotenoid:-**

A carotenoid compound, such as beta-carotene is a Precursor to vitamin A that has a critical role in the process Of skin cell regeneration and healing. It facilitates the growth Of new skin cells, aids in maintaining the skin's protective Barrier, and helps to produce a smoother, more even skin tone Citric acid, an organic compound, classified as an alpha Hydroxy acid occurs naturally in citrus fruits such as oranges. Alpha hydroxy acids are recognized for their exfoliative Characteristics, as they facilitate the elimination of deceased Epidermal cells from the outermost layer of the skin. This Process of exfoliation facilitates the turnover of skin Cells, thereby unveiling a layer of skin that is both fresher And more radiant in appearance.

**Material and Methods:-**

1. Plant Materials:-

Orange Peel (citrus sinesis) : collected from fresh ripe orange, washed, shade dried, and powered.

Amla fruits(Emblica officinalis) : fresh fruit cleaned, deseeded, shade dried and powdered. 2.Extraction solvent:-

- Ethanol
- Distilled water

3. Lotion based ingredients:-

- Stearic acid
- Cetyl alcohol
- Mineral oil/coconut oil/almond oil
- Glycerin

- Methyl paraben
- Distilled water
- Herbal Extract (Orange peel + Amla)
- Zinc oxide
- Aloe vera gel
- Beeswax
- Rose water

**Methods:-**

1. orange peel extract:

- Dry orange peel powder (50 g) was extracted using 500 mL of 70% ethanol by Soxhlet extraction or cold maceration for 24-48 hours.
- The extract was filtered and concentrated under reduce pressure using rotary evaporator.
- The residue was dried and store in an airtight container at 4°c until use.

2. Amla Extract:-

- Dried Amla powder (59g) was extracted with 70% ethanol using same procedure
- The filtrate was concentrated and store under similar conditions.

**Procedure:-**

**1.oil phase:-**

- Weigh stearic acid, cetyl alcohol, coconut oil, almond oil.
- Transfer these into a beaker and heat at 70°c on a water bath until melted and homogenous.
- Add zinc oxide and mix until evenly dispersed

**2. Aqueous phase:-**

- In separate beaker dissolve glycerin, methyl paraben, distilled water, rose water to 70°c to match the oil phase temperature.
- Add aloe vera gel, orange peel extract and amla extract; stir until uniform.

**3. Emulsification process:-**

- Slowly add the aqueous phase to the oil phase with continuous stirring using mechanical stirrer.
- Continue stirring until a uniform, creamy emulsion is obtained.

- Allow the mixture cool down to around 40°C.

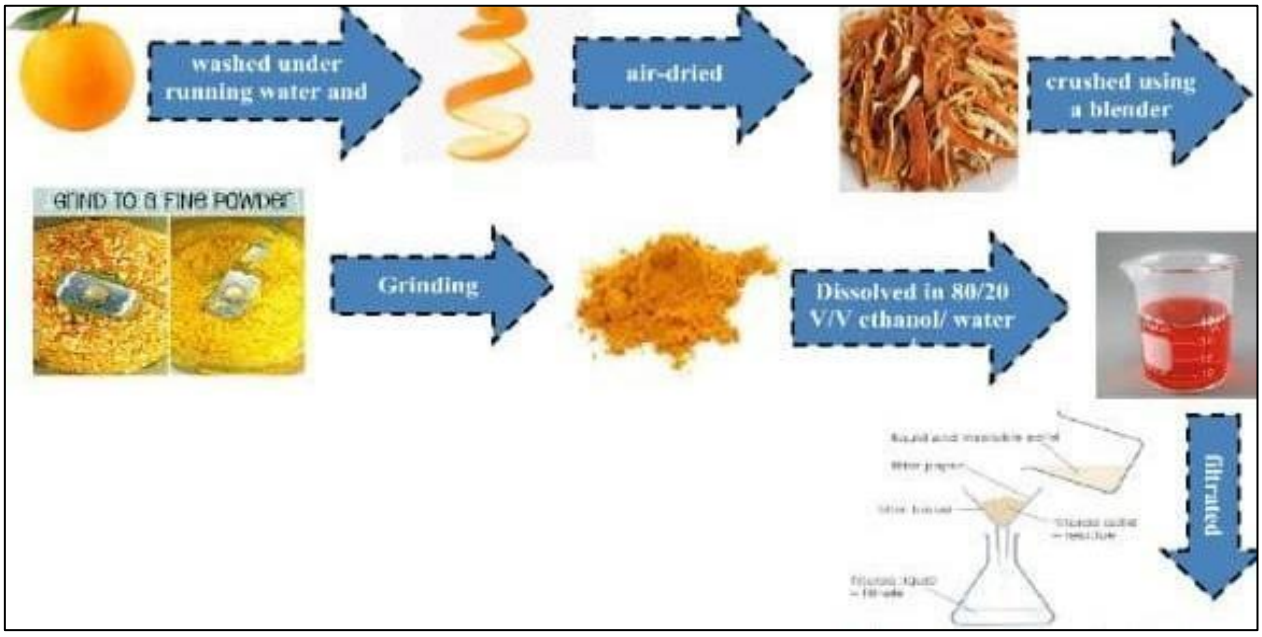


**Fig.Orange peel extraction**

**Evaluation Test of Sunscreen Lotion:-**

- *Physical parameters*

Appearance, color, and homogeneity were determined.

- *Determination of viscosity*

The Brookfield viscometer (RVDV-2+PRO) was used in to test viscosity, with the proper number of spindles selected. A50 ml beaker was used to hold 59 g of preparation until the spindles groove was dipped and the rpm was set. Herbal sunscreen viscosity was measure at 5,10,20,50 and 100 rpm.

- *Determination of pH*

The pH if herbal sunscreen was determined using digital pH meter. pH was measure after 1 g of formulation was dissolved in 100 ml of newly prepared distilled water for 2 hours. The purpose of this study was to guarantee that the pH of the produced herbal sunscreen is similar to the pH of the skin after 24 hours of use.

- *Extrudability study*

The extrudability of the herbal sunscreen was determined in this study by calculating the percentage of formulation extruded from the collapsible tube based on the weight in gram necessary to extruded at least 0.5 cm of gel ribbon in 10 seconds. [18]

- *Spreadability*

The spreadability of herbal sunscreens determined their therapeutic efficiency. The appropriate amount of herbal sunscreen was applied two slides and under specified load direction and the two side took the time in seconds to slide off. Spreadability was defined as the amount of time it took to separate two slides in less time.[19] The formula for calculating it is:

$$S= M \times L/t$$

Where M= weight tied to upper slides L= length of glass slide

T= time taken to separate the slides

- *Thermal stability*

The oil separation from herbal sunscreen was evaluated in a humidity chamber at 60-70% RH and 37±1°C. A 20 mm wide and 5 mm thick stripe of herbal sunscreen was applied to the intern wall of a 100 ml capacity chamber in its whole heights. The beaker was store in a humidity chamber for 8 hous at 60-70 % relatives humidity and 37°C . There should be no oil separation in the herbal sunscreen to pass the test.[20]

- *Skin irritation test*

Three healthy rats group (1273/PO/Re/S/09/CPCSEA), each with six rays either sex, we're use in the skin irritation investigation. The animal were fed conventional animal feed and has unlimited access to water. Hair was shaved from the backs of the rats on one of the study days 5 $cm^2$of the area was marked on both sides, with one side serving as control and the other being tested. No reaction, slight patchy erythema, slight but confluent or moderate but patchy erythema, and Severe erythema with or without edema were graded as 0, 1, 2, 3 for no reaction, slight patchy erythema, slight but confluent Or moderate but patchy erythema, and severe erythema with or without edema, respectively. [21]

- *Determination of spf*

A UV visible spectrophotometer was used to examine the in- vitro efficacy of herbal sunscreen. A 0.10 percent solution (w/v) of herbal sunscreen lotion is ethanol was made by dissolving 0.050 g of herbal sunscreen lotion in 50.0 ml of ethanol. Between 290 and 320 nm, aliquots of each herbal sunscreen were scanned atv5 nm interval. SPF was calculated using the equation below. Three times each sample was analyzed.[22]

$$SPF = CF\sum EE(\lambda) \times I(\lambda) \times A(\lambda)$$

Where as, CF= correction factor; EE= Erythemogenic effect; I= Intensity of solar light of wavelength; A= Absorbance

- *DPPH Method for in-vitro Antioxidant Activity Determination*

In different vials, 1 ml of varying concentrations of herbal sunscreens and ascorbic acid as standard were taken. 5 mL of DPPH Methanolic solution was added to this, shaken thoroughly, and incubated at 370C for 20 minutes. At 516 nm, the absorbance Was measured against methanol as a blank. The DPPH absorbance was used as a control [23].

- *Stability Testing*

Centrifugation and the freeze-thaw method were used to test the stability of each herbal sunscreen. For 10 minutes, the Centrifugation was carried out at 10000 rpm with 500 rpm intervals, and phase separation was observed. All herbal sunscreens Were stored at 20°C and 40°C in freeze-thaw research, and phase separation was noted. All of the tests were done three times[24].

- *Safety Evaluation by Mutagenicity Assay*

Salmonella typhimurium strain TA 100 without the S9 mix was employed in the investigation. Sodium azide (CAS Number: 26628-22–8) was used as a positive control for TA 100: 5 g/plate. As a negative control, sterile distilled water was used. Before The start of each experiment, fresh solutions of the reference mutagen were created. The samples were dissolved in dimethyl Sulfoxide (DMSO) and preincubated in phosphate buffer with the test strain for 20 minutes at 37°C. The plates were incubated At 37°C for 48 hours after the test samples (herbal sunscreens) were added. The mutagenic reactions of the sunscreen Compounds were assessed using a triplicate assay for each sample [25], [26], [27].

International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 31, Issue 12, December 2025 ijppr.humanjournals.com ISSN: 2349-7203

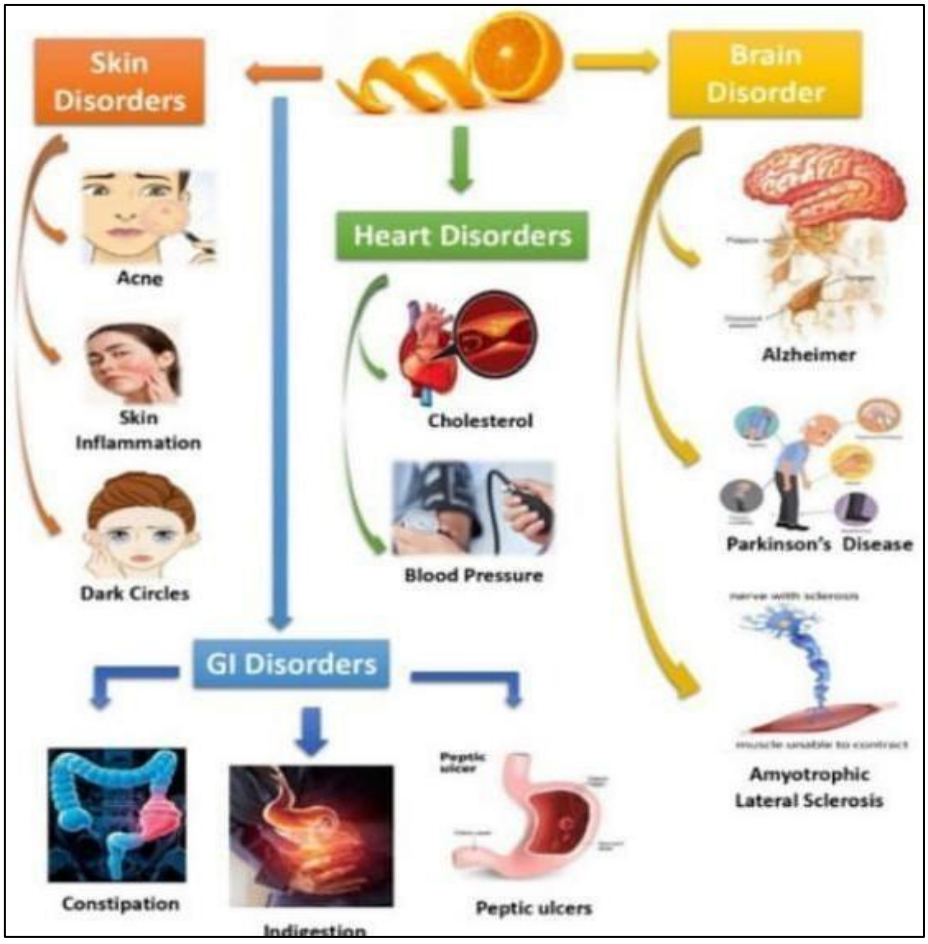


**Fig.Health implications of OP against various diseases Benefits of sunscreen lotion:-**

1. Natural sun protection
2. Rich in Antioxidant
3. Brightness and evens skin tone
4. Prevent sunburn and pigmentation
5. Anti-Aging effect
6. Soothes and Refreshes skin
7. Nourishes and moisturizes skin
8. Prevent Acne and skin Infection
9. Eco-Friendly and Safe
10. Pleasant Natural Fragrance

**Conclusion:-**

The formulation of herbal sunscreen lotion using orange peel and amla extract demonstrate effective photoprotective and antioxidant properties. Both ingredients are rich in natural bioactive compounds such as flavonoids, vitamin C, and phenolic acids,

which help in absorbing ultraviolet (UV) radiation and preventing oxidative skin damage. The prepared lotion showed good spreadability, stability, and non-greasy texture, making it suitable for topical application. Compared to synthetic sunscreen the herbal formulation offers safer, ecoFriendly and skin-friendly alternative with minimal side effects. Overall the study support the potential of orange peel and amla extract as effective natural ingredients in herbal sunscreen formulation for daily skin protection.

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How to cite this article:
Ms Manisha K. Nannaware et al. Ijppr.Human, 2025; Vol. 31 (12): 270-279.

Conflict of Interest Statement: All authors have nothing else to disclose.