

Formulation and Evaluation anti acne and brightening vitamin C Face Serum

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Abstract

Topical L-ascorbic acid (LAA, the biologically active form of vitamin C) is widely used in dermatology and cosmetology for its antioxidant, photoprotective, collagen-stimulating, and depigmenting actions. Despite extensive clinical and laboratory data supporting biological activity, LAA presents formulation challenges—chiefly chemical instability (oxidation), poor skin penetration (due to ionization at physiological pH), and potential for irritation at high concentrations. This review summarizes mechanisms of action, clinical evidence for common indications (photoaging, hyperpigmentation), formulation strategies to improve stability and delivery (pH control, derivatives, antioxidant cofactors, encapsulation), safety considerations, and research gaps. Practical recommendations for clinicians and formulators are provided. Facial serums are highly concentrated skincare products designed to deliver active ingredients into deeper layers of the skin. Unlike traditional creams and lotions, serums are formulated with smaller molecules that allow better skin penetration.

The present investigation was carried out to formulate and evaluate an anti-acne and skin brightening Vitamin C face serum. The formulation was developed using Vitamin C with suitable excipients such as glycerin, aloe vera gel, and propylene glycol. The prepared serum was assessed for physical appearance, pH, spreadability, viscosity, stability, washability, and skin compatibility. The study demonstrated that the serum possessed acceptable cosmetic properties and potential skin care benefits. The present investigation was carried out to formulate and evaluate an anti-acne and skin brightening Vitamin C face serum. The formulation was developed using Vitamin C with suitable excipients such as glycerin, aloe vera gel, and propylene glycol. The prepared serum was assessed for physical appearance, pH, spreadability, viscosity, stability, washability, and skin.

The present study was focused on the formulation and evaluation of a herbal Vitamin C face serum using orange peel extract (*Citrus sinensis*) and aloe vera extract (Aloe vera) for anti-acne and skin brightening activity. Herbal cosmetics are gaining increasing importance due to their safety, effectiveness, affordability, and fewer side effects compared to synthetic cosmetic products. Orange peel, a natural waste product rich in Vitamin C, flavonoids, phenolic compounds, and antioxidants, was selected as the major active ingredient because of its antioxidant, antimicrobial, and skin-brightening properties. Aloe vera was incorporated for its soothing, moisturizing, and anti-inflammatory effects.

Keywords: L-ascorbic acid; Topical vitamin C; Antioxidant; Photoprotection; Hyperpigmentation; Collagen synthesis; Formulation; Stability

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1. Introduction

This Project Focuses on making an herbal face serum using orange peel. It explain the natural ingredients used , how they are extracted how the serum is prepared and how it is tested

The project also describe the important active compounds present in orange peel and how they help improve skin health. It explains different methods to get useful extract form orange peel and other herbal ingredients. Finally it shows how this extracts are combined to make a safe, stable and effective face serum. Herbal cosmetics are products made from natural plant ingredients they are good for the skin and have fever side effects ,they are also eco-friendly and safe to use. ⁽¹⁾

Aloe vera extract(liquid) soothing xanthan gum gel former disodium edta stabilized phenoxyethanol preservative sodium hydroxide Orange peel is usually throun away after processing fruits,but it actually contains many usefull natural compounds. Every year a large amount of orange peel is produced as waste. In india more than 25 laks tons of orange are grown annually mainly in states like Punjab,Madhya Pradesh,Andhra Pradesh,Maharashtra ,Rajastan,Assam and Karnataka. ⁽²⁾ Aloe vera gel is clear jelly like substance taken from the leaves of the aloe vera plant. It is widely used in skincare and medicine because of its soothing and healing properties The demand foe natural and eco-friendly skin care products is increasing because of this cosmetic and pharmaceutical industries are focusing on plant based ingredients that have beneficial effects on the skin.⁽³⁾ Vitamin c is one of the most important ingredient used in skincare because it works as an antioxidant , helps britten the skin and keps it hydrated . However synthetic vitamin c has some problem such as how stability and poor absorption in the skin .⁽⁴⁾ Therefore people are now more interested in using natural sources of vitamin c ,like citrus fruits which are easily available ,affordable and better for the environment. Vitamin c is very important for healthy skin , it acts as a strong antioxidants which means it protects the skin from damage caused by stress,pollution and other environmental factors ⁽⁵⁾

It also helps in reducing dark spots by inhibiting an enzyme known as tyrosinase, which plays a key role in melanin production (the pigment responsible for skin color). By slowing this process, Vitamin C decreases melanin formation, resulting in a brighter and more even complexion.The skin, being the most visible part of the body, clearly reflects signs of aging. Skin aging is a complex process that occurs as damage gradually accumulates over time due to both internal and external factors. Intrinsic aging, or natural aging, originates within the body. It is inevitable and influenced by factors such as age, genetics, gender, and ethnicity. Over time, these elements gradually alter the skin's appearance and function.⁽⁶⁾

Extrinsic aging, on the other hand, results from external influences. These include exposure to ultraviolet (UV) radiation from sunlight, pollution, smoking, an unhealthy diet, and microorganisms. Such factors can accelerate the aging process and lead to faster skin damage.⁽⁷⁾

Introduction: Vitamin C, also known as ascorbic acid, is a water-soluble nutrient essential for human health because the body cannot produce or effectively store it. As a result, it needs to beregularly obtained through dietary sources. It primarily functions as an important biological agent Vitamin C acts as an electron donor, which gives it powerful antioxidant properties. This enables it to neutralize harmful free radicals and reduce oxidative stress within the body.⁽⁸⁾ It also plays a crucial role in collagen production, a structural protein necessary for maintaining the strength and integrity of connective tissues, including the skin, bones, cartilage, ligaments, and blood vessels. Because of this, Vitamin C is essential for promoting healthy skin, improving elasticity, and supporting overall tissue repair.⁽⁹⁾

Furthermore Vitamin C aids in wound healing by encouraging tissue regeneration and repair. It also strengthens the immune system by enhancing the function of various immune cells, helping the body defend against infections and illnesses. In addition, it improves the absorption of iron from plant-based foods, thereby lowering the risk of iron deficiency. Overall, Vitamin C is vital for protecting cells from damage, maintaining overall health, and supporting a wide range of physiological processes.⁽¹⁰⁾

Aloe vera gel is naturally rich in vitamins and various bioactive compounds. However, its stability may be influenced by certain components, particularly those involved in gel formation and preservation. To address this challenge, enriching aloe vera gel with additional nutrients such as vitamin E, vitamin B, collagen, and other supplements can increase its nutritional value and enhance its health benefits.⁽¹¹⁾

Although Thailand is a major exporter of aloe vera-based products—including sterile aloe vera, canned aloe vera, and saline aloe vera—there is limited research on directly incorporating vitamins and collagen into aloe vera gel through encapsulation methods. These techniques may help preserve the structure, effectiveness, and stability of the added

nutrients. Therefore, this study focuses on improving the stability and effectiveness of aloe vera gel enriched with vitamins and mangosteen extract by analyzing properties such as color, texture, and spectroscopic characteristics.⁽¹²⁾

To evaluate the quality and stability of the prepared aloe vera gel, several parameters were assessed. These included color, transparency, moisture content, viscosity, and microbial growth under different formulations containing vitamins and mangosteen extract. Such evaluations help ensure both the physical stability and antioxidant activity of the enriched aloe vera gel.⁽¹³⁾

1.1. *Citrus sinensis*



Figure 1 *Citrus sinensis*

- **Botanical name:** *Citrus sinensis*
- **Biological source:** Orange is the fresh fruit peel of *Citrus sinensis*
- **Part typically use:** peel I
- **family:** Rutaceae.
- **Common name:** Orange, Sweet orange
- **Morphological properties:**
 - Fruit round aur orange color
 - Peel aromatic, rough aur oil glands
 - Pulp juicy aur sweet-sour taste
 - Characteristic citrus odor⁽¹⁴⁾

Table 1 Taxonomical classification

Kingdom	plant
division	magnoliophyta
class	magnoliopsida
oder	sapindales
family	rutaceae
genus	citrus
species	<i>Citrus sinensis</i>

Taxonomical classification

- **Geographical source:** Origin mainly China aur South-East Asia mana jata hai.
- India me orange ki cultivation mainly: Maharashtra, Karnataka, Andhra Pradesh, Punjab, Assam, Madhya Prades⁽¹⁵⁾
- **Macroscopic properties**
 - Colour: Orange to yellowish-orange

- Shape: Round / globular
- Odour: Pleasant aromatic citrus odour
- Taste: Sweet to slightly acidic
- Surface: Rough with oil glands
- Size: About 5–10 cm diameter⁽¹⁶⁾
- **Chemical constituents:**
 - Volatile oil (mainly limonene)
 - Citric acid
 - Flavonoids (hesperidin)
 - Vitamin C⁽¹⁷⁾
- **Uses**
 - Flavoring agent
 - Vitamin C source
 - Carminative
 - Antioxidant
 - Used in perfumes and cosmetics⁽¹⁸⁾
- **Identification tests**
 - Peel ko press karne par aromatic oil release hota hai
 - Volatile oil ki characteristic citrus smell aati hai. Fig: *Citrus sinensis*
- **Discription**

Citrus sinensis is a small evergreen tree belonging to the family Rutaceae. The fruit is commonly known as sweet orange. It is round or globular in shape with orange-colored aromatic peel containing numerous oil glands. The inner part consists of juicy segmented pulp having sweet to slightly acidic taste. The fruit is rich in vitamin C, flavonoids, citric acid, and volatile oils mainly limonene. Orange is widely used as a nutritional fruit, flavoring agent, antioxidant, and in pharmaceutical as well as cosmetic preparations.⁽¹⁹⁾

1.2. Aloe vera



Figure 2 Aloe vera

- **Botanical name :** Aloe vera / Aloe barbadensis Miller
- **Family :** Liliaceae (modern classification: Asphodelaceae)
- **Biological source :** Dried juice and fresh gel obtained from leaves of Aloe vera.
- **Part of typically use:** gel⁽²⁰⁾

Table 2 Taxonomical classification

Kingdom	plant
Division	Magnoliophyta
Class	Liliopsida
Order	Asparagales
Genus	Aloe
Species	Aloevera

Taxonomical classification

- **Geographical source**
 - Native to North Africa and Mediterranean region
 - Cultivated in India, Africa, Arabia, America, and tropical regions
 - In India mainly grown in Rajasthan, Gujarat, Maharashtra, Karnataka, and Tamil Nadu⁽²¹⁾
- **Chemical constituents**
 - Aloin
 - Aloe-emodin
 - Barbaloin
 - Anthraquinone glycosides
 - Vitamins and enzymes⁽²²⁾
- **Uses**
 - Laxative
 - Moisturizer
 - Wound healing
 - Anti-inflammatory
 - Used in cosmetics and skin care products⁽²³⁾
- **Macroscopic properties:**
 - Colour: Green outer surface, colorless gel inside
 - Shape: Long, lance-shaped fleshy leaves
 - Odour: Characteristic faint odour
 - Taste: Bitter
 - Surface: Thick, smooth, succulent with spiny margins⁽²⁴⁾
- **Description:**

Aloe vera is a perennial succulent plant with thick fleshy leaves containing mucilaginous transparent gel. The leaves are green with serrated edges and contain bitter yellow latex beneath the outer rind. Aloe vera is widely used in pharmacognosy, cosmetics, and herbal medicine for its soothing, moisturizing, and healing properties⁽²⁵⁾.

2. Review of literature

Herbal cosmetics have gained considerable attention in recent years due to the increasing preference for natural and safer skincare products. Unlike synthetic cosmetic preparations, herbal formulations are considered eco-friendly, less toxic, and suitable for long-term use.⁽²⁶⁾ Natural plant extracts contain various bioactive compounds such as flavonoids, polyphenols, vitamins, tannins, and antioxidants that provide beneficial effects on skin health including anti-aging, anti-inflammatory, antimicrobial, and skin-brightening activities. Orange peel is an important natural ingredient widely studied in cosmetic and pharmaceutical research. It is a rich source of Vitamin C, flavonoids, carotenoids, phenolic compounds, and essential oils.⁽²⁷⁾ Although orange peel is generally discarded as agricultural waste, several studies have demonstrated its medicinal and cosmetic value. Orange peel extract exhibits strong antioxidant activity that helps neutralize free radicals and reduce oxidative stress responsible for premature skin aging. In addition, the natural acids present in orange peel assist in exfoliation, removal of dead skin cells, reduction of pigmentation, and improvement of overall skin tone. Ghasemi et al. reported that citrus fruit peels possess high antioxidant potential because of their elevated phenolic and flavonoid content.⁽²⁸⁾ Their study concluded that orange peel extract may be effectively utilized in cosmetic and dermatological formulations for skin protection and rejuvenation. Vitamin C (ascorbic acid) is one of the most commonly used active ingredients in skincare preparations because of its antioxidant and collagen-boosting properties. It plays an essential role in collagen synthesis, tissue repair, wound healing, and maintenance of healthy skin. Vitamin C also inhibits tyrosinase enzyme activity, thereby reducing melanin formation and improving skin brightness.⁽²⁹⁾ Due to these properties, Vitamin C is extensively incorporated into anti-aging creams, face serums, sunscreens, and anti-pigmentation products. Pullar et al. explained that Vitamin C is vital for skin health because it protects skin cells from oxidative stress and supports collagen biosynthesis. Their research highlighted that topical Vitamin C formulations improve skin elasticity, hydration, and overall appearance. Farris reported that topical application of Vitamin C significantly reduces wrinkles, fine lines, and photoaging. Continuous use of Vitamin C-based products was found to improve skin texture and reduce visible signs of aging due to enhanced collagen production and antioxidant protection. Aloe vera is another important herbal ingredient extensively used in cosmetic preparations. Aloe vera gel contains vitamins, enzymes, amino acids, minerals, and polysaccharides that provide moisturizing, soothing, anti-inflammatory, and wound-healing effects. It is especially useful for acne-prone and sensitive skin because it reduces irritation and promotes healing of damaged tissues. Surjushe et al. reviewed the medicinal properties of Aloe vera and

concluded that it possesses antimicrobial, anti-inflammatory, and skin-healing activities that support its application in dermatological and cosmetic formulations.⁽³⁰⁾ Face serums are lightweight cosmetic formulations designed to deliver concentrated active ingredients into deeper layers of the skin. Compared to creams and lotions, serums possess better penetration and faster absorption due to their low viscosity and smaller molecular structure. Modern herbal serums combine natural antioxidants, vitamins, and moisturizing agents to provide multiple skin benefits including hydration, anti-aging activity, acne control, and skin brightening. Several studies on herbal cosmetic formulations suggest that plant-based serums containing antioxidants and natural extracts provide effective skincare benefits with minimal side effects. Herbal face serums prepared using orange peel extract, aloe vera, glycerin, and Vitamin E have shown promising antioxidant, moisturizing, anti-acne, and skin-rejuvenating properties.⁽³¹⁾

Objective

NEED OF THE STUDY: The increasing demand for herbal and natural skincare products has encouraged researchers and cosmetic industries to explore plant-based ingredients for safer and more effective skin formulations. Synthetic cosmetic products often contain harsh chemicals, artificial preservatives, and strong active agents that may cause skin irritation, dryness, allergic reactions, and long-term side effects, especially in individuals with sensitive or acne-prone skin. Therefore, there is a growing interest in developing herbal formulations that are safer, eco-friendly, economical, and suitable for regular use.⁽³²⁾

Vitamin C is one of the most important active ingredients used in skincare because of its antioxidant, anti-aging, anti-acne, and skin-brightening properties. It helps in collagen synthesis, protects the skin from free radical damage, reduces pigmentation, and improves skin elasticity. However, synthetic Vitamin C formulations often suffer from instability and oxidation when exposed to air, light, or heat, reducing their effectiveness. Hence, the use of natural sources of Vitamin C has gained considerable attention in cosmetic research.⁽³³⁾

Orange peel is a rich natural source of Vitamin C, flavonoids, polyphenols, and essential oils. Although orange peel is generally discarded as agricultural waste after fruit processing, it possesses significant medicinal and cosmetic value. Utilizing orange peel in cosmetic formulations not only enhances skin benefits but also supports waste utilization and environmental sustainability. Orange peel exhibits antioxidant, antimicrobial, anti-inflammatory, and skin-brightening activities, making it highly beneficial for acne management and improvement of skin appearance.⁽³⁴⁾

- Ideal Qualities of a Face Serum

Hydration An effective face serum should deeply moisturize the skin, helping to retain adequate hydration levels and protect against dryness or dehydration.

- Absorption

It should have a light, non-greasy formula that absorbs quickly into the skin without leaving behind any sticky or oily residue.

- Active Ingredients

A good serum is rich in potent active ingredients such as vitamins, antioxidants, and other beneficial compounds that address specific skin concerns.

- Reduction of Dark Spots and Puffiness:

Serums containing Vitamin E and antioxidants can help reduce dark spots and uneven skin tone, particularly around delicate areas like the eyes. Their calming and cooling properties also assist in reducing puffiness and revitalizing the skin.⁽³⁵⁾

2.1. Types of face serum:

- **Oil-Based Serum:** Oil-based serums are among the simplest types of facial serums to prepare. They are typically formulated using high-quality, fast-absorbing carrier oils, often referred to as "dry" oils. These oils offer excellent moisturizing benefits and help repair the skin barrier. They are also rich in polyphenols, essential fatty acids, and other nutrients that are readily absorbed and utilized by the skin.

- Gel Serum: Gel-based serums provide a mild tightening or firming effect on the skin, giving a temporary lifting appearance to certain facial areas. Due to their water-based composition, they can incorporate hydrophilic.⁽³⁶⁾
- Water-Based Serum: Water-based serums typically contain minimal or no thickening agents or gums. They are especially suitable for delivering potent hydrophilic plant extracts that stay on the skin beneath creams or lotions, thereby boosting the effectiveness of other skincare products.
- Emulsion-Based Serum: Emulsion-based serums act as moisturizers that support and strengthen the skin's protective barrier while efficiently delivering active ingredients. These formulations combine two immiscible components, such as oil and water, using emulsifiers to maintain stability and consistency, resulting in improved overall performance.
- Pressed Balm Serum: Pressed balm serums are created using a traditional blend of butters, waxes, and oils. They include oil-soluble (lipophilic) active ingredients that provide benefits to the skin. The presence of butters and waxes forms an occlusive layer that helps retain moisture and nourish the skin, while the active components work together to enhance skin health.⁽³⁷⁾

2.2. Plan work

- Collection of plant material
- Literature review
- Extraction of phytoconstituents from plant material
- Phytochemical testing of extracts
- Formulation of serum
- Evaluation of serum⁽³⁸⁾

3. Materials and methods

3.1. Basics of Face Serum:

Face serums are formulated to provide the skin with only the most necessary and effective ingredients. They exclude unnecessary additives, fillers, and excess substances that are often present in many other skincare products. As serum formulations are not always emulsions, they generally do not need emulsifying agents, which can sometimes interfere with the stability of active ingredients.⁽³⁹⁾

Typically, serums are made with a limited number of carefully chosen ingredients to improve the efficiency and absorption of active components such as vitamins, growth factors, and plant-based extracts. These formulations are lightweight in nature due to their smaller molecular composition and the absence of heavy oils or occlusive materials.

Compared to creams and moisturizers, serums often contain a much higher concentration of active ingredients—sometimes reaching up to 70%—which makes them particularly effective for targeted skin care and nourishment. Their light consistency and low density allow for quicker absorption and deeper penetration into the skin layers. Moreover, their thin viscosity ensures smooth application and effective delivery of active ingredients into the dermis.⁽⁴⁰⁾



Figure 3 Orange peel

3.2. Instrument

3.2.1. Raw material

- Extraction of citrus senensis
- gel of aloevera

3.2.2. Chemical

- L-Ascorbic Acid(Vitamin C) Primary active
- Glycerin Humectant
- Propylene glycoln Solvent+Stability
- Xanthan gum Gel former
- Disodium EDTA Stabilizer (chelates metals)
- Phenoxyethanol Preservative
- Sodium Hydroxide ⁽⁴¹⁾

- **Preparation of exteaction**



Figure 4 Clavenger assembly for extraction

- **Materials Required**

- Fresh or dried orange peel of Orange
- Clevenger apparatus
- Round bottom flask
- Heating mantle
- Water
- Condenser

Wash and cut the orange peels into small pieces. Place the peels in a round bottom flask. Add sufficient distilled water to immerse the peels. Assemble the Clevenger apparatus with condenser properly. Start water circulation through the condenser. Heat the flask gently using a heating mantle. Water boils and steam carries volatile oil from the peels. Vapors condense in the condenser and collect in the graduated tube. Oil separates from water due to density difference. Collect the essential oil from the side arm or collection tube.⁽⁴²⁾

- **Distilled Water:** Distilled water serves as the main solvent and base in the formulation. It aids in dissolving water-soluble ingredients such as L-ascorbic acid, glycerin, and EDTA. Since it is free from impurities and ions, it helps maintain the stability and purity of the final product.
- **L-Ascorbic Acid (Vitamin C) – Primary Active:** L-ascorbic acid functions as the key active ingredient, providing antioxidant and skin-brightening benefits. It helps in reducing pigmentation, supports collagen production, and protects the skin from damage caused by free radicals. However, it is highly unstable and sensitive to light, heat, and air, making proper stabilization essential. ⁽⁴³⁾



Figure 5 L- Ascorbic acid

- **Orange Peel Extract (Hydroglycolic / Water-Soluble):** Orange peel extract acts as a natural antioxidant and brightening agent for the skin. It contains vitamin C, flavonoids, and citric acid, which help enhance skin tone, reduce dullness, and provide gentle exfoliation. It also contributes to improving the overall effectiveness of the serum.



Figure 6 Orange Peel Extract

- **Benefits:**
 - Helps in naturally brightening the skin tone
 - Assists in fighting acne and cleansing the skin
 - Provides hydration and moisture
 - Helps in toning the skin
 - Reduces visible signs of aging⁽⁴⁴⁾
- **Glycerin :** Glycerin acts as a humectant that draws moisture from the surroundings into the skin. It helps maintain hydration, leaving the skin soft, smooth, and improving the overall texture and spreadability of the serum.

It functions by retaining moisture within the skin, keeping it well-hydrated. Glycerin is a colorless, odorless, and viscous liquid known for its soothing and softening properties. It is also commonly used in wound care and various pharmaceutical preparations.

As a natural humectant, glycerin helps keep the skin supple, soft, and moisturized. It is non-comedogenic, making it suitable for all skin types, including dry and sensitive skin.⁽⁴⁵⁾



Figure 7 Glycerin

Product used: Patanjali Saundarya Glycerine – commonly used in skincare formulations to retain moisture and enhance skin texture.

- **Formula:** $C_3H_8O_3$
- **Density:** 1.26 g/cm^3
- **Boiling Point:** 290°C
- **Molar Mass:** 92.09382 g/mol
- **IUPAC Name:** Propane-1,2,3-triol
- **Viscosity:** $1.412 \text{ Pa}\cdot\text{s}$ (at 20°C)
- **Classification:** Alcohol, Polyol⁽⁴⁶⁾

Propylene Glycol: Propylene glycol acts as a solvent and also enhances penetration. It helps in dissolving active ingredients and promotes their absorption into the skin. Additionally, it supports the overall stability of the formulation.⁽⁴⁷⁾



Figure 8 Propylene Glycol

Aloe Vera Extract : Aloe vera extract offers soothing and anti-inflammatory effects. It helps in minimizing irritation caused by active ingredients such as vitamin C while also improving skin hydration and supporting the healing process.



Figure 9 Aloe Vera Extract

- **Benefits of Overnight Application:**
 - Helps reduce tanning and dullness
 - Minimizes dark circles and dryness
 - Provides relief from sunburn
 - Helps fade acne scars and blemishes
 - Slows down early signs of aging
 - Works as a natural moisturizer, especially for oily skin ⁽⁴⁸⁾
- **Gum Tragacanth**

Gum Tragacanth is a natural gum obtained from the dried sap of plants belonging to the Astragalus species family. It swells in water and forms a viscous colloidal solution or gel.

- **Source**
 - Obtained mainly from:
 - Astragalus gummifer
 - Astragalus microcephalus
 - Family: Fabaceae (Leguminosae)
- **Nature**
 - Natural polysaccharide
 - Odorless
 - Tasteless
 - White to cream colored powder⁽⁴⁹⁾
- **Chemical Composition**
 - Gum tragacanth contains two major fractions:
 - Tragacanthin
 - Water soluble
 - Forms colloidal solution
 - Bassorin
 - Water insoluble but swells in water
 - Responsible for gel formation
 - These polysaccharides contain:
 - Arabinose
 - Xylose
 - Galacturonic acid⁽⁵⁰⁾
- **Disodium EDTA** : Disodium EDTA functions as a chelating agent that binds metal ions which might otherwise degrade vitamin C. This helps improve the stability and shelf life of the serum.⁽⁵¹⁾



Figure 10 Disodium EDTA

- **Phenoxyethanol** : Phenoxyethanol is used as a preservative to inhibit the growth of bacteria, fungi, and other microorganisms, thereby ensuring the product remains safe and stable over time.⁽⁵²⁾

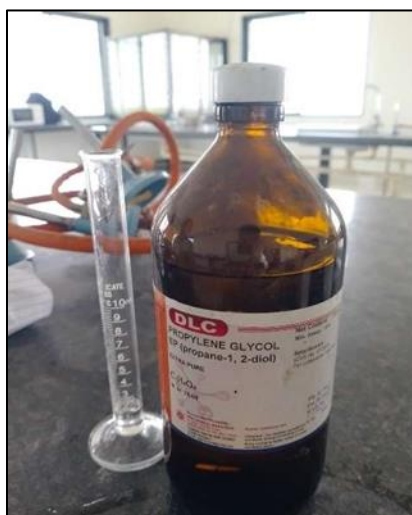


Figure 11 Phenoxyethanol

- **Sodium Hydroxide** : Sodium hydroxide acts as a pH adjuster. It helps maintain an optimal pH level (approximately 3–4 for vitamin C serums), which is essential for the stability and effectiveness of L-ascorbic acid.⁽⁵³⁾



Figure 12 Sodium Hydroxide

3.3. Method of preparation

Preparation of Herbal Vitamin C Face Serum A measured quantity of distilled water was taken in a clean beaker as the base solvent. Xanthan gum was mixed with glycerin separately to avoid lump formation and then slowly added into distilled water with continuous stirring to form a uniform gel base. Propylene glycol and disodium EDTA were added slowly with continuous stirring until completely dissolved.⁽⁵⁴⁾ L-ascorbic acid was added gradually into the formulation while maintaining the temperature below 35°C to avoid degradation of Vitamin C. Orange peel extract and aloe vera extract were then incorporated into the formulation and mixed thoroughly to obtain a homogeneous solution. The pH of the formulation was adjusted to approximately 3–4 using sodium hydroxide solution. Phenoxyethanol was added as a preservative and mixed properly. Finally, the prepared serum was transferred into amber-colored airtight containers and stored in a cool and dry place for further evaluation.⁽⁵⁵⁾

3.4. Preparation of Vitamin C Gel Serum

3.4.1. Procedure

Step 1: Preparation of Gel Base: First, take a clean and dry beaker and add 21.8 mL of distilled water, which serves as the main solvent base.

In a separate container, prepare a uniform mixture of 1.5 mL glycerin and 0.09 g xanthan gum. Glycerin helps in dispersing xanthan gum evenly and prevents the formation of lumps.

Gradually add this glycerin–xanthan gum mixture into the distilled water with continuous stirring, preferably using a magnetic stirrer or a glass rod. Continue stirring until a consistent gel structure begins to form. Allow sufficient time for complete hydration.

Step 2: Addition of Stabilizers and Humectants Once the gel base is formed

Add 0.9 mL of propylene glycol slowly under continuous stirring. This enhances solubility and improves skin hydration.

Then add 0.015 g of disodium EDTA and mix until fully dissolved. It acts as a chelating agent by binding metal ions, thereby improving formulation stability.

Step 3: Incorporation of Active Ingredients Carefully add the active components as follows

Slowly incorporate 3 g of L-ascorbic acid (Vitamin C) in small portions while stirring gently to ensure complete dissolution.

Maintain the temperature below 30–35°C, as Vitamin C is sensitive to heat and may degrade at higher temperatures.

After complete dissolution, add 1.5 mL of orange peel extract, which provides antioxidant and skin-brightening effects, followed by 0.9 mL of aloe vera extract for soothing and moisturizing benefits.

Mix thoroughly until a uniform solution is obtained.⁽⁵⁶⁾

Step 4: pH Adjustment

Measure the pH using a pH meter or pH strips. Prepare a 10% NaOH solution separately.

Add this solution drop by drop with continuous stirring until the pH reaches between 2.8 and 3.2. This range is essential for maintaining the stability and effectiveness of L-ascorbic acid.

Step 5: Addition of Preservative

Add 0.24 mL of phenoxyethanol as a preservative. Stir gently to ensure uniform distribution while avoiding excessive agitation to prevent air bubble formation.

Step 6: Final Processing and Packaging

Examine the final product; it should appear as a clear to slightly hazy gel with no lumps or undissolved particles.

Transfer the serum into a dark amber glass bottle or an airtight container to protect it from light exposure and oxidation.⁽⁵⁷⁾

3.5. Applications

- **Anti-Acne Formulations** – Its antibacterial and astringent properties help in reducing acne, controlling excess sebum, and tightening pores. It is commonly used in anti-acne gels, face washes, and spot treatments.
- **Exfoliating Scrubs** – Finely powdered peel works as a natural exfoliant, removing dead skin cells and improving skin texture.⁽⁵⁸⁾
- **Anti-Aging Products** – Due to its antioxidant content, it is used in serums and creams to reduce wrinkles, fine lines, and oxidative damage.
- **Moisturizers and Hydrating Masks** – Flavonoids and essential oils provide hydration and nourishment to the skin.
- **Sunscreen & UV-Protective Formulations** – Photoprotective compounds such as hesperidin make it useful in sunscreens and after-sun care products.
- **Skin-Toning Lotions** – Used in toners to refresh the skin, reduce blemishes, and tighten pores.⁽⁵⁹⁾
- **Oil Control & Mattifying Products** – Helps absorb excess oil, making it suitable for oily and combination skin formulations.
- **Hair Care Products** – Used in shampoos and conditioners for dandruff control, scalp cleansing, and enhancing hair shine.
- **Aromatherapy & Fragrance Products** – Orange peel essential oil is used in perfumes, body mists, and bath products for its refreshing citrus aroma.
- **Skin Brightening Products** – Used in face packs, masks, and cleansers to reduce pigmentation, dark spots, and improve overall skin tone due to its high vitamin C content.⁽⁶⁰⁾

4. Result

4.1. Evaluation of Face Serum

4.1.1. Physical Evaluation

The formulations were assessed for organoleptic properties such as color, odor, and homogeneity. They were also visually inspected for clarity and the presence of any foreign particles.



Figure 13 Physical Evaluation

4.1.2. Result:

Smooth, lump-free, clear/pale yellow

4.1.3. pH Value

The pH of the formulation was determined using a calibrated pH meter. Approximately 1 mL of serum was dissolved in 50 mL of distilled water, and the pH was measured. Since the skin has an acidic nature, the ideal pH range for serum is 2.97



Figure 14 ph Value

4.1.4. Determination of Spreadability:

Spreadability refers to the extent to which a topical formulation spreads when applied to the skin. About 3 g of sample was placed between two glass slides and compressed to form a uniform film. A 20 g weight was placed on the upper pan, and the time taken for the upper slide to move 10 cm over the lower plate was recorded.

Result: Easily spread

4.1.5. Stability Studies:

Stability evaluation is essential to determine the physical and chemical stability of the formulation and ensure its safety. A short-term accelerated stability study was performed over several months. Samples were stored under different conditions such as 25°C, 35°C, and 40°C.

Result : stable

4.1.6. Washability:

The formulation was applied to the skin, and its ease of removal using water was evaluated manually.

Result : Easily washable

4.1.7. Patch Test:

A small quantity of serum was applied to a skin patch, such as the inner forearm, and observed for any adverse reactions like redness or itching. This helps determine its suitability for different skin types.



Figure 15 Patch Test

Result : smooth , not irritate, easily spread

4.1.8. Determination of Viscosity:

Viscosity was measured using a Brookfield viscometer with spindle number 64 at 50 rpm.



Figure 16 Determination of Viscosity

Result: moderate viscosity

Table 3 Observation table

Parameter	Observtion
Colour	Light yellow
Odour	Pleasant citrus
Texture	Smooth gel
Honogenecity	Uniform
Ph	2.97
spreadability	Good
Washability	Easily washable
Skin irritation	No irritation
Viscosity	Moderate

5. Conclusion

The present study successfully formulated and evaluated a herbal Vitamin C face serum using orange peel extract (*Citrus sinensis*) and aloe vera extract (Aloe vera) for anti-acne and skin brightening applications. The formulation was prepared using natural ingredients rich in antioxidants, vitamins, and bioactive compounds that provide beneficial effects on skin health. Orange peel extract served as a natural source of Vitamin C and flavonoids, while aloe vera contributed soothing, moisturizing, and anti-inflammatory properties.

The prepared serum showed satisfactory physicochemical characteristics including good appearance, pleasant citrus odor, smooth texture, proper homogeneity, suitable pH, good spreadability, acceptable viscosity, easy washability, and satisfactory stability under different storage conditions. Patch test evaluation indicated that the formulation was safe for topical application and did not produce irritation or adverse skin reactions.

Topical L-ascorbic acid is a well-supported ingredient for photoprotection, improving visible signs of photoaging, and modestly reducing hyperpigmentation when formulated and used correctly. The strongest evidence supports 10–15% LAA at acidic pH, ideally combined with vitamin E and ferulic acid and delivered in protective packaging, with sunscreen used as the foundation of photoprotection.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest regarding the publication of this research paper.

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