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Formulation and Evaluation of Herbal Face Serum from Guava Fruit

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Abstract
Herbal remedies have always been a key part of traditional medicine, with origins tracing back to ancient eras, as mentioned in old texts like the Vedas. Among the many plant-based components, guava (Psidium guajava L.) stands out for its high content of beneficial compounds and healing qualities. This research investigates the creation of a facial serum using guava extract and assesses its stability, effectiveness, and advantages for consumers. Guava is rich in vitamin C, which is vital for producing collagen, brightening the skin, and providing antioxidant defense. It also holds flavonoids, carotenoids, tannins, and polyphenols, which help combat aging, reduce inflammation, and fight bacteria. Organic acids, including ascorbic, citric, and malic acids, facilitate gentle peeling and skin regeneration, while minerals like potassium, calcium, magnesium, and zinc support hydration, healing of wounds, and the maintenance of the skin barrier. Serums are concentrated skincare items aimed at penetrating deeply and efficiently delivering active components. Unlike lotions and creams, serums are composed of smaller molecules that enhance both absorption and effectiveness. The development of a guava-infused facial serum focuses on keeping its bioactivity, ensuring stability, and enhancing sensory experiences to achieve the best outcomes. Its goal is to boost moisture, lessen the appearance of aging features, and shield against environmental damage.

Keyword: Herbal healing, antioxidants, anti-aging, herbal cosmetics, face serum, bioactive compounds, hydration, skin renewal, natural skincare, phytochemicals, collagen synthesis, oxidative stress.

1. INTRODUCTION:

The herbal healing has been mentioned from the ancient era, from Vedas, and even from ancient religious work. Probably it is the oldest medical care system in the world. The herbal healing deals with use of herbs, herbs extracts or natural products for the betterment of health condition. Nowadays in westerns countries medical practitioners and mostly prescribing medicines containing plant extract.

Developed countries also appreciating this traditional and ancients form of medicine. As a result, Indian herbal drugs are in demand and witnessing rapid growth in global market. Wide growth and demand for herbal cures, herbal skin care products and even herbal cosmetics were observed in recent years [1]. In recent years, there has been a growing interest in utilizing natural sources for skincare products due to their perceived safety and potential health benefits. Guava (Psidium guajava L.) is a tropical fruit rich in antioxidants, vitamins (particularly vitamin C), and other phytochemicals known for their skin-nourishing properties. These bioactive compounds not only contribute to the fruit's nutritional value but also offer promising applications in cosmeceuticals. The evaluation of this herbal face serum will involve comprehensive assessments including antioxidant activity, skin hydration potential, and potential anti-inflammatory effects. These parameters are essential for establishing the efficacy and safety profile of the guava-based serum compared to conventional synthetic skincare products. Overall, this project bridges the gap between natural product development and cosmetic science, offering insights into the potential of guava fruit as a sustainable source of skincare solutions.

Serum are thin viscosity topical products that contain concentrated amount of active ingredients. Serum is a concentrated product which widely used in Cosmetology. The name comes from itself in professional cosmetology. The cosmetic serum is as concentrated in water or oil as any other cream. Serum, or other concentrated product that contains ten times more organic matter than cream. Therefore, deal with the cosmetic problem quickly and effectively. Serum is a skin care product that contains a gel or lightweight lotion or moisturizer and has the ability to penetrate deep to bring the active ingredients to the skin. A good skin serum may give your skin firmness, a smooth texture, make the pores appear smaller and increase moisture levels. Psidium guajava Linn, a well known traditional medicinal plant used in various indigenous system of medicine, also known as Guava belonging to family Myrtaceae. It is represented by approximately 130-150 species [2] and widely distributed throughout the world [3]. All parts of the plants being used as medicine, the parts like fruits, leaves, bark and root have been used to treat diarrhea and used as stomachache, respiratory and gastrointestinal disorders as antispasmodic, anti-inflammatory, as cough sedative, in obesity, to control diabetes mellitus. Seeds possess antimicrobial [4], anti inflammatory [5], anti allergic [6], and anti carcinogenic activity [7].

2. AIMS & OBJECTIVES:

Aim: Formulation and Evaluation of Herbal Face Serum from Guava fruit.

Objectives:

1. The main Objective of these study is to formulate and evaluate an herbal face serum various herb for multipurpose use.
2. To improve skin texture.
3. To minimize the skin pores.
4. Reduce the fine lines wrinkles.
5. Hydrates and nourishes the skin.
6. Improve skin elasticity.
7. Reduced dark circle.
8. Protect from the reed radical.

3. PLANT PROFILE:

3.1 Guava Fruit (Psidium guajava L)

Synonyms – ***Guava, Amrood, Peruka***

Kingdom – plantae

Division – Magnoliophyte

Class – Magnoliopsida

Order – Myrtales

Family – *Myrtaceae*

Genus – Psidium L.

Botanical Name - Psidium guajava L.

Fig: 01 Psidium guajava L

Morphological characteristics: -

1. Shape: Guava fruits are typically round or oval in shape.

Size: They range in size from small (about 3–4 cm in diameter) to larger fruits (about 10 cm in diameter).

Weight: A typical guava weighs between 150–250 grams, although larger varieties can be heavier.

Color: Unripe Guavas: The skin of an unripe guava is typically **green**, which gradually changes as the fruit ripens. **Ripe Guavas**: The skin of ripe guavas can range in color from: **Yellow**: Some varieties of guava, particularly the common ones found in tropical regions, turn yellow when ripe.**Pink or Red**: Some guavas, especially varieties like the **pink guava**, have a **pinkish** or **red** hue when ripe.

Texture: The skin is smooth and sometimes slightly waxy, with a uniform color depending on the ripeness of the fruit.

Flesh: White, pink, yellow, or red, depending on the variety.

Seeds: Numerous small, hard seeds embedded in the flesh.

Chemical composition:

Proximate Composition - Guava fruits are a rich source of including vitamins, antioxidants, and fatty acids and antioxidants, and other skin-nourishing compounds. Vit. C. Approximately 200–300 mg per 100 grams. Guava contains **approximately 624 IU of Vitamin A** per 100 grams. Guava contains around **5-6 grams of fiber** per 100 grams. Also contains Tannins and Flavonoids. various health-promoting micro- and macronutrients as well as bioactive compounds. They contain 82.47% moisture, 3.64% ash, 0.62% fat, 18.53% protein, 12.74% carbohydrates, 103 mg ascorbic acid, and 1717 mg gallic acid equivalents (GAE)/g total phenolic compounds.

1. Phenolic Compounds – The various secondary metabolites present in GLs include phenolic acids, flavonoids, triterpenoids, sesquiterpenes, glycosides, alkaloids, and saponins. Phenolic compounds (PCs)

serve as key bioactive compounds which provide antioxidant and hypoglycemic properties to GLs. Generally, five quercetin glycosides are present in GLs. The presence of two new benzophenone galloyl glycosides (guaianolides A and B) and one quercetin galloyl glycoside (guaianolide C) was also reported**.**

2. Minerals and Vitamins- Guava leaves are the rich source of minerals, such as calcium, potassium, sulfur, sodium, iron, boron, magnesium, manganese, and vitamins C and B. The higher concentrations of Mg, Na, S, Mn, and B in GLs makes them a highly suitable choice for human nutrition and also as an animal feed to prevent micronutrient deficiency The higher vitamin C content in GLs may help in improving the immune system and maintain the health of blood vessels, whereas vitamin B plays an important role in improving blood circulation, nerve relaxation, and cognitive function stimulation.

3. Protein- Guava leaves contain 9.73% protein on a dry weight basis. Proteins are large biomolecules composed of amino acids and act as building blocks of cells. Proteins play a major role in growth and maintenance, enzyme regulation, and cell signaling, and also as biocatalysts.

4. Essential Oil- GL share a rich source of essential oils. The major constituent of GL essential oil includes 1,8-cineole and transcaryophyllene. GL essential oil from the Philippines was found to contain a different profile, with limonene, α-pinene, βcaryophyllene, and long cyclone as major compounds. Ecuadorian GL essential oil contained a higher content of monoterpenes (limonene and α-pinene).

Uses: Rich antioxidant, vitamin and skin-repairing properties.

3. 2 Aloe Vera (Aloe barbadensis miller)

Synonyms: *Aloe vera, Ghritkumari, Gwarpatha*

Kingdom: Plantae

Division: Angiosperms

Class: Monocots

Order: Asparagales

Family: *Asphodelaceae* (Liliaceae)

Genus: Aloe

Botanical Name: Aloe barbadensis miller

Fig: 02 Aloe Vera

Morphological characteristics: -

Colour: Aloe vera leaves are green to greyish-green, with some varieties displaying white spots or streaks on young leaves. The inner gel is clear and translucent, while the latex (found beneath the leaf surface) is yellowish.

Odour: Fresh Aloe vera gel has a mild, earthy, and herbal scent. When the leaf is cut, it may release a slightly bitter or pungent odor due to the presence of bioactive compounds. The latex has a strong, unpleasant smell.
Taste: Aloe vera gel has a mildly bitter and slightly tangy taste, often described as watery with a cooling effect. The latex, on the other hand, is extremely bitter and pungent, making it unpalatable in raw form.
Size: Aloe vera plants typically grow 60 to 100 cm (2 to 3 feet) in height. The leaves range from 30 to 60 cm (12 to 24 inches) in length and 5 to 8 cm (2 to 3 inches) in width at the base. The flower stalk (inflorescence) can grow up to 90 cm (3 feet) tall, bearing yellow or orange tubular flowers.
Shape: The leaves are long, thick, fleshy, and sword-shaped (lanceolate) with a pointed tip. They grow in a rosette pattern, spreading outward from the short stem. The leaf margins are serrated with small, white, sharp spines.
Chemical Constituents: Aloe vera (Aloe barbadensis miller) contains a rich blend of vitamins (A, C, E, and B-complex), minerals (calcium, magnesium, zinc, and iron), and enzymes (amylase, lipase, and bradykinase) that support skin health, immunity, and digestion. It is abundant in polysaccharides like acemannan and glucomannan, which enhance hydration, wound healing, and immune function. The plant also has phenolic compounds (aloin, aloe-emodin) with antibacterial and antifungal properties, along with saponins and sterols that provide anti-inflammatory and antiseptic benefits. Salicylic acid helps in exfoliation and acne treatment, while its 99% water content ensures deep hydration and soothing effects. These bioactive compounds make Aloe vera a powerful ingredient in medicine, skincare, and herbal formulations.
Uses: Anti-ageing and skin-repairing properties.

3.3 Sandalwood oil (Santalum album)

Synonyms: East Indian Sandalwood Oil, White Sandalwood Oil
Kingdom: Plantae
Division: Magnoliophyta (Angiosperms)
Class: Magnoliopsida (Dicotyledons)
Order: Santalales
Family: Santalaceae
Genus: Santalum
Botanical Name: Santalum album

Morphological Characteristics

Fig: 03 Sandalwood oil

Colour: Pale yellow to golden yellow

Odour: Strong, woody, sweet, warm, and long-lasting fragrance
Taste: Slightly bitter with a woody undertone
Size: Obtained from trees that grow up to **10–15 meters** in height
Shape: The oil is **viscous** in texture, while the tree has smooth bark with elliptical leaves
Chemical Constituents

- **Santalols (α-santalol, β-santalol)** – Major active components, responsible for the characteristic fragrance and medicinal benefits.
- **Santalenes (α-santalene, β-santalene)** – Contribute to the oil's aroma and antimicrobial properties.
- **Terpenoids and Sesquiterpenes** – Have anti-inflammatory, antiseptic, and soothing effects.
- **Farnesol** – Known for its antibacterial and skin-rejuvenating properties.
- **Lanceol and Bergamotol** – Enhance the **calming and relaxing** effects of sandalwood oil.

Uses: Antibacterial, Anti-inflammatory, and Antioxidant.

4. APPARATUS AND CHEMICALS:

Table No. 01: Apparatus, Chemicals and Instruments

Apparatus	Beaker, measuring cylinder, stirrer, petri plate, etc.
Chemicals	Aloe vera gel, sandalwood oil, coconut oil, glycerin, sweet almond oil, tween 20, methyl paraben
Instruments	Magnetic stirrer, mixer, etc.

Table No. 02: Formulation of Herbal Face serum

Sr. No.	Ingredients	Batch A	Batch B	Category
1.	Guava Fruit Extract in Sweet Almond oil	25ml	25ml	Rich antioxidant, vitamin, and skin-repairing properties
2.	Aloe vera	5gm	5gm	Anti-ageing
3.	Methyl Paraben	0.1gm	0.1gm	Preservative
4.	Glycerin	12.5ml	12.5ml	Toner
5.	Sandal wood oil	1ml	1ml	Antibacterial, Anti-inflammatory, and Antioxidant
6.	Coconut oil	1ml	1ml	moisturizing
7.	Tween 20	4ml	4ml	Emulsifier

8.	Rose Water	Qt as pre req.	Qt as pre req.	Hydrating, Soothing

5. PROCEDURE:

Collection of Plant Materials: The Fruits of Psidium guajava were collected from Market the Collected materials were cleaned and flesh was removed for further processes of separation of vit. C the infusion method was used with sweet almond oil.

Steps Involved:

1. **Select Fresh Guavas**: Choose ripe guavas, as they contain the highest amount of Vitamin C. The guava can be washed thoroughly to remove any dirt or pesticides.
2. **Crushing the Guava**: Using a crusher or blender, mash the guava into a pulp. This will release the juice and all of the fruit's nutrients, including Vitamin C.
3. **Air Drying**: Spread the crushed guava pulp out in a thin layer and allow it to air dry. This step is crucial because the drying process helps concentrate the Vitamin C and other nutrients in the fruit, as some of the water content evaporates. Ensure the drying area is clean and free from contamination. You can dry it in the sun or in a controlled environment with low humidity to avoid mold growth.
4. **Infusing with Sweet Almond Oil**: After the guava pulp is dried, it can be mixed into sweet almond oil. Almond oil is known for its high content of vitamins (such as Vitamin E) and fatty acids, which may help in extracting and preserving the Vitamin C from the guava pulp. Place the dried pulp into a container and add the sweet almond oil.
5. **Infusion Process**: Allow the mixture to infuse for seven days, During this time, the almond oil will extract the soluble compounds from the guava, including the Vitamin C and any antioxidants. You can gently warm the oil and guava mixture in a double boiler for a more efficient extraction, but be careful not to overheat it, as Vitamin C is sensitive to heat and can degrade.
6. **Strain and Store**: After the infusion period, strain the oil to remove any solid fruit particles. The resulting liquid will contain the infused sweet almond oil with Vitamin C from the guava. Store it in a clean, airtight container, away from light and heat to preserve its potency.

Face serum is an oil in water type of emulsion.

Here's a step-by-step procedure for preparing the biphasic emulsion:

Preparation of Oil Phase:

- The ingredients for oil phase: Sandalwood oil, Tween 20, Coconut oil used as an emulsifier are taken in a clean container.
- Stir this oil mixture together for about 10 minutes until a uniform solution get obtained.

Preparation of water Phase:

- Simultaneously, prepare the ingredients for water phase: Aloe vera, glycerin, guava fruit extract & small amount of rose water. in another clean container. Stir until all ingredients are uniformly mixed.
- Add Some amount of Methyl Paraben as a preservative.

Combine the Phases:

- Once both phases are ready, slowly add the oily phase to the aqueous or water phase drop by drop. It can be achieved by using a mechanical vibration set at around 2500 rpm.

Monitor and Adjust:

Monitor the addition carefully to ensure a stable emulsion is formed. The dropwise addition helps to preventing phase separation and promotes the formation of small droplets which is dispersed in the water phase.

Packaging and storage:

- Transfer the prepared biphasic emulsion to suitable packaging containers, ensuring they are clean and sterilized.
- Once the emulsion is well-formed and homogeneous, it can be transferred into a suitable container for storage or further evaluation processing.

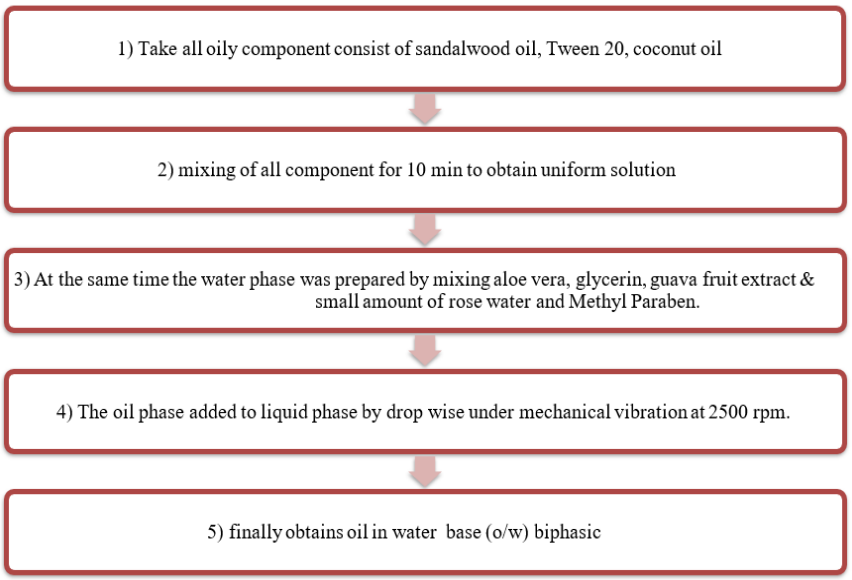
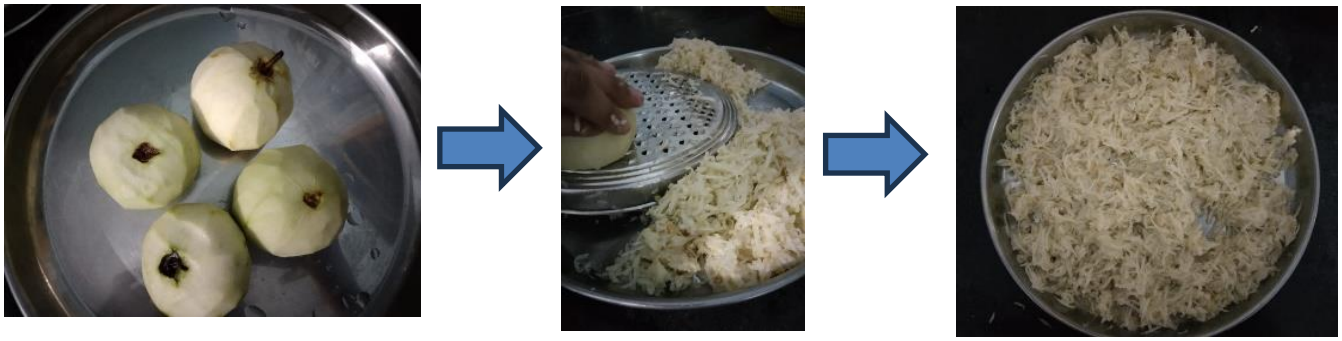


Fig: 04 Procedure



Guava Fruit (Psidium guajava L) **Crushing the Guava** **Guava Pulp**

Air Dried Guava Pulp Oil

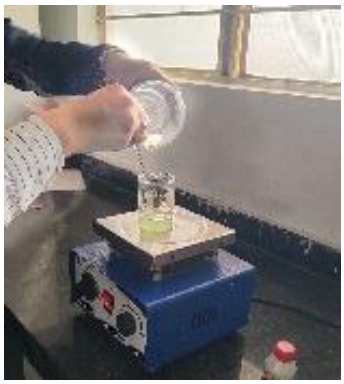
50gm of Dried Guava Pulp

Infusion with sweet Almond

Filtering of Guava Fruit extract Sweet

Filtering of Guava Fruit extract

Guava Fruit Extract in In Sweet Almond oil



Addition of Oil phase To Water phase

Mechanical vibration set at around 2500 rpm

Biphasic Final Face Serum Formulation

6. EVALUATION PARAMETER:

Chemical test: -

Test for Alkaloids – Dandruffs test: Take 2 ml of each extract, few drops of Dandruff's reagent

(potassium Dandruffs bismuth iodide solution) was added. A turbid organ/ orange-red precipitate was observed in presence of alkaloids.

Test of tannins– Ferric chloride reagent test:-2-3 drops of ferric chloride solution were taken and they are poured on both extracts. Then the formulation of green (greenish-black color indicates the presence of tannins.

Test for phenolic Compounds: - An equal amount of ferric chloride solution and 1 % potassium ferrocyanide was mixed, 3 drops of this prepared mixture were added to the 2 ml of extracts. The positive result shows the formulation of a bluish color.

Test for flavonoids: **-**

Alkaline reagent test: -1ml of 10% solution hydroxide solution was taken and added to the extract to form yellow color, which confirms the presence of flavonoids in the sample.

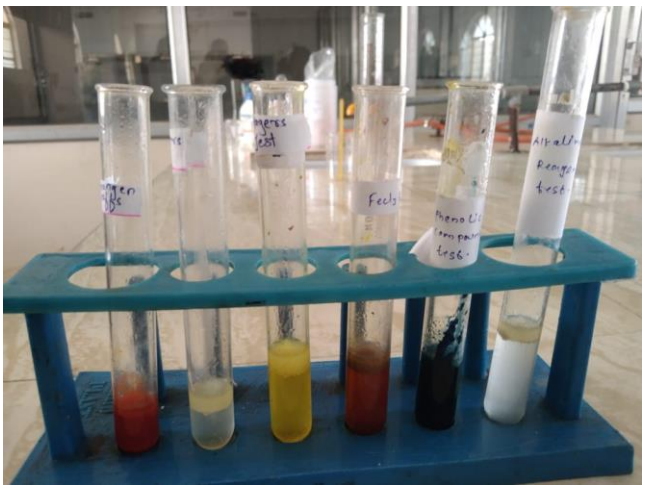


Fig: 05 Chemical Test of Herbal Face Serum

When evaluating herbal face serums based on physical appearance, we have to address aspects such as the serum's color, consistency, scent, clarity, absorbance, uniformity, and viscosity.

Physical Test: -

Appearance: -

The colour and appearance of the herbal face serum were observed virtually. The observation states that the colour of the formulation was Milky opaque. The texture of the serum is smooth and lightweight, allowing it to get easily absorbed after application.

Odor: -

The formulation was applied to the hand and the fragrance and feel were characteristic.

Consistency: -

The serum was found to be lightweight, semi-liquid, smooth in visual appearance, and effortlessly absorbed into the skin after application.

Fig: 06 Guava Fruit Herbal

Face Serum

pH: -

The pH meter was calibrated using standard buffer solutions typically, pH 4.01, pH 7.00, and pH 10.01 buffers were used. Since the pH of the skin is acidic hence the ideal pH should be in the range of 4.1 to 6.7. The pH was found to be 5.95.

The physical tests like appearance, odor, consistency, and pH were evaluated and the results were translucent yellow, characteristic odor, semi-liquid consistency, and the pH was found to be 5.95 respectively.

Fig : 07 PH Test

Homogeneity and Uniformity: -

The serum was found to exhibit uniformity and was Biphasic, with color, texture, and scent throughout the product. There was phase separation of the formulation and there were no signs of instability.

The serum was found to be biphasic.

Stability Studies: -

Stability studies were conducted on the formulation to evaluate potential physical and chemical changes. There were no significant alterations in the formulation's properties were detected.

The result obtained was that there were no signs of any physical or chemical changes in the formulation and no signs of instability.

Irritancy Test: -

The irritation tests are utilized to check whether a chemical or a substance induces any sort of local irritation to the skin or the ocular tissues. The serum was applied to the area and was checked for any irritancy like edema, or erythema for up to the next 24 hours. According to the observation no irritancy was observed.

There were no signs of irritation found with the serum. After application, the skin didn't give any signs

of irritation or redness.

Fig: 08 Irritancy Test

Viscosity: -

A viscometer or rheometer is employed to measure the flow or deformation behavior of a liquid or any viscoelastic food. Viscosity governs many properties such as the spreadability, and pourability of the product from the container. Viscosity is affected by many factors such as changes in temperature, changes in manufacturing conditions, and the quality of the raw material. Hence it is very important to measure the viscosity of the product. There are two types of viscometer Brookfield viscometer and Ostwald viscometer. To study the viscosity of the serum we have employed an Ostwald viscometer.

Fig: 09 Ostwald Viscometer

The Ostwald viscometer was used to evaluate the viscosity of the serum, which was found to be 1.8cp.

Calculation: -

- Time for water flow (t_w) = 100 Sec
- Time for serum flow (t_s) = 150 Sec
- Density of water (P_w) = 1.0 g/cm^3 Sec
- Density of serum (P_s) = 1.2 g/cm^3
- Viscosity of water (η_w) = 1.0 cP (Centipoise) at 25^{o}C
- Viscosity of the serum (η_s):?

Formula used:

$$\eta_s = \eta_w \times (t_s / t_w) \times (P_s / P_w)$$

$$\eta_s = 1.0 \times (150 / 100) \times (1.2 / 1.0)$$

$$\eta_s = 1.0 \times 1.5 \times 1.2$$

$$\eta_s = 1.8 \text{ cP}$$

The viscosity of the serum was found to be 1.8cp

Globule size: -

The size of globules in a semi-solid dosage form can be determined by visual inspection through a microscope. This can help to determine the size of the globules and the consistency of the product. A

particle size analyzer can be used to measure the size of the globules in the product.
The globule size was found to be 0.48mm.

Fig: 10 Stage Micrometer

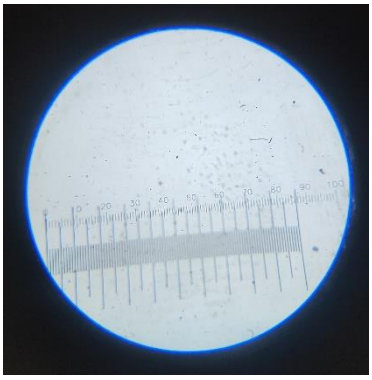


Fig: 11 Globule size

Different benefits of using guava fruits on skin:

Helps to Treat Wrinkles on Face: Guava leaves have anti-aging properties which help to prevent the appearance of wrinkles on the face. It helps in destroying the free radicals which are damaging your skin

Helps to Lighten Dark Spots: Guava leaves also help to lighten the dark spots on your face and also clears as the blemishes left behind on the skin. Guava leaves make an excellent skin lightening ingredient, thereby, providing you with a clear looking complexion and a spot free skin.

Treats Acne and Blemishes: Guava leaves are an excellent antibacterial agent which help to treat acne, pimples, and blemishes on the face. When applied on skin, guava leaves help in reducing the appearance of pimples and acne on the face.

Helps to Remove Blackheads: Guava leaves can help to remove blackheads and shrink the large sized pore.

Relieves Itching on Face: Itching can be one of the major problems for many and if you suffer from itching on the skin inflammation, guava leaves can help to treat this problem. Due to allergy blocking compounds present in the guava leaves, it helps to instantly cure itchiness on skin.

Fig: 12 How to use Face serum

7. RESULT: -

Table No. 03: - Result

Sr. No.	Test Parameter	Batch A	Batch B
1.	Physical Test	Milky Opaque Color	Milky Opaque Color
2.	Odor	Characteristic odor	Characteristic odor
3.	Consistency	Semi – liquid	Semi – liquid
4.	pH	5.95	5.95
5.	Homogeneity and Uniformity	Good	Good
6.	Washability	Washable	Washable
7.	Phase Separation	Yes	Nil
8.	Stability Studies	Stable	Stable
9.	Irritancy Test	No irritation	No irritation
9.	Viscosity	1.8cp	1.8cp
10.	Cyclic Temperature	Stable	Stable
11.	Globule Size	0.48mm	0.48mm

Table No. 04: - Cyclical temperature Test

Sr. No	Parameter	Stability
1	Freezer temperature	Unstable
2	Room temperature	Stable

8. CONCLUSION:

It is concluded that, the investigation result came out that the facial serum has an excellent product in field of cosmetology. In the study it is found that face serum is type of skin care product which moisturize the skin and release the active ingredients. The face serum give skin smoother, reduce the pore size and boost hydration. The main objective of this research is to optimize the thickness, PH, spread ability, cyclic temperature, and homogeneity. It studied that the Guava face serum has moisturizing activity which help in deep moisturizing and nourishing the skin. the final product has

great spread ability and optimum stable in nature.

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