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Formulation and Development of Anti-Acne Face Serum Using Centella Asitica

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ABSTRACT
Targeting those with acne-prone skin, this study describes the development and evaluation of a face serum containing salicylic acid and Centella Asiatica. The anti-inflammatory and wound-healing capabilities of Centella Asiatica work in concert with salicylic acid, a beta hydroxy acid that has anti-acne and exfoliating qualities. To ensure efficacy and user acceptance, the serum's formulation underwent optimization for stability, viscosity, and pH. The stability and compatibility of the active components were verified through in vitro experiments. Using the serum regularly reduced the severity of acne, inflammatory lesions, and sebum production in participants with acne, according to clinical evaluation. In addition, individuals reported changes in skin texture and general look, indicating that the serum had positive tolerability and cosmetic elegance. The potential of Centella Asiatica is highlighted by these results.

KEYWORDS: Acne-prone skin, Centella asiatica, optimization, inflammatory lesions, sebum, potential.

I. INTRODUCTION

STRUCTURE AND FUNCTION OF HUMAN SKIN

The organ that creates the barrier separating an organism from its surroundings is its skin. In addition to preventing dehydration and preventing the entry of harmful foreign substances and microbes, skin also protects the body from mechanical shock, helps to regulate body temperature, and transduces external sensations. Skin health maintenance is essential for the skin to carry out these activities, and it's a goal that cosmetic formulators strive to achieve. Understanding the structure and function of the skin is crucial for cosmetic scientists, regardless of whether they are focused on pharmacological skin improvement or artifice-related damage avoidance. The effects of light on skin and the aging process of skin have become so significant in the field of cosmetics that a thorough examination of the topic is necessary. [1]

SKIN MORPHOLOGY

The epidermis, dermis, and subcutaneous tissue (hypodermis) are the three layers that make up the skin. The skin's outermost layer, or epidermis, is made up of stratified squamous epithelium. Its thickness ranges from 0.05 mm to 1.5 mm, depending on the location. The main constituents of the epidermis are keratinocyteswhose primary job is to create keratin, a filamentous protein that, when combined with other lipid components, acts as a protective barrier. In addition, these cells create additional proteins, such as cytokines, which are involved in the inflammatory response on the skin. GAGs and collagen, a structural protein, make up the so-called ground substance that separates the dermis from the epidermis. The dermis is composed of two layers: the reticular layer, which reaches into the subcutaneous tissue, and the papillary layer, which interdigitates with the epidermal rete ridges. Its thickness likewise varies with location, ranging from 0.3 mm to 3.0 mm. The subcutis, also called the hypodermis, is the lowest layer of the skin and is mainly made up of lipocytes. [1]

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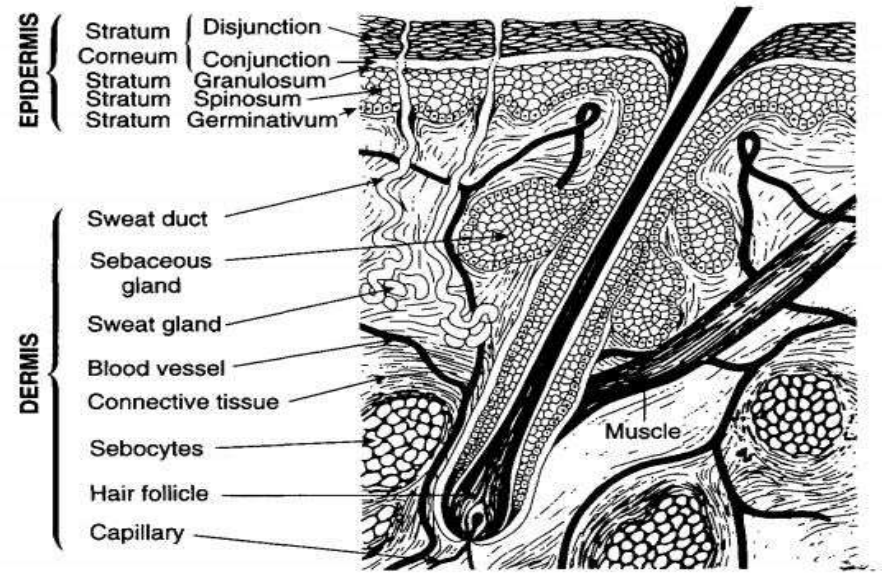

Figure 1 Diagram of normal human skin [1]

1. EPIDERMIS:

The outermost layer of skin that is avascular is called the epidermis. Dendritic cells and keratinocytes make up its composition. Over 90% of all cells in the epidermis are keratinocytes, making them the most common cell type there. They are crucial to the skin's ability to act as a barrier of defence and to repair the skin's integrity during wound healing through epithelization. Conversely, dendritic cells are crucial to the functioning of the immune system. [2]

There are five additional layers within the epidermis. The stratum corneum, stratum lucidum, stratum granulosum, stratum spinosum, and stratum basale are the layers that make up the skin anatomy. [2]

2. STRATUM CORNEUM:

It is the epidermis' uppermost layer. "Keratinocytes" are flattened, anucleated cells that make up the stratum corneum. The term comes from the strong, fibrous, insoluble protein called keratin that fills these cells. The stratum corneum is resistant to abrasion because it contains proteins such as keratin. Approximately two thirds of the thickness of the epidermis is made up of the stratum corneum. Variations in age and gender are among the characteristics that affect the stratum corneum's thickness. A lipid matrix that is enhanced in the stratum corneum improves the skin's ability to operate as a barrier of defence. [2]

3. STRATUM LUCIDUM:

A second higher layer of skin known as the "stratum lucidum" typically sits beneath the stratum corneum. It is exclusive to regions with thicker skin, like the palms and soles, in contrast to other layers of the epidermis. It is not present on sections of skin that are thinner, such the eyelids. Stratum lucidum is seen as a thin, translucent layer of keratinocytes that have been flattened under a microscope. [2]

4. STRATUM GRANULOSUM:

Because granules are present in the keratinocytes of the stratum granulosum, this layer is also referred to as the "granular layer". The keratinocytes, which have a distinctive diamond form, have not yet been flattened, in contrast to the first two layers of the epidermis. The stratum granulosum is also the layer where keratinization first appears. [2]

5. STRATUM SPINOSUM:

The spine-like keratinocyte projections that give this layer's stratum spinosum its name. But these spines are byproducts of tissue preparation; they are not present in living cells. Desmosomes, often known as "tight junctions," are what hold the keratinocytes in this layer together. Thus, during tissue preparation, the cytoplasm of keratinocytes shrinks, giving the appearance of a "spine" for the desmosomes. [2]

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6. STRATUMBASALE**:**

The base or innermost layer of the epidermis is called the stratum basale. Mitotically active cells in this layer produce new keratinocytes that are driven toward the top layers of the epidermis. This layer also contains melanocytes, the skin cells that produce pigment. [2]

7. DERMIS:

The skin's thickest and most vascular layer is called the dermis. In contrast to the keratinocyte-rich epidermis, the dermis is home to fibroblasts, skin vasculature, and skin innervation. The position of the body affects the thickness of the dermis, which in turn affects the thickness of the skin. The dermal blood vessels are in charge of thermoregulation, nutritional support, and homeostasis maintenance. Despite the fact that blood vessels do not penetrate the epidermis, simple diffusion allowed the dermal vasculature to supply the epidermis' cells with nutrients and oxygen.

The dermis is composed of two layers: the "reticular dermis," which is a thicker layer that is deeper than the "papillary dermis," and the thin outer layer. "Dermal papillae" are peg-like projections on the outer surface of the papillary dermis that indent into the surrounding epidermis. Touch receptors, free nerve endings, and blood vessels can all be found in dermal papillae.

Dense connective tissue is seen in the reticular dermis as opposed to loose areolar tissue found in the papillary dermis. More than 80% of the dermis' entire thickness is made up of dense bundles of collagen fibers. The papillary and reticular dermis cannot be easily distinguished from one another, in contrast to the epidermis and dermis, which are divided by a basement membrane. [2]

8. HYPODERMIS:

The lowest layer of skin, known as the hypodermis or subcutaneous tissue, is located directly beneath the dermis. It serves to connect the dermis to the underlying structures where the hair follicles are located. It is mainly made up of adipose tissue. The hypodermis gives the skin cushioning, serves as an energy store, and acts as an insulator.

FUNCTION OF HUMAN SKIN

One of the largest and most noticeable organs in the human body is the skin. Numerous medical disorders can present cutaneously, which can give doctors crucial information about what they are diagnosing. The human skin serves many vital purposes for the body. Clinicians can more effectively address the effects of skin diseases by having a greater grasp and respect of these roles.

- **Protection:** The defense of internal organs against exterior diseases, environmental irritants, and UV radiation is arguably one of the skin's most vital roles. It acts as a barrier to keep the human body safe. An undamaged epithelium serves as the body's initial line of defense against infections. Sebum, an oily lipid released by the skin's sebaceous glands, gives the skin an acidic layer that gives it antibacterial qualities. Melanin, a pigment that contributes to skin pigmentation, aids in providing protection from the sun's harmful UV radiation. Tissue macrophages and Langerhans cells are two other immune cell types found in the skin.

- **Thermoregulation:** Skin plays an important role in maintaining body temperature through a process called thermoregulation. The two primary mechanisms involved in thermoregulation are sweating and blood circulation. To dissipate excess heat, the blood vessels in the skin dilate which results in increased blood flow. The heat is lost from the surface of the skin by conduction, convection, radiation, and evaporation. Excess amount of sweat is also produced by the sweat glands which results in the dissipation of heat. In contrast, vasoconstriction of the blood vessels results in the conservation of heat.

- **Sensation:** The skin has a number of receptors that allow it to sense various sensations, including pressure, temperature, touch, and pain. Nerve fibers then transport these feelings to the cerebral cortex, where they are processed. The skin has a variety of sensory receptors, such as unmyelinated free nerve endings, Merkel cells, Meissner corpuscles, and Krause end bulbs. The fact that diabetic neuropathies enhance the risk of injuries is evidence of the relevance of skin sensibility. Skin sensations are the body's adaptive reaction to shield it from damage from the outside world.

- **Metabolism:** In the presence of sunshine, the skin plays a significant role in the production of vitamin D. 7-dehydrocholesterol is changed

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into cholecalciferol when exposed to UV radiation. The body's regulation of calcium and phosphorus levels is significantly influenced by vitamin D. Vitamin D insufficiency can cause fragile, weak bones. This is the reason that for the best vitamin D synthesis, adequate sun exposure is frequently advised.[2]

FACE SERUM

HISTORY:

Our exploration of the history of face serums starts in the centre of ancient Egypt, a culture where skincare was extremely important. The Egyptians were well-known for their beauty regimens, which included applying various plant-based oils on their skin. Among these precious concoctions were castor and sesame oils as well as olive oils. It is said that Cleopatra, the legendary queen known for her enduring beauty and her marriage to Julius Caesar, favoured sesame and olive oils for her personal grooming routine. In ancient Egypt, these oils were used for two purposes. Not only did they improve the skin's appearance, but they also provided defence against the harsh desert environment. With their rejuvenating and nourishing properties, these early combinations functioned as the model for the products we now know as face serums. [3]

Since the first facial serums were created commercially in the 1930s, serums have undergone significant evolution and have come a long way. Naturally, their shelf life was quite limited due to their high susceptibility to bacterial and fungal illnesses; yet, the underlying idea of these items was developed. The original serums were designed to tighten the face and lessen wrinkles. [4]

These serums were generally based on albumin – the tightening ingredient in egg whites, which have been used by women all over the world for ages as a facial mask. [4]

INTRODUCTION:

Humanity has recognized the value of beauty since the prehistoric era, and the desire to appear well and attractive has grown across society. The Greek term "cosmetic" means "to adorn," as in adding something ornamental to a person or something. The study and practice of cosmetic treatments is known as cosmetology. It's the science or art of enhancing and beautifying the skin, nails, and hair as well as the study of makeup application. To get the desired result, a skin care formulation needs to be able to penetrate the skin and release the potent ingredient. Face serum is the solution for delivering the valuable active ingredient into the skin and doing away with the need for dangerous chemicals to get immediate results.

In cosmetology, serum is a concentrated substance that is often utilized. In the field of professional cosmetology, the name originates from itself. Similar to other creams, the cosmetic serum has the same concentration of water or oil. Ten times as much organic content is present in serums than in creams, making them concentrated products. Consequently, promptly and successfully addresses the aesthetic issue. Face serum is an oil- and water-based emulsion that is extremely concentrated. Because serums, also known as concentrates, have roughly 10 times the amount of biologically active ingredients as creams do, they are a better option for treating skin issues. Within a month or less, adding a few drops of face serum to your regular skin care regimen will show results. This is due to the fact that face serums are composed of minuscule molecules that facilitate rapid penetration of the skin. Numerous beneficial active ingredients and nutrients, including ceramides, amino acids, and antioxidants, are abundant in serum. This explains why the face serum in a skin care set is always the most expensive item. [4]

TYPES OF FACE SERUMS:

There are generally 5 types of face serums[6]

1. ANTI-AGEING SERUM

These serums have the ability to both slow down aging generally and treat the most prevalent indications of age. They firm and plump the skin, addressing any existing wrinkles, sagging, or fine lines. Additionally, anti-aging serums work to support improved cell turnover, repair, and rejuvenation. This improves the skin's general texture and look and helps to revitalize it. Retinol, a vitamin A derivative, is a well-known and widely utilized substance with potent anti-aging properties. It aids in cell turnover, firming, plumping or moisturizing the skin, boosting the formation of collagen and elastic, and reducing collagen loss.[6]

2. SKIN BRIGHTENING SERUM

Smoothing your complexion, reducing hyperpigmentation, balancing out skin tone, and minimizing age spots are all achieved by using brightening serums. Your skin has a wonderful, natural glow after applying this. Certain serums may include antioxidants like vitamin C and E, or

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extracts like grapefruit, liquorice root, and green tea. Kojic acid, ferulic acid, peptides, and light reflectors or optical diffusers—which provide you an instant flawless glow—are additional elements for lightening and brightness.[6]

3. ANTI-ACNE SERUM

Acne-fighting serums might be the key to permanently eliminating undesirable acne outbreaks. Most of the time, we react to acne by treating it after it has already spread far and wide. Actually, preventing outbreaks before they occur is the main objective of anti-acne serum. Because of their small molecular formulation, they can quickly penetrate the skin's surface and deliver powerful active ingredients. In contrast, face cleansers and lotions tend to target the skin's surface more. Before acne outbreaks ever occur, serums help prevent them. They can also help fade the scars left by acne while carefully clearing away any accumulation of dead skin cell. Serums that fight acne tighten the skin, reduce and unclog pores, absorb extra oil, and lessen redness and inflammation.

Salicylic acid, alpha- and beta-hydroxy acids (AHA and BHA), glycolic acid, citric acid, zinc, and plant extracts such as tea tree, thyme, cucumber, and green tea are effective ingredients for treating acne. [6]

4. HYDRATING SERUM

There are instances when lotions and moisturizers are insufficient for dry, parched skin. This is the situation where hydrating facial serums are useful. Hydrating face serums aren't meant to take the place of your regular moisturizer, though. They enhance the moisturizing benefits of your moisturizer when used together. These specific face serums provide an additional layer of hydration by penetrating deeply into your pores. Since your moisturizer helps to seal in these healthy components, you should apply it after your serum. Look for components like argan oil, glycerine, hyaluronic acid, aloe vera, rosehip oil, ceramide, rosewater, sea kelp, jojoba, and vitamin E to help moisturize parched skin.[6]

5. EXPOLATING SERUM

Due to its numerous benefits for the skin, exfoliation holds a unique position in our skincare regimen. Exfoliating serums reduce wrinkles and fine lines, even out skin tone, and treat hyperpigmentation and discolouration caused by UV damage and aging. As we age, our skin produces less collagen and elastin and is far less effective at eliminating dead skin cells. Dry, cracked skin is caused by the accumulation of dead skin cells on the skin's surface. It becomes less protected, more prone to irritation, and improper absorption reduces the effectiveness of your other cosmetic products. Using exfoliating serums is a simple approach to make sure your skin is performing at its best. Besides that, they help to clear clogged pores and stop outbreaks. Alpha hydroxy acids, such as lactic or glycolic acid, retinol, enzymes derived from plant or fruit extracts, and citric acid are essential components in exfoliating face serums.[6]

MATERIALS

The instruments used include a set of distillation tools, a beaker, a petri dish, an analytical balance, an autoclave, a magnetic stirrer, a pH meter, a Brookefield viscometer, Hot plate, FTIR Spectrometer, Desiccator and a spatula.

The materials were used including Centella asiatica powdered extract from sanchomeeherbovedapvt.Ltd traded as mankarnikaaushadhalya, salicylic acid, propylene glycol, xanthan gum, rose hydrosol from sanchomeeherbovedapvt.Ltd traded as mankarnikaaushadhalya, distilled water, sodium benzoate,ethanol.

PREFORMULATION STUDIES

For Herbal ingredient [16-17]

1. Phytochemical tests for Centella asiatica

A) Test for alkaloids:

After the extract was dissolved in water and thoroughly shaken, it was filtered. The filtrate that was utilized for the subsequent tests.

i) Dragondroff's test:[22]

Few drops of Dragondroff's reagent were added to 2 - 3 ml filtrate. Presence of alkaloids indicated by formation of orange brown precipitate.

ii) Mayer's test:[22]

Two drops of Mayer's reagent in 2-3 ml filtrate. Presence of alkaloids indicated by formation of cream coloured precipitate.

iii) Hager's test:

Few drops of Hager's reagent were added to 2-3 ml filtrate; Presence of alkaloids indicated by formation yellow precipitate.

iv) Wagner's test:

Few drops of Wagner's reagent were added to 2-3 ml filtrate, presence of alkaloids is indicated by formation color. [22]

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B) Test for Tannins:
Gelatin test:

1 ml of sample solution in test tube. Add 1 % gelatin solution and 10% of sodium chloride solution. Presence of tannin causes precipitation of gelatin from solution.

C) Test for Flavonoid:
i)Alkaline reagent test:

Two to three drops of sodium hydroxide were added to 2 mL of extract. Initially, a deep yellow colour appeared but it gradually became colourless by adding few drops of dilute HCL, indicating that flavonoids were present.[23]

ii) Shinod's test:

Ten drops of dilute HCL and a piece of magnesium were added to 1 mL of extract, the resulting deep pink colour indicating the presence of flavonoids.

D) Test for Saponin:
i)Foam Test

Drug extract or dry powder is added to water and vigorously shaken. Then the persistent foam observed.
ii)Haemolytic test: Place one drop of blood on glass slide then add the drug extract on to the drop of blood. Haemolytic zone appears.[23]

E) Test for Glycoside**:**
Borntrager's test:

In 3 ml extract, add di]. H2S04. Boil and filter it, to cold filtrate add equal volume of benzene or chloroform. Then shake well. Separate the organic solvent. Add ammonia, ammonia layer turns pink or red.[24]

2. Determination of ash values

The residue remaining after complete incineration of the drug or sample is the ash content or ash value of the powdered sample which represents inorganic salts, naturally occurring in sample or adhering to it or deliberately added.
Ash values are helpful in determining the quality and purity of powdered sample or product. Ash values helps as a criterion for acceptance of powdered sample.
Ash values can be determined by as follows

a)Incineration of powder

b) Ash Obtained

c) Desiccator

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a) Total ash value

● Preparation of silica crucible:

Weigh several clean and dry crucibles using the analytical balance. Record their weights accurately.Then add 2gm of powderedCentella asiatica and weigh again.

●Ashing:

Place silica crucible with the sample on burner and gradually increase the flame to form ash. Once the ash formed then cool it into desiccator for 15-20 minutes and then weigh. Record the weight precisely.

● Calculations:

$$\text{Total ash content} = \frac{C-D}{B} \times 100$$

Were,
C= Weight of silica crucible with Drug
D= Weight of silica crucible with ash
B= Weight of drug

b) Acid insoluble ash value

● Preparation acid treated ash:

Add 25ml HCL in beaker and add the total ash. Cover with the watch glass and boil for 5 min.

● Filter with the ashless paper:

Filter the acid contain ash with the ashless filter paper and wash with the hot water.

● Ashing:

Transfer the filtered ash along with the ashless filter paper into the silica crucible and keep on burner. Once ash formed cool in desiccator for 10 min and weigh accurately.

● Calculations:

$$\text{Acid soluble Ash} = \frac{100 \times (W_2 - W_1)}{W}$$

W_1= Weight of empty dish
$W_{2=}$ Weight of dish with acid insoluble ash
W= Weight of sample

c) Water soluble ash value

● Preparation of water treated ash:

Take 25ml distilled water with total ash and boil for 5 min.

● Filtration:

Filter the sample with ashless filter paper and collect the insoluble matter on ashless filter paper. Wash with hot water.

● Ashing:

Transfer the filtered ash along with the ashless filter paper into the silica crucible and keep on burner. Once ash formed cool in desiccator for 10 min and weigh accurately.

● Calculation:

$$\text{Water soluble ash} = \text{Total ash(a)} - \text{water insoluble ash(b)}$$

$$\%\ \text{Water soluble ash} = \frac{a}{\text{Drug}} \times 100$$

3. Determination of Extractive values

Extractive values of drug or powder sample with particular solvent are the percentage of soluble components extracted by that solvent. These are the indicative of quality of crude drugs. Alcoholic and water-soluble extractive values are official in pharmacopoeias and are generally considered as standards for evaluating crude drugs.

a) Alcohol soluble extractive value

● Preparation of sample:

2 gm of accurately weighed sample with 50ml 90% ethanol in a stoppered flask was macerated for 24 hours. Shaken frequently for first 6 hours.

●Filtration:

Filtered after 24 hours through filter paper and evaporate 25ml of filtrate to dryness in a petri dish.

●Evaporation:

Evaporate to dryness on a water bath and completely dry the residue in an oven at 105° and weigh. Kept it in a desiccator. The residue was weighed and percentage extractive value was calculated.

● Calculations:

$$\text{Weight of dried extract} = \text{Weight of porcelain dish with Extract} - \text{Weight of empty porcelain dish}$$

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$$\% \text{ alcohol soluble extractive value} = \frac{c}{d} \times 100$$

Where,
c= Weight of dried extract from 100 ml alcohol
d= Weight of drug

b) Water Soluble extractive value

● Preparation of sample:
5gm of accurately weighed sample with 50ml chlorofonn water in a stoppered flask was macerated for 24 hours. Shaken frequently for first 6 hours.

● Filtration:
Filtered after 24 hours through filter paper and evaporate 25ml of filtrate to dryness in a petri dish.

● Evaporation:
Evaporate to dryness on a water bath and completely dry the residue in an oven at 105° and weigh. Kept it in a desiccator. The residue was weighed and percentage extractive value was calculated.

● Calculations:

$$\% \text{ Water soluble aqueous extractive value} = \frac{\text{weight of dried extract from 100ml aqueous extract}}{\text{Weight of drug}} \times 100$$

For Active ingredients

FTIR Spectroscopy:

Fourier Transform Infrared (FTIR) spectroscopy is a powerful analytical technique used to identify and analyse chemical compounds based on their molecular fingerprint in the infrared region of the electromagnetic spectrum. It can be utilized to check the compatibility of ingredients in any formulation.[13]

a) INSTRUMENTATION

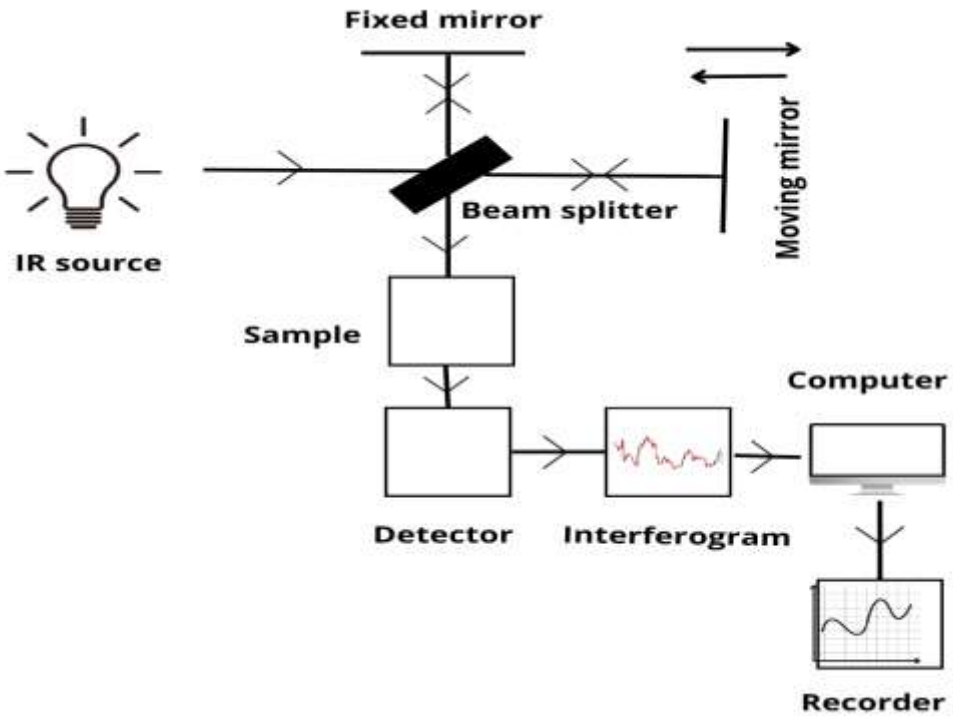

Figure no.2: Instrumentation of FTIR Spectrometer[15]

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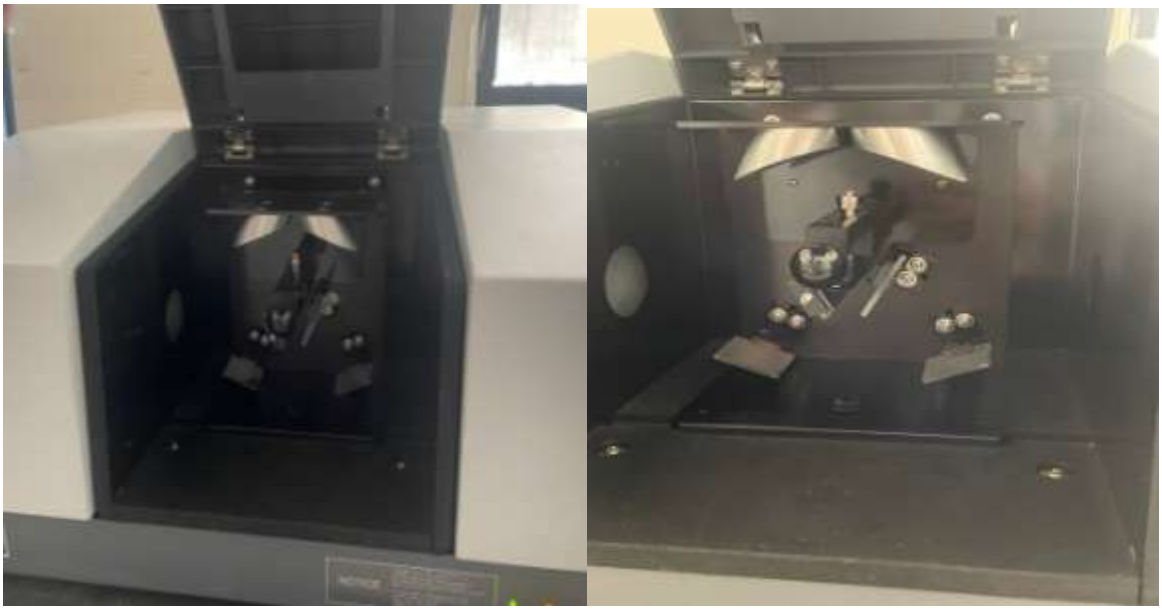

Figure 3: Fourier Transform Infrared Spectrometer Instrumentation

b) MATERIALS

1. FTIR Spectrometer:

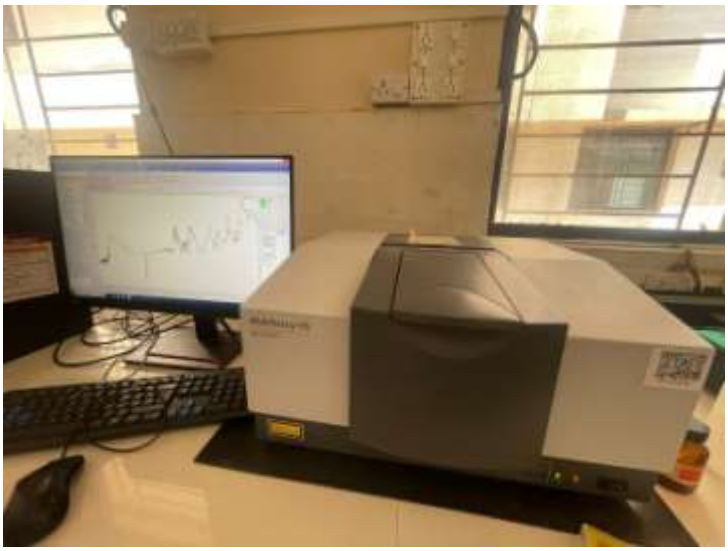

Figure 4: Fourier Transform Infrared Spectrometer Instrumentation setup

2. Potassium bromide (KBr) pellets
3. Spatula
4. Mortar and pestle
5. Dry active ingredients and Excipients
6. Brush
7. Methanol

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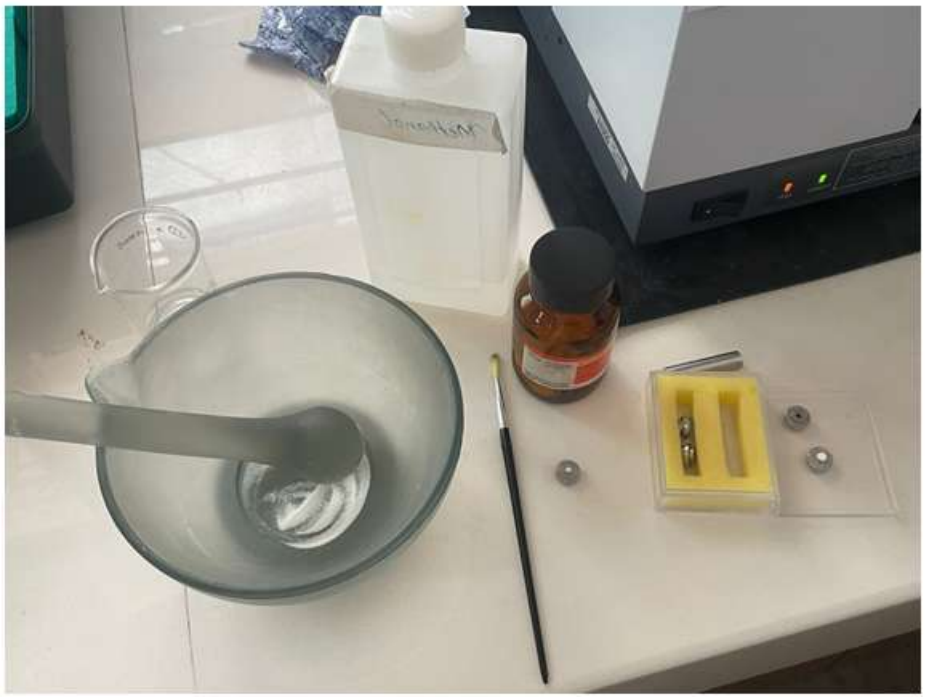

Figure no.5: Requirements of FTIR spectroscopy

c) PROCEDURE

1. Sample Preparation

Using a mortar and pestle, grind a small portion of the Active ingredient and excipients mixture into a fine powder by adding a small amount of KBr. For a representative spectrum to be ensure, the sample to KBr ratio needs to be optimized.

Using a pellet press, create a pellet out of the powdered mixture.

2. Instrument setup

Ensure the FTIR Spectrometer is properly calibrated and ready for the use.

3. Data acquisition

Place prepared sample into the sample holder of the FTIR spectrometer.

Acquire the infrared spectrum of the sample by initiating the measurement.

Typically, a range of wavenumbers from around 4000 to 400 cm^-1 is scanned.

Collect multiple scans to improve signal-to-noise ratio and ensure data accuracy.

4. Data Analysis

Process the collected spectrum using FTIR spectroscopy software provided with the instrument.[25]

Identify characteristic peaks corresponding to functional groups present in the formulation and its ingredients.

Compare the obtained spectrum with reference spectra of individual ingredients to assess compatibility.

Look for shifts, changes in peak intensity, or the appearance of new peaks, which may indicate chemical interactions or incompatibility between ingredients.

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5. Interpretation of the data

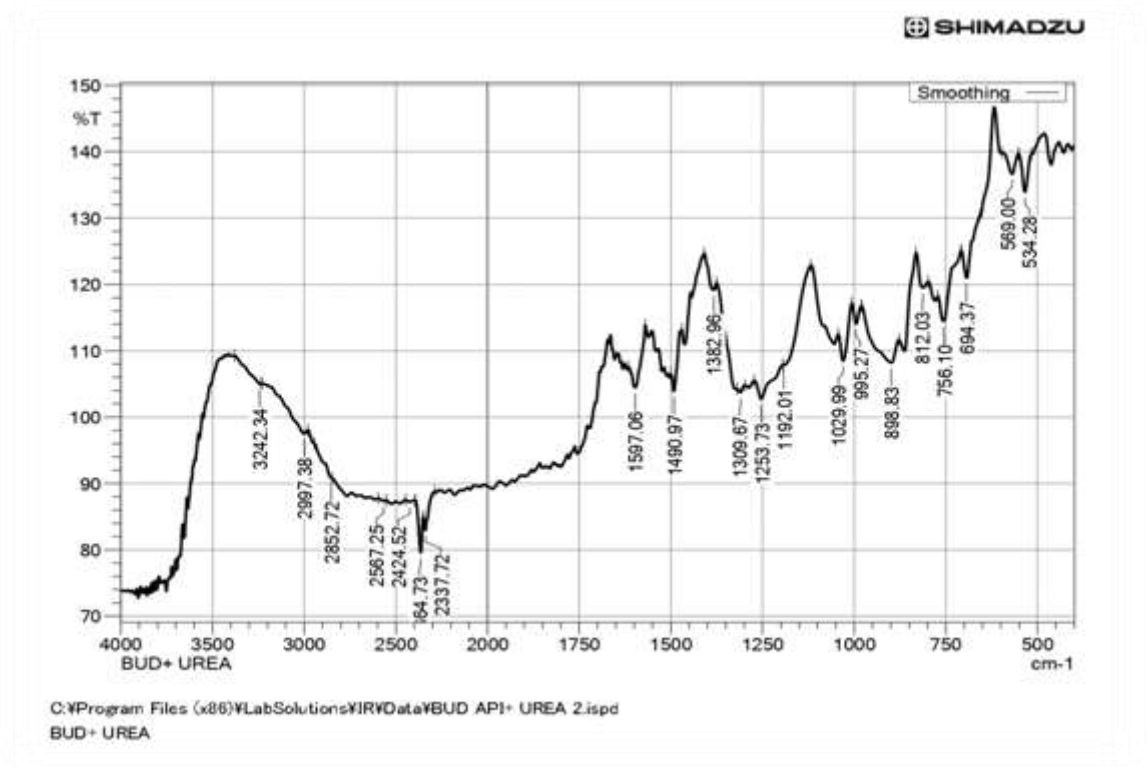

Figure 6: FTIR spectrum of Salicylic acid

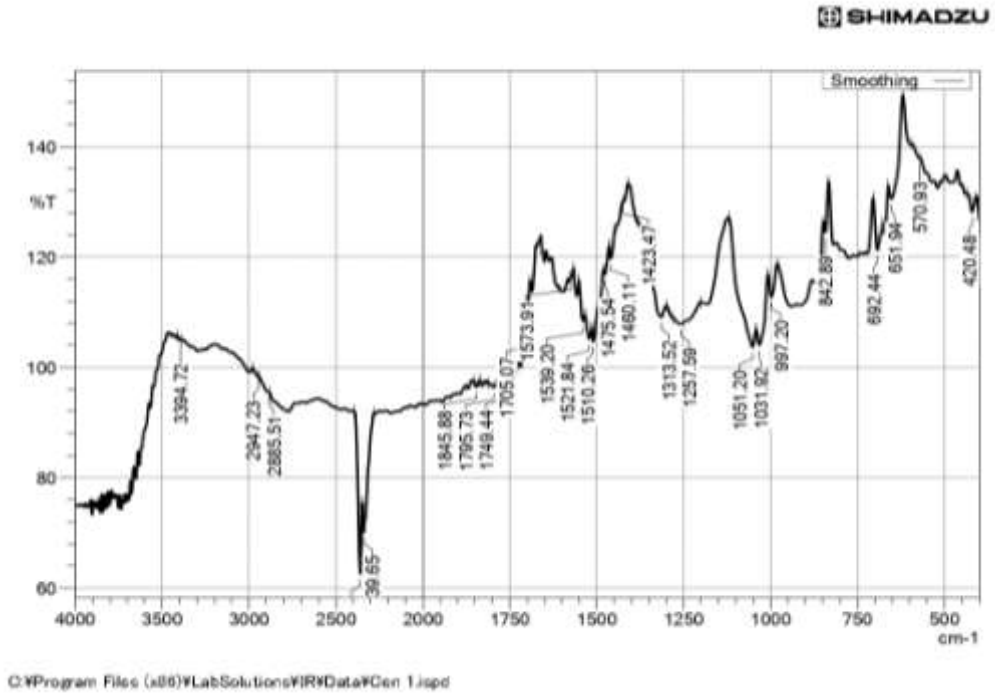

Figure no.7: FTIR spectrum of Centella asiatica

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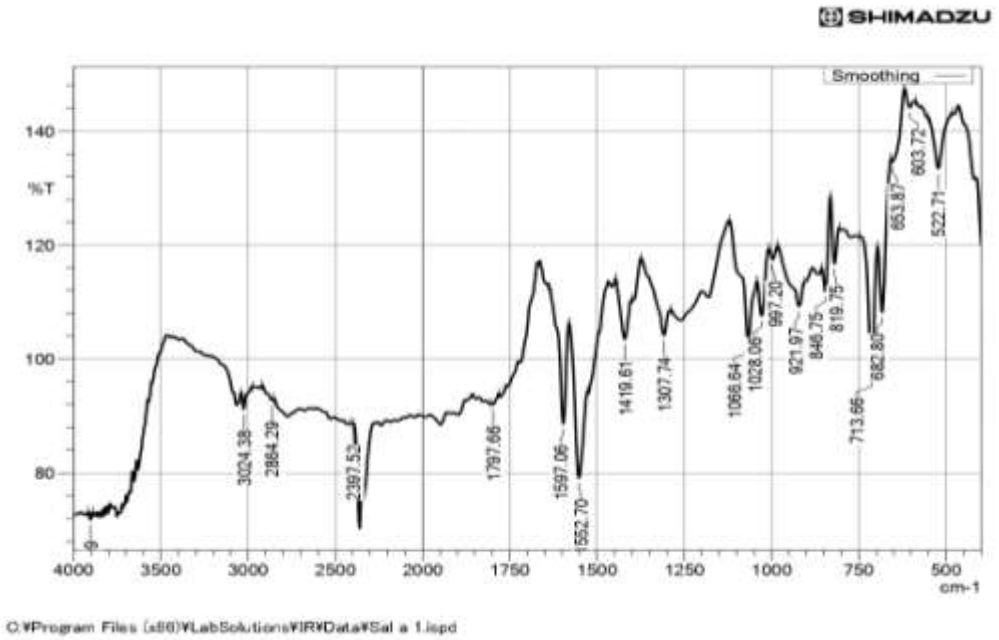

Figure 8: FTIR spectrum of sodium benzoate

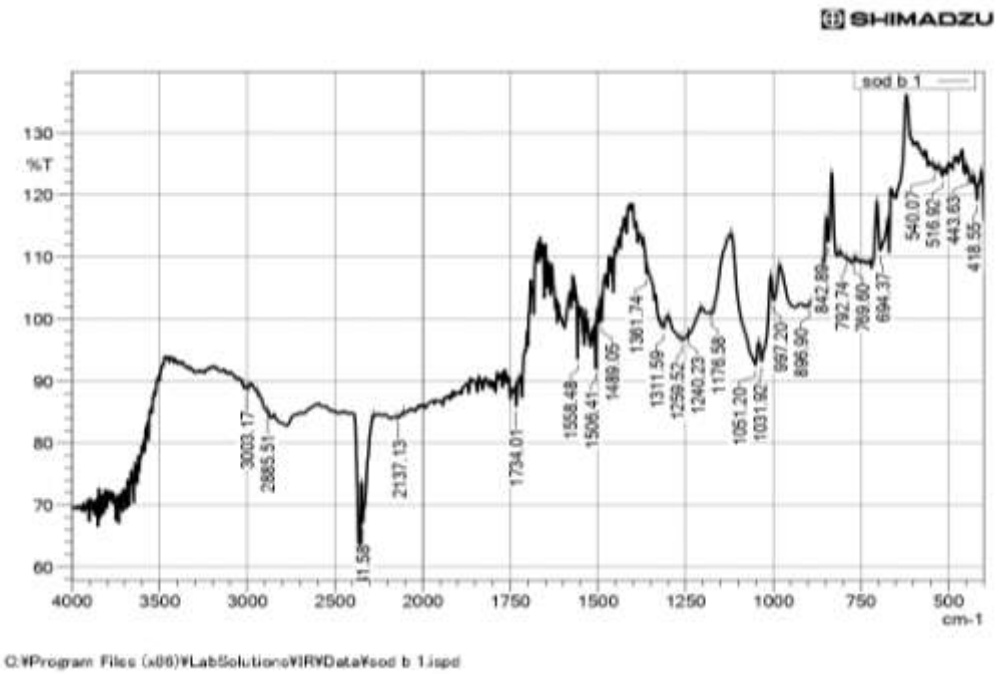

Figure 9: FTIR spectrum of xanthan gum

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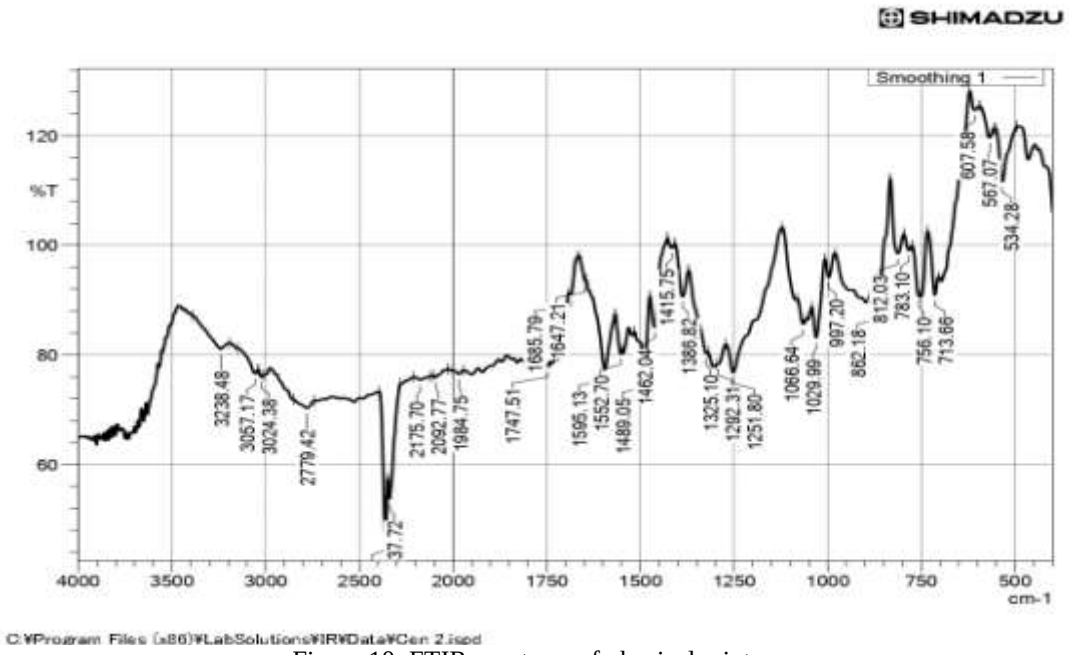

Figure 10: FTIR spectrum of physical mixture

Table no.3:

Sr. No.	Sample	Functional Group	Standard Absorption peak	Observational Absorption peak
1.	Salicylic acid	N-H stretch O-H stretch C=O stretch C-O stretch	3236.33 2592.5 2999 1612.69 1248.39	3242.34 2567.25 2997.38 1597.06 1253.73
2.	Sodium benzoate	N-H stretch	3028 1593 1551	3024 1597.70 1552.70
3.	Xanthan gum	C=O stretch C-O stretch	1737 1240 1036 1261	1734.01 1240.23 1031.92 1259.52
4.	Physical Mixture	N-H stretch O-H stretch C=O stretch C-O stretch	3236.33 2592.5 1741.88 1030	3240.41 2596.19 1735.93 1029.99

An intense and broad band exists between 2500-3300 cm $^{-1}$ which confirms the stretching of (OH^-) groups of polymeric constituents such as cellulose, pectin, hemicellulose, and lignin.The band that appears between 3100-3500 which shows stretching of (NH) amino groups . The band between 1550-1640 shows bending vibration of (NH) amino group. In addition, the band appearing at 1065-1068 signals the C-O stretching of ester, carboxylic groups. While the band between 1735-1750 and 1800-1830 which implies the presence of

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C=O group stretching ester, carboxylic and amide groups.
By comparison, the vibration bands of these two spectra remain unshifted, hence API and excipients are compatible with each other.

METHOD

◘ Step I: Make the ethanolic extract of the Centella asiatica [12]

- Preparation of plant material:

A dried Powdered extract of the Centella asiatica leaves was purchased from Manikarnika Aushadhalaya, Chinchwad, Pune.

- Maceration:

Take 500gm of the powdered extract of Centella asiatica in glass jar with lid.
Add >95% ethanol (Pure) and distilled water into the jar in the ratio of 4:6 respectively.
Seal the jar tightly with the lid and keep in the dark place for 3-4 days Shake the jar occasionally once or twice a day to agitate the mixture and facilitate the extraction process.

- Filtration:

After 3-4 days filter the mixture with the help of muslin cloth and separate the filtrate.

- Natural evaporation:

Keep the filtrate for the natural evaporation of the extract to form thick concentrated extract.

- Storage:

Store the extract into glass bottle in cool and dark place away from sunlight.

Figure 11: Ethanolic extract of Centella asiatica

◘ Step II: Weigh Ingredients

The ingredients specified above were precisely weighed with a digital balance.

Table no.4: **Composition:** concentration of ingredients of various Formulations.

Sr. No.	Ingredients	F1	F2	F3	F4	F5	F6
1	Salicylic Acid	0.6gm	0.6 gm	0.6gm	0.6gm	0.6gm	0.6gm
2	Centella asiatica Extract	1.5 ml	1.5 ml	1.5 ml	1.5 ml	1.5 ml	1.5 ml
3	Propylene glycol	3 ml	4.5 ml	4.5 ml	4.5 ml	3 ml	4.5 ml
4	Sodium benzoate	0.15 gm	0.15gm	0.15 gm	0.15 gm	0.15 gm	0.15 gm
5	Xanthan gum	0.1 gm	0.2 gm	0.3 gm	0.4 gm	0.5 gm	1 gm
6	Rose hydrosol	12.3 ml	11.5 ml	11.5 ml	11.5 ml	12.3 ml	11.5 ml
7	Distilled Water	12.3 ml	11.5 ml	11.5 ml	11.5 ml	12.3 ml	11.5 ml
	Total	30	30	30	30	30	30

◘ Step III: Dissolve active ingredients

Dissolve 2% salicylic acid in 15ml propylene glycol.

◘ **Step IV: Activation of xanthan gum**

Weigh the specified amount of xanthan gum as well as rose hydrosol and distilled water. Take a 100 ml of beaker and add distilled water and rose hydrosol in the ratio of 1:1. Add xanthan gum into the beaker and stir with the help of magnetic stirrer. Wait for the activation of xanthan gum.

◘ Step V: Addition of both the phases

Add the mixture of salicylic acid into the xanthan gum mixture and keep stirring to avoid the phase separation.

◘ Step VI: Addition of the preservative

While the mixing of two phases add preservative (Sodium Benzoate).

◘ Step VII: Storage

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Store the prepared face serum in the ambered colored bottle with dropper in cool and dry place away from sunlight.

EVALUATION PARAMETERS

1. Irritancy Test:

The prepared semi synthetic face serum was tested for irritancy. Table given below shows irritancy results.

Table no.9:

Sr. No.	Parameters	Observations
1.	Irritation	No
2.	Redness	No
3.	Swelling	No
4.	Photo irritation	No irritation in presence of sunlight

Before **After**

Result: NO irritation found after application of serum

2. Photo irritancy (in presence of light)

Before **After**

Result: NO irritation found in the presence of light on application of serum.

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3.Spreadability test: Batch 6serum is easily spreadable.
4.Viscosity:

Result: viscosity increases with increase in concentration of xanthan gum, and the batch 6found to be have perfect viscosity of 280.3 mPa.s

5.pH:

Result: pH test is found to be 4.97.

6.Microbial Contamination:

Before **Application of formulation** **After**

Result: NO microbial contamination found.

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7.Stability Studies:
Table given below shows the results of stability test.

Table no.10:

Sr. No.	Parameters	At room temperature	At 40°C
1.	Colour	cream	Cream
2.	Odour	Pleasant	Pleasant
3.	pH	4.97	5.05
4.	Texture	Smooth	Smooth

Result: It is found that with the exception of pH, no change in colour, aroma, texture or smoothness was noticed at the indicated stability conditions. The stability tests revealed a little variation in pH of a formulation.

8. Organoleptic Evaluation:

Table no.8: organoleptic evaluation of semi synthetic face serum.

Sr.No.	Parameters	B1	B2	B3	B4	B5	B6
1.	Appearance	watery	liquidy	thin	gelly	cloudy	optimum
2.	Colour	Yellow	Pale yellow	Pale yellow	cream	cream	cream
3.	Odour	unpleasant	unpleasant	Pleasant	pleasant	pleasant	pleasant
4.	Texture	smooth	smooth	smooth	smooth	smooth	smooth

RESULT:

Table no.11:

Sr. No.	Parameters	Observations
1.	Total ash value	80%
2.	Water soluble ash value	7.5%
3.	Acid soluble ash value	15.5%
4.	Alcohol soluble extractive value	52%
5.	Water soluble extractive value	36%
6.	Phytochemical tests of Centella asiatica	Flavonoid, saponin, qunins, glycosides found.
7.	FTIR Analysis	API and excipients are compatible with each other
8.	Appearance	cloudy
9.	Colour	cream
10.	Odour	pleasant
11.	Texture	smooth
12.	Irritancy Test	NO
13.	Photo irritancy test	NO
14.	Spreadability	Easily spreadable
15.	Viscosity	optimum
16.	pH	4.97
17.	Microbial contamination	NO
18.	Stability studies	stable

II. CONCLUSION

The formulation and evaluation of semi-synthetic face serum involve a systematic approach to develop a skincare product that offers both cosmetic and therapeutic benefits. By combining synthetic and natural ingredients, this serum aims to provide effective skincare solutions while ensuring safety and skin compatibility. Further research and development may be needed to optimize the formulation and address specific

skincare concerns. Face serum represents a valuable addition to skincare routines, offering targeted solutions for various skin concerns. Through a combination of potent ingredients and advanced formulation techniques, serums deliver noticeable improvements in skin health and appearance. However, it is crucial to select serums tailored to individual skin types and concerns and to follow proper application methods for optimal results

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