

Formulation And Evaluation of Anti-Bacterial Anti-Aging Herbal Face Serum

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Abstract-

Unwanted effects of UV exposure and photodamage include wrinkles on the face and aging skin. Serum is a deep formula that may enter deep layers of the skin, has a non-greasy finish, quick absorption, and a high concentration of active ingredients. The aim of the research was to create a serum by utilizing a polyherbal extract, taking into account these features. Aloe vera gel, bael fruit extract, and olive oil make up face serum, a highly concentrated cosmetic product. An extremely potent beauty product is a face serum made with olive oil, betel fruit extract, and aloe vera. Aloe vera serum's ability to absorb quickly and penetrate deeply results in both immediate cosmetic advantages and psychological gratification. Many skin conditions, sunburns, minor cuts, insect bites, and wound healing are commonly treated with aloe vera gel. It also has antifungal, antibacterial, and anti-inflammatory properties. Anti-inflammatory and antioxidant properties of fruit extract from bael. Phase separation, homogeneity, pH, and physiochemical characteristics of the facial serum were assessed. The stability research revealed that there was no change in the phase separation, homogeneity, or physical appearance.

Keywords: Herbal, Cosmetic, anti-aging, anti-inflammatory, anti-bacterial, face serum, formulation, Evaluation



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Introduction:

The examination of human skin is a crucial field for research and development in the fields of dermatology, toxicology, pharmacology, and cosmetology. This is because it allows for the evaluation of exogenous drugs' effects, interactions, absorption mechanisms, and/or toxicity towards various cutaneous structures.^[1] People have recognized the value of aesthetics from the dawn of time, and society has grown to value appearance as well as health. The term cosmetic originates from Greek and meaning "to adorn," as in adding something ornamental to a person or something. Studying and using aesthetic treatments is known as cosmetology. In addition to studying cosmetics and how they are applied, it is an art or science to enhance and beautify the skin, nails, and hair. To get the desired result, a skin care product has to be able to carry the potent ingredient into the skin. In order to transfer the valuable active ingredient into the skin and avoid using dangerous chemicals to get results right away, face serum is the solution.^[2]

Serums are skin care products with a moisturizing composition that have the ability to penetrate deeper into the skin and release active components. A good quality facial serum can give your skin a smoother, firmer texture, reduce pore size and increase moisture levels.^[3] All of these products - moisturizer, anti-wrinkle, anti-aging or face serum - should contain antioxidants.. a cell-interacting chemical and a skin-like component. These ingredients are essential for all skin types to achieve the healthiest complexion possible. Gel and liquid preparations are best for oily and combination skin; Serum and light cream are best for

normal and dry skin; and emollient creams and moisturizers are best for very dry/very dry skin. The components of healthy\great skin are the same for everyone, regardless of product, formula or personal taste.^[4] Texture depends on skin type. Although the largest and most protective organ of the body, the skin can sometimes appear due to a number of reasons, including exposure to UV rays, pollutants and makeup worn at night. you may have irritation or allergic reactions. Both aloe vera and bael fruit extract have distinctive antioxidant and antiaging compounds that can maintain a healthy and youthful appearance of skin. The leaf gel can be used topically to treat wounds, abrasions and burns, as well as itchy skin conditions such as psoriasis and shingles.^[5,6,7]

Aloe Vera polysaccharides have excellent moisturizing properties and together with essential oils create products that are perfect for sun protection and skin smoothing. Ayurveda recommends Aloe Vera for several skin problems due to its soothing and refreshing properties. The antibacterial and antifungal properties of Aloe Vera extract can also be useful in the treatment of minor skin diseases.^[8] The phenolic acid, marmelosin, from Aegle marmelos fruits has an excellent antioxidant quality.^[9,10]

The demand for cosmetic products has increased worldwide due to the cost of living. One of the most important financial resources is the cosmetics business in Malaysia. Cosmetics have become increasingly valuable as society's desire to look and feel young and attractive has grown. A skin care product known as a serum includes a gel, light moisturizer or lotion and has the ability to penetrate deep into the skin and deliver active ingredients. The right skin serum can provide your skin with elasticity, smooth texture, smaller looking pores and more moisture. All skin care products, be they moisturizers, anti-aging, anti-wrinkle or serums, should contain antioxidants, cell-derived compounds and skin-like components.

Damage to cellular DNA and proteins causes skin aging, which is a persistent process of degradation. The aging process can be classified into two different categories: photo aging and sequential skin aging. Each category possesses distinct clinical and historical attributes. A shift in the physiological functioning of the skin is the hallmark of sequential skin aging, a universal and predictable process.^[11]

In the field of cosmetics, serums are highly concentrated products. In professional cosmetology, the name originates from itself. Like other creams, the cosmetic serum is equally rich in both water and oil. A serum is a concentrated preparation with 10 times the amount of organic materials present in a cream. As a result, promptly and successfully addresses the cosmetic issue.^[12]

TOPICAL DRUG DELIVERY SYSTEM:

Topical drug delivery systems are a type of localized drug delivery system used to treat cutaneous disorders by delivering therapeutic chemicals via the skin. Usually, localized skin infections are treated with these methods. There are several forms of the formulas available, including solid, semisolid, and liquid. The skin plays a key role in improving medication absorption when the medicinal ingredient in the solution has a favorable lipid/water partition coefficient and is not an electrolyte. Although derma treatments come in a variety of formulations and consistency ranges, semisolid dosage forms are the most widely used type.^[13,16]

Advantages of topical drug delivery system:

1. avoiding the metabolism of main passes
2. Easy to apply and very convenient to use.
3. Simple way to stop taking the drugs.
4. medication sent at a certain location with preference.
5. There will be no gastrointestinal incompatibility.
6. offers a limited therapeutic window and a short biological half-life for medication use.
7. Enhanced adherence from patients.
8. Self-care with medicines.
9. It offers efficacy at low dosages and with continuous medication administration.
10. Reduces the chance of medication level and danger fluctuations.^[14,15,16]

HISTORY OF FACE SERUM:

The origins of herbal facial serums may be traced back hundreds of years, to the eras of ancient Egypt, Greece, and China. These cultures employed oils and extracts from plants as skincare products. For example, oils like olive, almond, and sesame were widely used to moisturize and preserve skin in ancient

Egypt. Herbal remedies with anti-inflammatory and antioxidant qualities, such as ginseng and green tea, were popular in China. Herbal medicines developed over time and were included into beauty rituals of many civilizations. As consumers look for natural alternatives to synthetic skincare products, the popularity of herbal face serums has increased in the modern day. These formulas frequently contain substances like rosehip oil, jojoba oil, and essential oils recognized for their nourishing and revitalizing benefits on the skin.

Ideal Qualities of Face Serum

1. Calms inflamed skin: Aloe vera is widely recognized for its antiviral and cell-regenerating properties. Aloe vera benefits are similar to how sunburn relief feels when applied topically.
2. Deep hydration: able to specifically increase and lower skin hydration levels.
3. Fight acne and reduce blemishes: The main cause of acne and pimples is bacterial overgrowth, which is stopped by bael fruit.
4. Eliminate puffiness and dark circles:
 - It lessens the visibility of under-eye circles.
 - Eliminating dead skin cells promotes the production of collagen.
5. Antioxidant properties included in it promote skin that seems healthy.^[17]

Advantages of herbal face serum:

- enhances the suppleness
- hydration
- nutrition of the skin while minimizing pores
- improving texture.^[17]

TYPE OF FACE SERUM^[2,17,18]

1. The Oil Serum:

Figure 1: The oil serum



Out of all the face serums, making the oil serum is the easiest. A base consisting solely of high-quality, quickly absorbing carrier oils—also known as "dry" oils—is frequently used first. The premium oils included in the serum contain polyphenols, essential fatty acids, and other ingredients that the skin may be able to break down in addition to their moisturizing and barrier-repairing properties.

1. The Gel Serum:

Figure 2: The Gel Serum



Gel serums provide the skin a "tightening" feeling that makes your customer feel as though their skin has been temporarily lifted or tightened in specific facial areas. Because this gel serum formulation is water-based, it gives you the opportunity to incorporate some amazing water-based (hydrophilic) plant extracts.

2. The Water based Serum:



Figure 3: The water Based Serum

While water-based serums may include very little or no gums and thickeners, they are similar to gel serums in other aspects. You would apply a face serum with a water basis to deliver high-performance hydrophilic plant extracts that are trapped against the skin beneath a cream or lotion. An anti-aging face mist applied first under an emulsion and then under an oil is the best way to encourage water-based compounds to penetrate the skin more deeply and deliver their high-performance components. In order to facilitate more component penetration, the oils will create an occlusive barrier.

3. The Emulsion Serum:**Figure 4: The Emulsion Serum**

A face serum with emulsion base is a moisturizing product that delivers high-performance ingredients to the skin and fortifies the skin's barrier function. An emulsion consists of two "immiscible" phases—phases such as water and oil—that do not want to mix. Oil and water are combined and kept in a stable form by the application of an emulsifier. By using an emulsion, you have the highest opportunity of getting potent active ingredients deeply into the skin's tissues. An oil and water mixture is the most appropriate for achieving this amazing accomplishment, even though it is extremely difficult for any cosmetic component to penetrate the dermis due to the skin's barrier function. The hydrating properties of the emulsion will reinforce the skin's barrier function.

4. The Pressed balm Serum:**Figure 5: The Pressed balm Serum**

In addition to the traditional balm base of oils, butters, and waxes, a balm serum contains active ingredients that are lipophilic (oil-soluble) and may benefit the skin. The butters and waxes create an occlusive barrier on the face, nourishing and moisturizing it as the active ingredients in the pressed serum are able to work. Thousands of fine plant oils can be blended with hundreds of interesting, one-of-a-kind butters and waxes to create a balm serum.

Drug and Excipients profile**ALOE VERA:**



Figure 6: Aloe vera

- **Kingdom:** Plantae
- **Order :** Asparagales
- **Family:** Asphodelaceae
- **Subfamily:** Asphodeloideae
- **Genus:** Aloe
- **Species:** Aloe vera
- **Botanical name:** Aloe barbadensis miller

Vernacular name

- **English:** India aloe.
- **Hindi:** Ghrith kumara, Gwarpatha^[19]

Chemical Constituents:

Aloe vera's skincare benefits come from its polysaccharides for hydration, vitamins C and E for antioxidant protection, enzymes for exfoliation, anthraquinones for anti-inflammatory properties, and amino acids for collagen support.

Blisters and Scratching:

Aloe Vera also eases itching and promotes the healing of wounds. Aloe vera contains vitamins B1, B2, B6, B12, and C, all of which contribute to the pleasant and relaxing sensation on the skin.^[20,21]

Ageing Face

Aloe Vera stimulates the synthesis of collagen and elastin. Stopping the deterioration of the epidermis requires these proteins.^[22,23]

Acne Aloe Vera minimizes the severity of acne and has chemical components that can stop pimples from appearing on the face. It also functions as an immunological stimulant and an anti-inflammatory to help get rid of acne marks.^[24]

Freshness:

Aloe Vera exudes a fresh vibe. It contributes to increased blood flow, which nourishes and simplifies the exchange of oxygen throughout cells.^[25]

Sun-burns:

Aloe Vera is incredibly effective in reducing sunburn discomfort. It is applied to the skin right away because of this. Aloe Vera products made after sun exposure or the plant's fresh juice can be used to cure sunburns.^[26,27]

AEGLE MARMELOS FRUIT:

Figure7: Aegle marmelos fruit

- **Kingdom:**Plantae.
- **Order:**Sapindales.
- **Family:**Rutaceae.
- **Subfamily:**Aurantioideae.
- **Genus:**Aegle Marmelos.
- **Botanical name:**Aegle Marmelos.

Vernacular names

- **English:**Beal fruit,Golden apple.
- **Hindi:**Bel,Bili.
- **Sanskrit:**Bilva,Adharautha.

Chemical Constituents:

Aegle marmelos, or Bael, contains essential oils with antimicrobial properties, flavonoids for antioxidant benefits, alkaloids for anti-inflammatory effects, tannins for astringency, and vitamins/minerals for overall skin health.

Treats Skin Rash:

The bael plant is a great treatment for skin abnormalities because it has anti-bacterial, anti-fungal, and anti-inflammatory qualities. Bael oil and bael leaf extracts eliminate dangerous fungi that can result in minor to serious skin infections. The treatment of skin rashes and itchy skin bumps might also be advantageous.

Reduces Skin Inflammation:

Bael's natural and moderate astringent characteristics are found in its root, bark, leaves, and fruits, which also include anti-inflammatory, antibacterial, antiviral, and antifungal properties. With all of these powerful qualities, this magnificent fruit balances an unbalanced pitta dosha and reduces skin swelling.

Increases the Production of Collagen:

Bael juice contains a lot of vitamin C and strong antioxidants that aid in the body's defence against free radicals. This enhances collagen formation, which ages the skin as we get older by reducing the signs of oxidative stress in the body ^[28,29]

TURMERIC:



Figure 8: Turmeric

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Liliopsida
- **Subclass:** Zingiberidae
- **Family:** Zingiberaceae
- **Genus:** Curcuma
- **Species:** C. longa
- **Botanical Name:** Curcuma longa

Vernacular names:

- **English:** Indian saffron,
- **Hindi:** haldi,
- **Sanskrit:** haridra

Chemical Constituents:

Turmeric's skincare benefits come from its active compound curcumin, which has antioxidant and anti-inflammatory properties. It helps brighten the skin, reduce acne, calm redness, and promote a more even skin tone.

Biological Source: Turmeric consists of dried as well as, fresh rhizomes of the plant *Curcuma longa*
Geographical source-Native to southern India and Indonesia, turmeric is widely cultivated on the mainland and in the islands of the Indian Ocean^[30,31]

ROSE WATER:



Figure 9: Rose water

Rose water is said to be a natural skin toner due to this amazing pH- balancing properties.

The primary phytoconstituents of rose water include flavonoids, triterpenoids, tannins, and polyphenolic chemicals. These constituents are primarily accountable for the anti-inflammatory and antioxidant effects of the water.^[32]

SANDALWOOD OIL



Figure 10: Sandalwood oil

Chemical Constituents:

Sandalwood oil contains chemical constituents such as α -santalol and β -santalol, which have anti-inflammatory and antimicrobial properties. It also contains sesquiterpenes, which contribute to its soothing and calming effects on the skin, making it beneficial for acne-prone or irritated skin.

Sandalwood oil is important in the perfume business because of its strong, sweet scent. The fragrant heartwood of *Santalum album*, which is mostly composed of sesquiterpenes, is steam-distilled to produce Indian sandalwood oil, an essential oil. The oil is well-known for its scent, which is woody, warm, and delicate. Owing to its smell, the oil has been used in many different products, including incense, attars, and perfumery. Throughout history, sandalwood oil has been used to culinary goods, cosmetics, and pharmaceuticals for a variety of uses. Nowadays, its benefits for wrinkly skin are becoming more widely acknowledged.^[33]

HONEY

Figure 11: Honey**Chemical Constituents:**

Honey contains natural sugars for hydration, antioxidants for protection, enzymes for exfoliation, amino acids for skin repair, and antimicrobial properties, all beneficial for skincare.

Uses:

- Brightens skin
- Promotes healing
- May aid in various skin conditions
- Excellent moisturizer
- Antibacterial
- Scalp cleanser

Honey kills germs since it is an antibacterial substance. Honey may be very hydrating and helps prevent bacterial infections. It reduces pores, combats germs, and maintains the youthful smoothness of your skin.^[34]

ASHWAGANDHA:**Figure 12: Ashwagandha**

- **Kingdom:** Plantae
- **Order:** Solanales
- **Family:** Solanaceae
- **Genus:** Withania
- **Species:** *W. somnifera*

Chemical Constituents:

Ashwagandha contains chemical constituents such as withanolides, alkaloids, and steroidal lactones. its antioxidant and anti-inflammatory properties indirectly support skin health.

Table 1: Ingredients and Category

Sr.no.	Ingredients	Category
1	Aloe vera	Anti-aging
2	Aegle Marmelos Fruit	Anti-oxidant, Anti-bacterial
3	Turmeric	anti-inflammatory
4	Rose water	Moisterizer and Toner(skin hydrate)
5	Sandalwood oil	Anti-microbial and for fregreance
6	Honey	Emulsifying and Brightening agent
7	Ashwagandha	Anti-oxidant

EXTRACTION OF AEGLE MARMELOS:

- To remove the contaminants, the mature fruits were gathered and given a complete water wash. The fruits were broken down into tiny bits and dried for a week in the shadow. The dried material was then ground into a coarse powder with a motorised blender.

Figure 13: Extraction of drugs



- Then aegle marmelos was extracted with ethanol by maceration process 10gm of above stated powder was taken in closed tight container and extracted with 100 ml ethanol for 24 hours
- Then filterd it out^[35]

Figure 14: Filtration



Preparation of Face Serum

- The emulsion (o/w) was prepared according to formula.
- The oily component is mixed together for 10 minutes in mortar pestle to obtain uniform solution.
- At the same time the water phase was prepared by mixing uniformly.
- Drop by drop, while continuously titrating, the oil phase is introduced to the water phase.
- The oil phase is added to the liquid phase by drop wise under mechanical vibration at 2500 rpm to obtain oil in water based on biphasic emulsion.



Figure 15: Water and Oil Phase



Figure 16: Final formulation

FORMULATION TABLE:

Table 2: Formulation table

Sr. No.	Ingrident	Formulation
1	Ashwagandha	3
2	Aegle marmelos	8
3	Turmeric	6
4	Aloe Vera	30
5	Honey	14
6	Rose water	10
7	Sandalwood oil	4

Evaluation Of face serum

1. Physical Evaluation

A.Colour and Appearance

Visual observations were made of the face serum's hue and look, which was light brown.

B.Odour

By applying preparation to the hand, the scent of the formulation was tested to ensure that it had a characteristic odor.

C.Consistency

Visual inspection revealed that the consistency of face serum was smooth and semi-liquid.

D.Homogeneity and Texture

An uniform distribution of the extracted material was used in the formulation.The lack of any particle matter and the product's tactile consistency served as visual cues that the preparation was homogeneous.

2. Washability

In order to determine if the formulation was easily washable, a tiny amount of the formulation was applied to the hand and then washed with tap water.

3. Phase separation

The prepared product was stored out of direct sunlight in a closed container at room temperature, between 25 and 1000C.Following a 24-hour period, phase separation was examined. The phase separation did not appear to change at all.

4. Irritancy



Figure 17: Irritancy Test

The region was treated with the serum, and the time was recorded. After that, it is observed for up to 24 hours to see whether there is any edema, erythema, or irritation before being reported. The formulation did not exhibit any erythema, edema, or irritation, according to the results.

5. Cyclical Temperature Test

These test is not carried out at any fixed temperature and humidity. In this test ,temperature was changed cyclically every day. At room temperature and frizzing temperature to stimulates the change in temperature

6. PH

pH of is evaluated by pH paper. The skin has an acidic range and the pH of the skin serum should be in the range of 4.1-6.7.The pH of formulation was found to be 5

7. Antimicrobial activity and Antifungal study

Zone of Inhibition Method was used to determine the antibacterial activity of the test substance. Bacillus subtilis NCIM 2063, Staphylococcus aureus NCIM 2079, Escherichia coli NCIM 2065, Proteus vulgaris NCIM 2813, Aspergillus niger NCIM 501, and Candida albicans NCIM 3471 were each cultured individually for 24 hours. We created sterile Nutrient agar plates for bacterial cultures and sterile

Chloramphenicol Yeast Glucose Agar plates for fungus cultures. A 0.2 ml culture of each type of microorganism was dispersed on various plates using sterile swabs. Four or five wells in the agar were created using an 8.0 mm cork borer on each plate. As a stock solution, a 10 mg/ml suspension of the test substance was produced in Dimethyl Sulfoxide (DMSO). Each well received 50µg/ml of the stock solution.

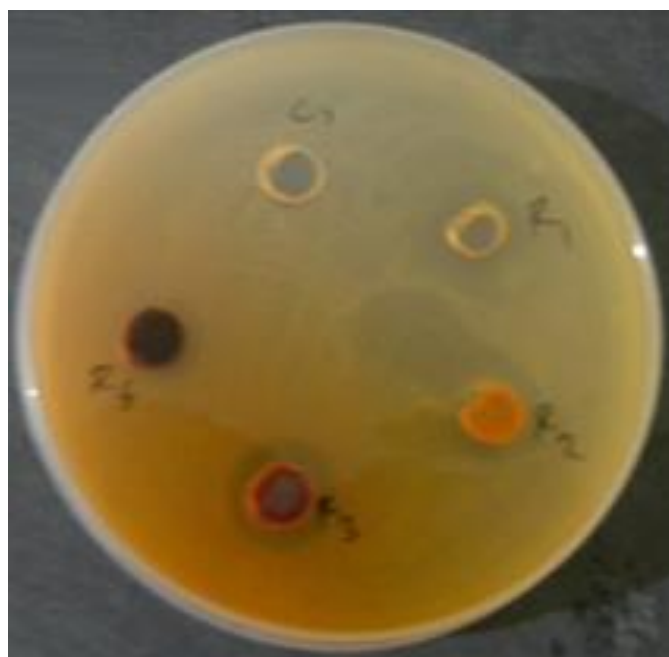
Sample Coding:

R3-Herbal Face Serum

Table 3: Antibacterial activity in terms of Zone of inhibition in mm.

Sample ID	Conc. of Stock solution	Zone of inhibition in mm					
		<i>Bacillus subtilis</i> NCIM 2063	<i>Staphylococcus aureus</i> NCIM 2079	<i>Escherichia coli</i> NCIM 2065	<i>Proteus vulgaris</i> NCIM 2813	<i>Aspergillus niger</i> NCIM 501	<i>Candida albicans</i> NCIM 3471
R3	10µg/ml	13	21	12	5	26	7
Amoxicillin	0.5mg/ml	19	33	14	11	N.D.	N.D.
Fluconazole		N.D.	N.D.	N.D.	N.D.	34	29

Figure 18. Zone of Inhibition against *Bacillus subtilis*



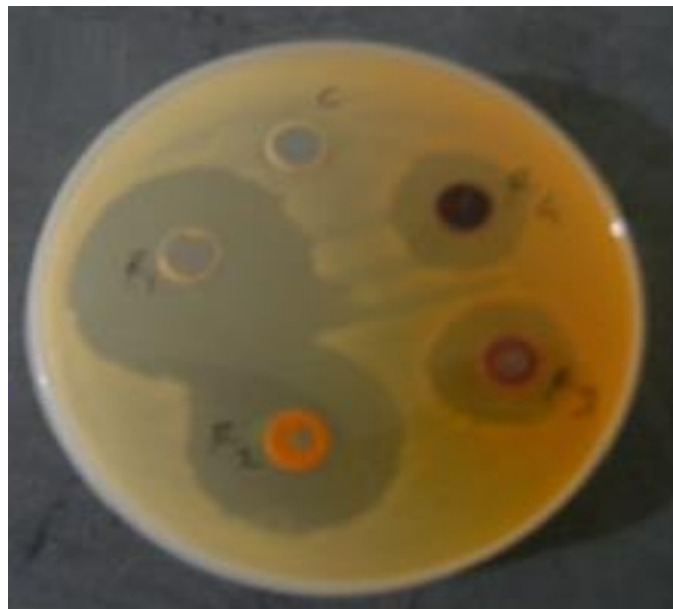


Figure 19. Zone of Inhibition against *Staphylococcus aureus*

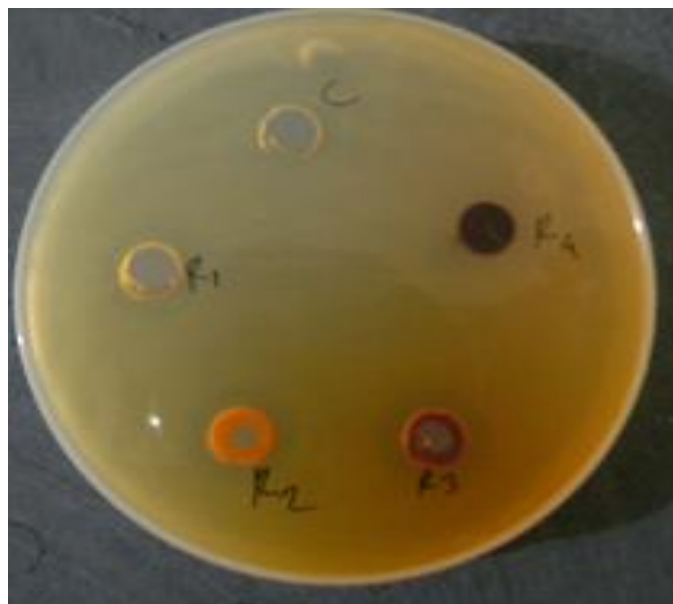


Figure 20. Zone of Inhibition against *Escherichia coli*



Figure 21. Zone of Inhibition against *Proteus vulgaris*



Figure 22. Zone of Inhibition against *Aspergillus niger*

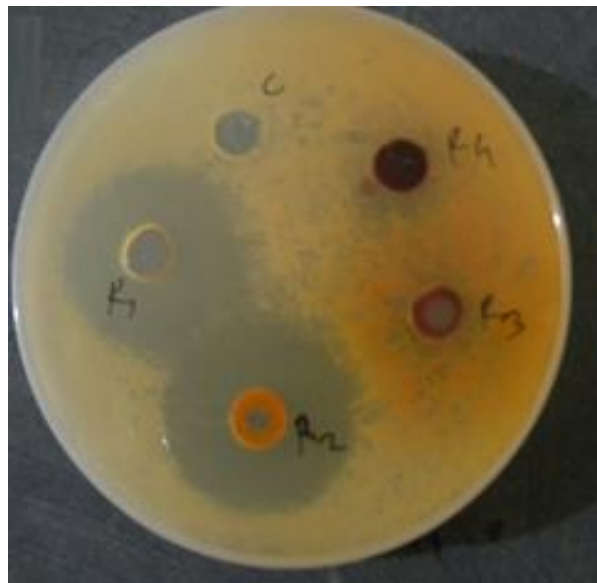


Figure 23. Zone of Inhibition against *Candida albicans*

RESULTS:

1. Sample R3 showing very moderate activity against *Bacillus subtilis*.
2. Sample R3 showing Good activity against *Staphylococcus aureus*.
3. Sample R3 showing moderate activity against *Escherichia coli*.
4. Sample R3 showing very less activity against *Proteus vulgaris*.
5. Sample R3 showing good activity against *Aspergillus niger*.
6. Sample R3 showing very less activity against *Candida albicans*.

CONCLUSION:

The objective of the research was to develop a serum that would improve facial skin's radiance. The essential elements of the serum include aloe vera, bael fruit extract, and oil. For acne, pimples, and other skin conditions, as well as burns from heat and sun exposure and radiation dermatitis, aloe vera gel from the inner center section of the leaf often works wonders. In order to preserve youthful, healthy skin, aloe vera is an excellent source of vitamins and minerals that have significant moisturizing ability. Antioxidants are another feature of bael fruit. The pH was found to be excellent. It removed easily and didn't leave any trace. In addition to encouraging cell growth, the gel helps mend damaged skin on its own. Thus, this serum will be utilized to treat skin-related conditions.

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