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Development And Characterization Of Herbal Serum For Skin Care Applications

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The growing interest in natural and herbal based skincare products has prompted the development of a novel herbal serum for skin care applications. The serum is formulated with plant-based ingredients known for their skin benefits, such as anti-aging, moisturizing, anti-inflammatory, and antioxidant properties. This study aims to develop and characterize herbal serum, evaluate its effectiveness, and assess its potential in skincare applications, focusing on its composition, stability, safety, and efficacy. The serum exhibited desirable physical and chemical properties, including a skin-compatible pH, smooth texture, and adequate viscosity for topical application. Antioxidant and antimicrobial evaluations indicated significant activity, supporting the protective and restorative potential of the formulation. The stability studies confirmed that the serum maintained its integrity and effectiveness over time without signs of phase separation or degradation.

Keywords: Banana root extract, Papaya leaves extract, orange peel, Aloe Vera gel, Honey, Rose oil.

1. INTRODUCTION

1.1 Serum

Natural products have served as a major source of drugs for centuries, and about half of the pharmaceuticals in use today are derived from natural products. Demand for cosmetics increases day by day & numerous people use them regularly. Herbal cosmetics are substantially used because they've lower negative effect & give further safe loss problem finding ways to enhance their development can help improve their effectiveness and address common issues. Our traditional knowledge about the use of factory wealth as described in Ayurveda, Siddha, Umami, and Tibetan system of drug, is of great help to identify the phytochemicals for skin and body care medications. Serum is thin viscosity topical products that contain concentrated amount of active ingredients. 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. Whether it is a moisturizing, anti- aging or anti-wrinkle product or serum for skin, all of these products should contain antioxidants, cell- based ingredients and skin- like ingredients.

Benefits of Herbal Serum

1. Minimizes the skin pores.
2. Hydrates and nourishes the skin.
3. Improve skin elasticity.
4. Improve skin texture.

1.2 Skin Anatomy & Physiology

Skin is the largest organ of the human body, playing a crucial role in protecting internal structures, regulating temperature, and providing sensory information. Composed of three primary layers epidermis, dermis, and sub cutis skin serves as a barrier against environmental hazards such as pathogens, UV radiation, & dehydration. The epidermis is the outermost layer, primarily made up of keratinocytes, which provide strength and protection. The dermis, located beneath the epidermis, contains connective tissue, blood vessels, and nerve endings, contributing to skin elasticity and sensation. The sub cutis, or hypodermis, is composed of fat and connective tissue, aiding in insulation and shock absorption.

Functions of Skin

1. Regulates body temperature.
2. Stores water and fat.
3. Skin is a sensory organ.
4. Prevents water loss.
5. Prevents entry of bacteria Acts as a barrier between the organism and its environment. Your skin takes on different thickness, color, and texture all over your body. For example, your head contains more hair follicles than anywhere else. But the soles of your feet have none. In addition, the soles of your feet and the palms of your hands are much thicker than skin on other areas of your body.

- **Skin layers**

a) Epidermis
b) Dermis
c) Subcutaneous fat layer (hypodermis)

- **Various Common Skin Diseases**

a) Skin Dryness
b) Acne
c) Skin Redness
d) Skin Burning
e) Skin Tanning (1)

2. PLANTS PROFILE

2.1 Banana Root

Bananas are one of the few fruits that ulcer patients can safely consume. Bananas neutralize the acidity of gastric juices, thereby reducing ulcer irritation by coating the lining of the

stomach. Not only can bananas relieve painful ulcer systems, and other intestinal disorders, they can also promote healing.
The fruit is also used as treatment for burns and wounds. For immediate pain relief, beat a ripe banana into a paste and spread it over a burn or wound. For best results, cover the area with a cloth bandage. Even banana leaves can be used as a cool compress for burns or wounds. Other medical benefits of bananas include aiding in constipation and diarrhea relief, treatment of arthritis, treatment of anemia.
Biological Name: Musa paradisiaca linn.
Biological Source: Banana roots are obtained from the banana plant (Musa spp), which is type of fruit bearing plant that belongs to the family Musaceae.
Synonym: Banana plant, Kanaha Beach.
Family: Musaceae.
Morphological Feature: Bananas have a fibrous root system, which develops from the base of the pseudo stem, the roots spreads widely but are usually found within 30-60 cm of soil depth. Uses: Phenols and other polyphenols, including tannins, contribute to the antioxidant properties. (2)

2.2 Orange

Plant is a living thing that grows in earth, in water, or on other plants, usually has a stem, leaves, roots, and flowers, and produces seeds. In terms of volume in production, with more than 108 million tons. Citrus ranks after banana as the world second fruit crop. Oranges are economically important fruit crops. With white flowers, it grows as a tree. For fruit to grow from seed it takes about six years. The human diet contains important micronutrients namely vitamins C and E, carotenoids and flavonoids, essential for maintenance of human health. Citrus fruits are main source of important phytochemical nutrients and for long have been valued for their wholesome nutritious and antioxidant properties. Oranges are also rich in iron, chlorine, manganese, zinc, sodium, phosphorous, iodine, calcium, folic acid, potassium, beta-carotene, amino acids, pectin and fiber. A single orange has about 170 phytonutrients and over 60 flavonoids with anti-tumor, anti-inflammatory, blood clot inhibiting and antioxidant properties.
Biological Name: Citrus sinensis.
Biological Source: Orange peel is obtained from the orange fruit (Citrus sinensis), which is a type of citrus fruit that belongs to the family Rutaceous.
Family: rutaceous.
Morphological Features: It is an outer protective layer of the orange fruit (Citrus sinensis) consist of two-layer exocarp and mesocarp, thickness varies from 2-5 cm. Texture of peels is slightly rough and dimpled due to the presence of oil glands. (9)
Uses: Phenolic compounds including coumarins and phenolic acids, which have antioxidant and anti-inflammatory properties. Orange peels contain Vitamin C (Ascorbic Acid) which helps in collagen production, skin brightening, and reducing dark spots.

2.3 Papaya

Papaya is a powerhouse of nutrients and is available throughout the year. It is a rich source of threes powerful antioxidant vitamin C, vitamin A and vitamin E; the minerals, magnesium and potassium; the B vitamin pantothenic acid and folate and fiber. The skin of papaya works

as a best medicine for wounds. Even you can use the pulp left after extracting the juice from papaya as poultice on the wounds. The enzymes papain and chymopapain and antioxidant nutrients found in papaya have been found helpful in lowering inflammation and healing burns.
Biological Name: Carica papaya.
Biological Source: The biological source of papaya is Carica papaya, a tropical fruit-bearing plant in the family Caricaceae.
Family: Caricaceae. Uses Protects, sooth and moisturizing the skin
Use for pimples,
Skin irritant, bactericidal, fungicidal. (7)

2.4 Aloe Vera

The scientific name for Aloe Vera is Aloe barbadensis miller. It is an annual plant that resembles a shrub or tree and is xerophytes, succulent, and pea green. The leaves of the aloe plant are long and triangular, and they are quite juicy. The maximum length and width of these and leaves are 20 5 inches, respectively. When it comes to maintaining good skin, Aloe Vera is widely believed to be one of the oldest plants utilized by humans. According to research, this plant has been utilized in herbal medicine since the first century AD. Research has shown that Aloe Vera (AV) gel possesses soothing properties that can be beneficial for various skin issues, including cuts, burns, bug bites, and inflammation. Important for healing wounds because of its
Anti-inflammatory, antiseptic, antibacterial, anti-tumor, skin-protecting, anti-diabetic, Aloe Vera has both antibacterial and antiviral properties.
Biological Name: Aloe barbadensis miller.
Biological source: Aloe is the dried juice collected by incision, from the bases of the leaves of various species of Aloe. Aloe Perry Baker, Aloe Vera Linn or Aloe barbadensis Mil and Aloe ferox Miller.
Family: Liliaceae.
Morphological Features: It is succulent plant, leaves are thick and fleshy, and it grows up to 60-100 cm long height, green in color.
Phytoconstituents: All the varieties of aloe are major sources of anthraquinone glycosides. The principal active constituent of aloe is aloin, which is a mixture of glycosides, among which barbaloin is the chief constituent.
Uses: Soothes Burns, heals Wounds, Eye irritations and injuries and also Aloe Vera supports wound healing by promoting moisture retention, enhancing cell movement, boosting collagen production, and reducing inflammation. (5)

2.5 Honey

Honey is utilized for its various health benefits, including its anti-inflammatory, antioxidant, and antibacterial properties. Honey helps retain moisture in the skin's deeper layers, promoting a healthy and youthful appearance.
Biological Name: Apis mellifera, Apis indica.
Biological Source: Honey is produced by various species of honeybees (Apis mellifera, Apis indica, etc.) from the nectar of flowers.
Family: Apidae.

Morphological Features: Color ranges from light golden to dark amber, depending on the nectar source. Texture is viscous and smooth, can be liquid or crystallized. Taste is sweet, with flavor variations depending on the nectar source.
Phytoconstituents: Carbohydrates (Fructose 30-40%, Glucose 20-30%), water (14-20%) Uses: Sweetener, energy source, wound healing, skincare, hair care.

3. PLAN OF WORK

Development and Characterization of Herbal Serum for Skin Care Applications

- Selection of plant: easily available in native area.
- Collection: collected from botanical garden.
- Authentication: The collected plant material will be authenticated by a qualified botanist or at a recognized institution such as a university department of botany. The collected Aloe vera sample will be authenticated at the Dadasaheb Dr. Suresh G. Patil College, Chopda, Department of Botany, by Prof. Dr. R. M. Bagul and a voucher specimen will be submitted.

- **Extraction**

- **Extraction of Banana Root:** First, collect the banana root and wash it thoroughly using distilled water. Then, cut the banana root into small pieces. The Soxhlet extraction method is used for extracting compounds from the banana root. Set up a Soxhlet extractor and use ethanol as the solvent. Apply heat using a heating mantle to facilitate the extraction process. After extraction, filter the extracted material and evaporate the solvent to obtain the final extracted compound.[2]

Fig. No. 1: Banana Root

- **Extraction of Orange Peel:** Water or hydro-distillation is one of the oldest and simplest methods of extraction. The distillation setup consists of a distillation flask, a basket heater, a horizontal condenser, and a conical flask. Approximately 45 g of orange peel powder is weighed using a digital weighing balance and transferred into a round-bottom flask. A sufficient amount of water is added to completely cover the peels. The flask is then

connected to the still column, which is further connected to the condenser. Heat is supplied to the distillation unit using a temperature-controlled basket heater. The experiment is conducted at different temperatures and time periods. The distillate is collected in a conical flask and forms two layers: a dense layer and a less dense layer. These layers are then separated using a separating funnel.

Fig. No. 02: Orange Peel Extract

- **Extraction of Papaya Leaf:** The Soxhlet extraction method is a widely used technique for extracting compounds from plant material, including papaya leaves.

Process

1. Preparation of Papaya Leaf: Thoroughly dry the papaya leaves, either by air drying in the shade or using a dehydrator. Grind the dried leaves into a fine powder to increase the surface area for extraction.
2. Setup of Soxhlet Apparatus: Place the powdered papaya leaf material into a Soxhlet thimble (a small cylindrical container). Insert the thimble into the Soxhlet extractor. Pour an appropriate solvent (e.g., ethanol) into the extraction flask, ensuring that there is enough solvent to cover the plant material during extraction. Connect the condenser to the Soxhlet apparatus to allow the vaporized solvent to condense and return to the flask.
3. Extraction Process: Heat the solvent in the extraction flask using a heating mantle or water bath, causing it to evaporate and rise into the condenser. The vaporized solvent condenses back into liquid form and drips onto the papaya leaf material in the thimble. As the solvent passes through the leaf material, it dissolves the soluble compounds. Once the solvent reaches a certain level in the extractor, it returns to the flask, and the process repeats. This continuous extraction is typically carried out for several hours (usually 4–6 hours or longer).
4. Completion of Extraction: After sufficient extraction, turn off the Soxhlet apparatus and remove the solvent from the system. The extract in the flask contains the dissolved compounds from the papaya leaves.
5. Post-Extraction Process: Use a rotary evaporator or other suitable methods to remove

the solvent from the extract if necessary. The remaining concentrated extract can be used for further analysis or research.[7]

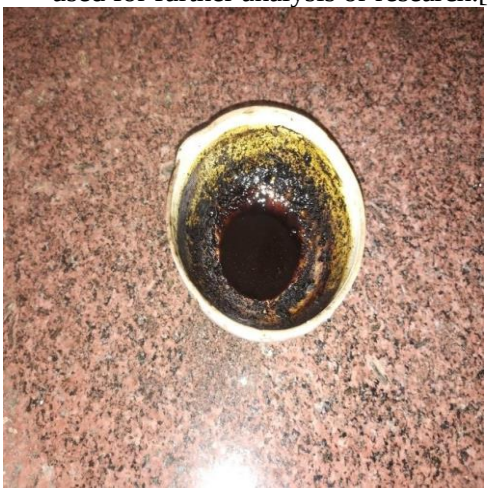

Fig. No. 03: Papaya Leaves Extract

- **Harvesting Aloe Vera Leaves**

Select ripe, healthy leaves from the outer sections of the aloe vera plant. Cut the leaves near the base of the plant using a sharp knife.
Cleaning the Leaves: Rinse the leaves under cold water to remove any dirt or debris.
Extracting the Gel: Use a spoon or knife to scoop out the gel from the leaves. Collect the extracted gel in a sanitized container. [5]

Fig. No. 04: Aloe Vera Gel

- Formulation: selection of ingredients.

Table No. 1: Ingredients

Ingredients
Banana root

Orange peel
Papaya leaf
Aloe Vera
Honey
Rose oil
Sodium benzoate

3.1 Preparation of Serum

- Techniques used: 1) Extraction 2) Hydro distillation
- Gather ingredient extract (Soxhlet extraction)
- Mix thoroughly
- Weigh then mix the preservative
- Heating, stirring
- Cool & package, label, store.

3.2 Evaluation Parameters

- Color
- Odor
- Consistency
- pH
- Viscosity
- Irritability

4. EXPERIMENTAL WORK

- Methodology

1) As per SOP, thoroughly clean and dry all glassware.
2) Accurately measure out the extract of banana root, papaya leaf, orange peel and aloe vera gel
3) Mix all extract into a beaker
4) Add the necessary amount rose oil to the mixture.
5) After that, use a magnetic stirrer to agitate the mixture.
6) Pour the mixture into a measuring cylinder and cap it at 20 milliliters.
7) Fill the container with the finished solution.

Table No. 2: Formulation

Ingredient	**Batch (20 ml)**
Banana Root Extract	2 gm.
Orange peel Oil	2 ml
Papaya leave Extract	2 gm.

Aloe Vera Gel	2 ml
Honey	2 ml
Rose Oil	10 ml

5. EVALUATION PARAMETERS

a. Physical appearance

Prepared Herbal serum's physical appearance, color, and texture are examined visually.

b. pH: weak acidic

c. Spread ability

The parallel plate method, which is used to assess and measure spread ability, was utilized to measure spread ability. Little quantity of squeezed bet serum After I minute, the spread diameter of two horizontal plates, each measuring 20 by 20 cm, was measured. The spread ability was computed using the formula.

S= M*L/T

S: spread ability. M: weight in pan. L: length move by the glass slide.

T: time taken to separate the slide completely.

d. Stability

The prepared herbal serum was stored in tightly sealed container at room temperature for a week. After that week, the viscosity and pH were measured and compared to the initial values.

e. Homogeneity test

Dry clean item glass was coated with hair serum before a care glass was bonded over it. Examine the look of a few coarse particles in the product. Visual inspection revealed homogeneity, presence of lumps, and flocculation in the herbal serum.

f. Viscosity

A spindle was used to measure the viscosity instead of Brookfield viscometer. The stem viscosity in the beaker (some OF HQ) was measured at a various.

g. Skin irritation test

After two hours, the skin is examined to see if there is any redness or itching.

h. Sensitivity

Applying serum to the skin and waiting ten minutes for the sun to shine on it to treat rashes and irritation.

Fig. No. 05: Formulated Serum

6. RESULT AND DISCUSSION

A. Physical Appearance

The physical appearance, color, Odor, and texture of the prepared herbal hair serum are visually tested reflects the outcome Physical appearance of herbal serum.

Table No. 3: Physical appearance of herbal serum

Parameter	Batch
Color	Dark brownish
Odor	Aromatic
Texture	Light weight

B. Homogeneity, Stability, And Spread ability Test

C.

Table No. 4: Homogeneity, Viscosity, And Test

Parameter	Batch
Homogeneity	Good
Stability	Good
Spread ability Test	Easily spreadable

D. Stability Study

Table No. 5: Stability Study

Parameter	**Batch**
pH	5.75-6.75
Viscosity	230

7. CONCLUSION

The development and characterization of an herbal serum for skin care applications present a promising approach to addressing various skin concerns while promoting overall skin health. The formulation, based on natural plant extracts, demonstrates significant potential due to the combined benefits of selected herbs, such as anti-inflammatory, antioxidant, and moisturizing properties. These attributes contribute to skin protection and rejuvenation, making the serum a valuable addition to skincare routines. The development and comprehensive evaluation of the herbal serum underscore its potential as a natural and effective skincare solution. The formulation process successfully integrated plant-based extracts known for their therapeutic properties, resulting in a serum with desirable physicochemical attributes, including appropriate pH, viscosity, and spread ability. Phytochemical analyses confirmed the presence of bioactive compounds such as flavonoids and phenolic acids, which are known for their antioxidant and anti-inflammatory benefits.

8. ACKNOWLEDGEMENT

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9. CONFLICTS OF INTEREST

Authors have no conflicts of interest to declare.

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