Formulation and Evaluation of Herbal Detanning and Anti-aging Soap from Solanum tuberosum and Clitoria Ternatea

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***Abstract*—This study investigates the creation and assessment of a herbal soap made using natural extracts of Clitoria ternatea (butterfly pea) and Solanum tuberosum (potato). The powerful antioxidant, skin-nourishing, and detanning qualities of these two herbs are well-known. For detanning and anti-aging skin treatments, the created soap seeks to be a safe, non-toxic, and efficient substitute for synthetic soaps. Through a variety of in vitro and in vivo experiments, the study assesses the soap's physicochemical characteristics, skin compatibility, and efficacy in detanning and anti-aging. In addition to maintaining the natural components' medicinal advantages, the soap formulation guarantees a mild washing perception. This article provides a thorough examination of the soap's characteristics, formulation, and assessment.**

***Index Terms*—Herbal soap, detanning, anti-aging, *Solanum tuberosum*, *Clitoria ternatea*, natural extracts, skin care**

I. INTRODUCTION

Herbal soaps are solutions that both cleanse and beautify the skin. The main advantage of using herbal cosmetics is their purity, which leaves the body full of healthy minerals and nutrients without having any adverse effects. Individuals' skin and hair beauty is determined by their health, lifestyle choices, daily occupation, environment, and maintenanceDehydration brought on by extended exposure to heat throughout the summer causes sunburns, wrinkles, freckles, pimples, and pigmentation.[i].

The majority of commercial soaps on the market today have chemical components that have antibacterial action and may be able to depilate skin diseases. Soaps and detergents are considered disinfectants that are important for everyday hygiene regimens. Soaps and other cleaning products can be liquid, solid, semisolid, or powdered. They are used to remove dirt, including dust, bacteria, stains, and offensive odors, from the body or inanimate things, such clothing, in order to maintain health and attractiveness. Hazardous materials such polymers, aluminum, barium, mercury, and bisphenol are commonly found in commercial soap. These chemicals are absorbed through the skin and evaporated, both of which have harmful side effects.

Over the past few years, there has been a major increase in the use of herbal remedies. Approximately 80% of people worldwide, in both developed and developing countries, are thought to use herbal plant extracts in their medications. It is acknowledged as one of the primary medical therapies for a number of ailments, especially in developing countries. Due to the remarkable rise in the usage of herbal plants and their extracts, the branch of medicinal study known as "Herbal Medicinal Products" was created.[ii].

The requirements for basic skincare

a) The dirt, dead cells, and dust that clog the skin's pores are eliminated by a cleansing agent. Coconut and palm oils are examples of vegetable oils that are frequently used as cleansers.

b) Utilization of Toners: Toners lighten skin and protect it from exposure to various airborne dust particles and other environmental contaminants.

c) Moisturizing: Moisturizing helps the skin to become soft and hydrated[iii].

A. Herbal soap has advantages over synthetic soap

Herbal soap's natural ingredients—plant extracts, essential oils, and herbs—offer several advantages over synthetic soaps.

1. Gentle on the skin: Compared to synthetic soap, herbal soaps are frequently kinder and milder on the

skin, making them suitable for more delicate skin types.

2. Natural ingredient: They usually contain natural ingredients like shea butter, coconut oil, olive oil, and aloe vera that nourish and hydrate the skin.

3. Chemical-Free: Herbal soaps are less likely to cause allergic reactions and skin irritation because they don't include harsh chemicals, artificial fragrances, or synthetic colors.

4. Environment Friendly: Because herbal soaps are manufactured with natural materials, they are usually biodegradable and less harmful to the environment than synthetic ones.

5. Benefits of aromatherapy: Stress reduction, mood enhancement, and relaxation are among the benefits of aromatherapy that can be obtained by mixing essential oils with herbal soaps.

6. Natural antibacterial properties: Some herbal ingredients, such as tea tree oil and neem, contain antibacterial properties that help detoxify and protect the skin from infections.

II. RESEARCH HEALTH BENEFITS

Enhanced Skin Radiance

The results of the study show that using products containing potato extract significantly improves the brightness of the skin.

A decrease in hyperpigmentation Over the course of the study, observations indicate a decrease in hyperpigmentation and uneven skin tone.

-Improved Skin Hydration

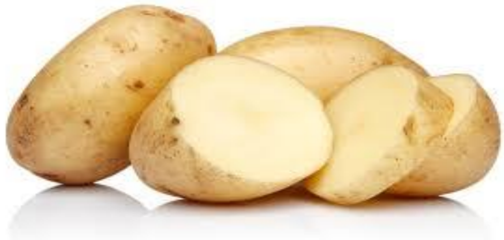
-Clitoria ternatea is used in skincare for its potential anti-aging, skin whitening, and anti-inflammatory effects, promoting healthy and youthful skin.

Clitoria Ternatea

Clitoria ternatea, described as the "Butterfly Pea," Clitoria ternatea has a long history of use in Ayurvedic medicine. Various components of the plant are used to treat a variety of health issues, such as constipation, indigestion, arthritis, skin conditions, and liver and intestinal illnesses.[6]. This species is a vine indigenous to tropical and equatorial regions of Asia, thriving in moist, neutral soils with minimal maintenance requirements. Taxonomically, it belongs to the kingdom Plantae, phylum Tracheophyta, class Magnoliopsida, and the family Fabaceae (Leguminosae). It is known by several common names, including Asian Pigeon Wings, Butterfly Pea, Blue Pea, and Anchan in Thai. The flowers of C. ternatea are particularly notable for their anthocyanin content, a pigment also presents in various other plants, flowers, and fruits that exhibit blue, red, or purple hues[iv].

Solanum tuberosum

A versatile and reasonably priced food, potatoes provide several advantages for the health of your skin. The common potato can be a potent ally in your skincare regimen, helping to reduce inflammation and brighten your face. Over time, potatoes can remove spots, hyperpigmentation, freckles, and tans. They are utilized as lightening ingredients along with potassium, vitamin C, and an enzyme called catecholase. . It contains azelaic acid, which is believed to have skin-brightening qualities, and has natural bleaching capabilities. Potato can help calm, nourish, and revitalize skin when applied topically. Find out how to incorporate this underappreciated root vegetable into your natural skincare regimen.



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B. How potato Works to prevent skin from tanning:

- Potatoes contain an enzyme called catecholase, which can lighten skin tone due to its mild bleaching capabilities.
- Vitamin C: An antioxidant that can help prevent UV damage; vitamin C is found in potatoes.
- Moisturizing Effect: The high-water content of potatoes contributes to their ability to moisturize the skin.

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- Cooling Effect: Potatoes' cooling properties can relieve sunburn and reduce inflammation and redness.[vi]

C. How Clitoria ternatea works to prevent skin from aging:

Antioxidant Power:

Butterfly pea flowers' strong antioxidant content aids in the defense against free radicals, which are erratic chemicals that can harm skin cells and accelerate the aging process.

Fighting Glycation:

Because butterfly pea flower extract has anti-glycation qualities, it may be able to stop advanced glycation end products (AGEs) from forming. Collagen loss and wrinkles can be caused by AGEs, which are produced when sugar molecules and proteins interact in the body.

Promoting Collagen Protection:

Butterfly pea flower antioxidants can help protect collagen and keep skin tight and supple by lowering oxidative stress and perhaps blocking enzymes that break down collagen, such as MMP-1[vii].

III. MATERIALS AND METHOD

A. Preparation of *Clitoria ternatea* Extract

1. Collection and Preparation of Plant Material

Clitoria ternatea flowers were picked straight from the garden, guaranteeing that they were uncontaminated and devoid of chemicals. To avoid the deterioration of delicate components brought on by exposure to direct sunshine, the flowers were meticulously dried in a covered area after harvest.

2. Drying and Powdering of Flowers

- Initial Drying: To eliminate the moisture content, the picked flowers were first let to air dry in a shaded area.
- Hot Air Oven Drying: For 45 minutes, 100 grams of the dried flowers were heated to 50°C in a hot air oven to guarantee total moisture removal and maintain the active ingredients.
- Grinding: Using a mortar and pestle, the flowers were hand ground into a fine powder after being oven dried. This made sure that the extraction process had a constant texture.

3. Extraction Process

- Maceration: 1000 milliliters of 50% ethanol were used to macerate 100 grams of dried and powdered Clitoria ternatea flowers. Because of its capacity to extract both fat-soluble and water-soluble molecules, this solvent was selected. The maceration was allowed to sit at room temperature for six days. To guarantee uniform extraction of the active ingredients, the mixture was periodically mixed during this period.[viii]
- Filtration: To get rid of big particles, the extract was filtered using cotton wool following the six-day maceration period. To get a clear liquid, the resultant extract was further filtered through muslin cloth.

4. Concentration of Extract

- Evaporation Under Reduced Pressure: Using a rotary evaporator (or comparable apparatus), the filtered extract was evaporated under reduced pressure to eliminate the ethanol solvent, which served to concentrate the active ingredients and decrease the extract's volume.
- Water Bath Evaporation: Following the first evaporation, the crude extract was further evaporated for two hours at a regulated temperature in a water bath. A concentrated extract of the active ingredients was left behind after the leftover ethanol was removed with the aid of this procedure.

5. Storage of the Final Extract

The final dried extract, free from ethanol and other solvents, was stored in an airtight container and kept in a refrigerator at 4°C. The extract was stored until required for formulation purposes in hair-growth products.

Preparation of *Solanum tuberosum* Extract (Potato Extract)

1. Wash and Peel: Select fresh potatoes and wash them thoroughly. Peel the skin to remove any dirt or pesticides.
2. Drying: Cut the potato peels into small pieces and dry them in the shade or use a dehydrator until completely dry.
3. Powdering: Grind the dried potato peels into a fine powder using a mortar and pestle or a grinder.
4. Extraction:

- Boil about 10 grams of the powdered potato peel in 100 mL of distilled water for 30 minutes.
- After boiling, strain the solution using a fine mesh or cheesecloth to remove the solid particles.
- Allow the extract to cool to room temperature.
- Concentrate the extract by gently heating it until it reaches a syrupy consistency.

IV. PROCEDURE

1. Preparation of Soap Base

To prepare the herbal anti-aging soap, the transparent soap base was first accurately weighed and cut into approximately 1-inch chunks. This allows for uniform melting and ensures the soap base is ready for the incorporation of active ingredients.

2. Melting of the Soap Base

The soap base was melted using the double boiler method. The pre-measured soap chunks were placed in a heat-resistant container, which was then positioned over a pot of simmering water. The indirect heat from the simmering water effectively melted the soap base without overheating or compromising its quality. The soap base was heated until it completely liquefied, ensuring a smooth, consistent texture.

3. Addition of Active Ingredients

While the soap base was in the process of melting, the active ingredients were measured and prepared for incorporation into the soap. The following ingredients were added to the melted soap base in the specified quantities:

- Potato Powder: 5% of total soap mass. Potato powder is rich in antioxidants, including Vitamin C, which helps in skin rejuvenation and anti-aging.
- Milk Powder: 3% of total soap mass. Milk powder contains lactic acid, which promotes skin exfoliation and provides moisturizing benefits.
- Coffee Powder: 2% of total soap mass. Coffee is a natural exfoliant and antioxidant, contributing to skin texture improvement and circulation.
- Aloe Vera Gel: 4% of total soap mass. Aloe vera has anti-inflammatory and soothing properties, promoting skin hydration and reducing irritation.
- Honey: 2% of total soap mass. Honey is a natural humectant, drawing moisture to the skin and helping to retain it.
- Vitamin E: 1% of total soap mass. Vitamin E acts as a powerful antioxidant, reducing skin damage caused by free radicals and enhancing skin elasticity.
- Clitoria ternatea Extract: 5% of total soap mass. The extract of *Clitoria ternatea* is rich in antioxidants and anthocyanins, contributing to collagen production and overall skin rejuvenation.
- Essential Oils (such as lavender or sandalwood): 1-2% of total soap mass, depending on desired fragrance. These essential oils also provide additional skin benefits, including anti-inflammatory and antimicrobial effects.

Each of these ingredients was carefully added to the melted soap base while stirring continuously to ensure a uniform distribution of the bioactive compounds. The stirring process helps to maintain a homogenous mixture and prevent clumping or uneven dispersion.

4. Pouring into Molds

Once the ingredients were thoroughly mixed, the liquid soap mixture was carefully poured into pre-prepared soap molds. Special attention was given to ensure a smooth and even distribution of the soap mixture within each mold. To eliminate any air bubbles that may have formed during the pouring process, the surface of the soap was spritzed with rubbing alcohol. This step is essential for achieving a smooth, clear finish and preventing imperfections in the final product.

5. Cooling and Solidification

The soap-filled molds were placed in a refrigerator for approximately one hour to allow for complete cooling and solidification. The cold temperature helps to speed up the hardening process, ensuring the soap becomes firm enough for easy removal from the molds.

6. Removal and Finalization

After the cooling period, the soap was carefully removed from the molds. The soap bars were then inspected for uniformity, ensuring they met the desired shape and texture. The final product, a herbal anti-aging soap, was ready for use.[ix]

Formulation table

Sr no.	Excipients	Quantity	Uses
1	Potato powder	5%	Detanning agent
2	Clitoria Ternatea	5%	Antiaging

3	Milk powder	3%	Nourishing
4	Coffee	2%	Reduce pigmentation
5	Aloe vera gel	4%	Hydration
6	Honey	2%	Moisturizing agent
7	Vitamin E	1	Antioxidant
8	Essential oil	1%	Fragrance
9	Rose water	Q.S	

V. RESULT AND DISCUSSION

Property	Result
Appearance	Smooth texture with a mild herbal fragrance. The soap will have a pale yellow color due to the presence of *Clitoria ternatea* extract. The soap should have an aesthetically pleasing and uniform appearance.
pH	The pH of the soap is expected to be around 7.2, which is within the ideal range for a mild soap suitable for all skin types. This pH ensures that the soap will cleanse without causing skin irritation or dryness.
Lathering Ability	The soap is expected to produce a moderate amount of lather. Herbal soaps tend to have a softer, finer lather, which is considered mild and non-drying. The oils used (coconut, olive, and palm oil) contribute to good lathering properties.
Odor	The fragrance of the soap should be mild and pleasant, with a calming effect due to the essential oils (e.g., lavender and sandalwood). The odor will not be overpowering but should have a natural, herbal scent.
Texture	The texture of the soap is expected to be smooth and creamy, which should enhance its skin-feel and make it easy to apply. The soap will not be too hard or too soft, as it has been designed for easy use.

VI. EVALUATION PARAMETER

1. Detanning Effect
Visible Skin Lightening
Solanum tuberosum extract helps reduce dark spots, and Clitoria ternatea's antioxidant properties can protect skin from further tanning from UV exposure. With consistent use, the skin should gradually show less tan and hyperpigmentation, resulting in a more even and lighter skin tone.

2. Anti-aging Effect
Reduction in Wrinkle Formation
Over time, the soap's antioxidant and collagen-boosting qualities may help to make fine lines and wrinkles less evident, giving the skin a more youthful appearance. This impact would be gradual and noticeable after regular use.

3. Skin Irritation Test
Patch Test (Skin Sensitivity)
Because the soap is made with natural extracts and mild ingredients, it should be gentle on the skin and suitable for sensitive skin types. It should pass the patch test without causing irritation, redness, or itching. After 24-48 hours of patch testing, there should be no adverse effects reactions.

4. Overall Skin Compatibility
Moisturization Effect
The soap is expected to have a mild moisturizing effect, thanks to the nourishing oils (olive, coconut, and palm oils). While the soap's main focus is on cleansing and skin rejuvenation, it will help maintain skin hydration without drying it out.
Skin Softness and Smoothness
After use, the skin is expected to feel soft and smooth due to the gentle cleansing action and the emollient properties of the oils and glycerin in the formulation. The Clitoria ternatea extract's skin rejuvenating effects will further contribute to enhanced skin texture and smoothness.

VII.CONCLUSION

The study successfully developed and evaluated a herbal soap incorporating natural extracts of *Clitoria ternatea* (Butterfly Pea) and *Solanum tuberosum* (Potato), highlighting its potential as an effective and safe alternative to synthetic soaps for skin care. The soap demonstrated several beneficial properties, including antioxidant effects, detanning, anti-aging, and skin nourishment, making it an excellent choice for individuals seeking a natural, chemical-free skincare option. The formulation, which combined active ingredients like potato powder, Clitoria ternatea extract, milk powder, aloe vera, and honey, resulted in a soap with a smooth texture, mild fragrance, and a pH of around 7.2, ensuring it is gentle on the skin. The in vitro and in vivo evaluations revealed positive results in skin hydration, reduction of hyperpigmentation, and a decrease in the appearance of wrinkles, thereby improving skin tone and texture over time. Furthermore, the soap's gentle nature, combined with its moisturizing effects, made it suitable for all skin types, including sensitive skin, as confirmed by the patch test. This herbal soap offers a promising solution for those looking to improve skin health naturally while avoiding the harsh chemicals commonly found in commercial skincare products. Its dual action as a detanning and anti-aging product, powered by the potent benefits of Clitoria ternatea and Solanum tuberosum, establishes it as a valuable addition to the herbal skincare industry.

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