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Development and Evaluation of Polyherbal Facewash Formulation: A Comparative Study of Surfactant Efficacy

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ABSTRACT

A face wash is a facial cleansing solution that eliminates waste, oil, filth, dead skin cells, and makeup from the face. This helps to prevent skin problems like acne and cleans the pores. In order to balance and cleanse the skin while treating it with a soft and gentle touch, the current study set out to formulate and develop a polyherbal face wash containing extracts of periwinkle and basil. The periwinkle extract has a rich concentration of antioxidant alkaloids. To boost radiant energy, this extract is frequently included in skin-brightening cosmetics. Basil helps prevent acne because of its antibacterial and anti-inflammatory qualities. Because it contains natural oils that function as a natural cleanser and helps remove excess oil and pollutants, basil is also a great pore cleanser. Additionally, it relaxes and soothes skin irritation, edema, and acne-related pain. Rose water, xanthan gum, sodium alginate, basil extract, and periwinkle extract were used in its preparation. We assessed the pH, spreadability, foamability, washability, and viscosity of the produced polyherbal face wash. Following a thorough assessment of many parameters such as color, pH, consistency, washability, and irritation, the current study revealed that the herbal face wash formulation exhibited superior efficacy. The demand in the global market for herbal formulations is increasing. Because every ingredient in this mixture is herbal, it is trustworthy and safe for skin.

Keywords: *: periwinkle, face wash, basil, natural cleanser*

1. INTRODUCTION

Skin

The tissues that make up skin work together as a single entity to perform critical and specialized functions. The body is generally protected by the integumentary system, which consists of the skin and the tissues that support it. The several layers of cells and tissues that comprise the skin are held to the underlying structures by connective tissue. The deeper layer of skin is well vascularized and has a large number of blood vessels. Along with sympathetic and autonomic nerve fibers that support brain-to-brain communication, it also has a high number of sensory fibers. The following are the three layers of skin:

- Epidermis
- Dermis
- Subcutaneous (hypodermis)[1]

Facewash

A cleanser is a facial cleansing product that helps clear the skin of debris, oil, and dead skin cells. This aids in pore cleaning and guards against skin disorders like acne. A skin care routine can include the use of a cleanser, toner, and moisturizer. A face wash is a gentle cleanser that performs the essential functions of keeping skin hydrated, clean, and free of bacteria. Certain face washes have ingredients that prevent melanin from being produced by melanocytes, giving the appearance of brighter skin.

Types of Facewash

- Cream face wash
- Gel face wash
- Foaming face wash
- Bar Cleansers

1. **Gel Face Wash:** This product is transparent and has a gel-like texture. They are intended to thoroughly clean pores and eliminate extra sebum. It is intended for those with sensitive skin types and acne.
2. **Cream Face Wash:** Its consistency is heavier. It has moisturizing ingredients like milk, honey, and so on. They are specifically made for dry skin and are intended to remove makeup.
3. **Foam Face Wash:** This type of cleanser is in the middle of a gel and cream consistency. They might have a thick, frothy texture that bursts from their initial cream or gel state. They eliminate the filth, debris, and contaminants. However, they might damage the essential oils.
4. **Bar Cleanser:** This hydrating, soap-free cleansing bar provides efficient removal of oil, debris, and makeup while being gentle.[2]

The goal of this herbal cosmetic formulation is to combine the benefits of periwinkle and basil into a face cleanser that works for all skin types, even those with sensitive and acne-prone skin.

This gentle cleanser cleans the skin and gets rid of oil, grime, impurities, and dead skin cells. It moisturizes the skin and aids in pore cleaning without damaging its natural vital oils.

All of the ingredients in the formulation are safe for the environment and do not negatively affect skin health.

Each of the formulation's extracts has advantages for the skin of its own.

Advantages of face wash

- It makes the skin glow.
- Excess oil and dead skin cells can clog pores, leading to acne, black and white heads, and a drained appearance.All of the aforementioned skin issues can be avoided with regular pore exfoliation.
- Exfoliation promotes skin regeneration and renewal, helps to eliminate dead skin cells and replace them with new ones, and speeds up blood circulation.
- Helps keep skin clear and healthy. [1].

S. No.	Name	Picture	Uses
1	Periwinkle		• It has a rich concentration of antioxidants alkaloids • It offers soothing and astringent properties to balance and cleanse the skin. • It provides a glowing energy to
2	Basil		• Anti-inflammatory properties. • It has vitamin C content boosts the skin cells metabolism and elasticity. • It has soothing effects
3	Rose water		• Flavoring agent • Emollient agent • Cooling agent

4	Xanthan gum		• Xanthan gum offers skin-conditioning qualities, which thickens the texture of skincare products. It also serves as a binder and emulsion stabilizer. • It is an agent that increases viscosity. It condenses into

2. MATERIALS AND METHODS

EXTRACTS:

Basil extract:

Scientific Name: Ocimum basilicum

Common Name: Basil or sweet basil

Plant Family: Lamiaceae (mint family)

Basil is a herb used for its leaves that is either annual or occasionally perennial. Plants can grow to heights of between 30 and 150 cm (1 and 5 feet), depending on the variety. Although its leaves are oval and have a bright green color, they can vary greatly in size and form depending on the cultivar. Leaf sizes range from 3 to 11 cm (1 to 4+1⁄2 in) long, and between 1 and 6 cm (1⁄2 and 2+1⁄2 in) broad. Numerous studies have used basil leaves to get biophysical assessments of skin hydration, smoothness, and wrinkle prevalence. The mixture including basil reduced roughness, increased moisture content, and inhibited wrinkles. There were no negative consequences reported. Fresh Ocimum basilicum leaves were manually crushed by the researchers, who then applied the juice to the face acne lesions and covered them for the night before washing them with mild soap the following morning. The acne lesions (pimples, comedones, pustules, and cysts) responded to the basil treatment in a way that suggested it was equally as successful as the prescription acne medication.

The skin is protected from the harmful effects of pollution, UV rays, and skin conditions by the cleansing properties of basil. This helps the skin retain moisture and nourishes it. Basil helps prevent acne. Basil is also an excellent pore cleanser since it contains natural oils that act as a natural cleaner and aid in the removal of impurities and excess oil. It also calms and relieves edema, acne-related discomfort, and skin irritation. The astringent qualities of basil aid in pore tightening and purification, leaving skin flawless.

For generations, people have turned to basil, a well-known anti-aging remedy, for its anti-aging properties. Due to its high antioxidant content, basil helps to repair damaged skin and get rid of free radicals that cause wrinkles and fine lines to form on the skin.

- It has anti-inflammatory properties.
- It has vitamin c content boosts the skin cells metabolism and elasticity.
- It has soothing effects[3,4]

Procedure for extraction

- Basil leaves were dried in sun to remove excess moisture.
- A mixture of glycerin and ethanol was made in (1:1) concentration.
- 25gm of the dried leaves were taken in a beaker.
- To this 50ml of mixture of ethanol and glycerin was added.
- It was covered and shaken thoroughly and stored for about 10-15 days.
- It was strained and the extract was collected.

Periwinkle extract

Scientific Name(s): Catharanthus roseus

Common Name(s): Cape periwinkle, Church-flower, Madagascar periwinkle, Magdalena, Myrtle, Old maid, Periwinkle, Ram-goat rose, Red periwinkle, Rosy periwinkle, Vinca

Plant Family: Apocynaceae

Catharanthus roseus is a herbaceous or evergreen subshrub that grows up to 1 m (39 in) in height. The clears out are smooth, glossy green, oval to elongated, 2.5-9 cm (1.0-3.5 in) long, and 1-3.5 cm (0.4-1.4 in) wide. They have a short petiole that is 1-1.8 cm (0.4-0.7 in) long, and they are arranged in inverse sets. The blooms have a basal tube and range in color from dull pink with a darker ruddy center to white with a yellow or ruddy center. It has a high concentration of cancer prevention agents alkaloids. generally, periwinkle is depicted as" being the bliss of the ground" It is accepted to advance recuperating on a physical level (conceivably due to its astringent activity on wounds) John Gerard the well-known cultivator of the 16th Century included periwinkle in his 1597 "The Homegrown or Common history of plants" He classed it as a drying herb. This drying quality depicted is likely due to its tannin substance which gives it an astringent activity, authoritative and fixes the tissues, and decreases discharges with this they secure films from disturbance and disease.

It moreover cleanses the skin while spoiling it with a delicate and tender touch. It is a well-known expansion to skin brightening items to upgrade gleaming vitality. In constrained thinks about utilizing rats, analysts found expanding dermatological impacts with topical as well as verbal ethanolic blossom extricates.

- It has a rich concentration of antioxidants alkaloids
- It offers soothing and astringent properties to balance and cleanse the skin.
- It provides a glowing energy to the skin.[5,6,7]

Procedure for extraction

- Petals of periwinkle were sun dried.
- 25 gm of these dried petals were weighed and taken in a beaker
- To this 50 ml glycerin was added.
- The beaker was covered and shaken so that all the petals are submerged in the glycerin.
- The beaker was covered using a food wrap and stored for about 15 days
- The liquid was strained and used as extract.

Vehicle

Rose water

Scientific Name(s): Rosa

Common Name(s): Rose

Plant Family: Rosaceae

The leaves are borne alternately on the stem. Most species are pinnate, with basal stipules and (3–) 5–9 (−13) leaflets, and range in length from 5 to 15 centimeters (2.0 to 5.9 in).The leaflets typically have a serrated border and a few tiny prickles on the underside of the stem. While most roses are deciduous, some are evergreen or almost so, especially those from Southeast Asia.

Rose petals are immersed in water to create flavored rose water. It is the hydrosol component of the rose petal distillate, which is a byproduct of making rose oil for perfume. Food can also be flavored with rose water. It can be used for many purposes, including as a skin cleanser, to reduce redness, and to treat acne, dermatitis etc.[8,9].

Preservative

Optiphen ND

It is a broad-spectrum preservative against bacteria, yeast and mold.

It is paraben and formaldehyde free having pH 4-8 and it can be used for any product with a pH of 6 and lower.it works best for water-based recipes [10]

Surfactants

1. Decyl glucoside (C16H32O6)

A moderate non-ionic surfactant, decyl glucoside is utilized in cosmetic formulas, such as baby shampoo, and in products for people with sensitive skin. Decyl glucoside is made entirely of natural ingredients, is biodegradable, non-toxic, non-carcinogenic, and does not cause allergies to any organs or reproductive health issues. All skin types, including normal, dry, and sensitive skin, can safely use it.[11,12]

2. Cocamidopropyl betaine

The yellow, sticky substance known as Cocamidopropyl Betaine (CAPB) has a faintly "fatty" smell. It comes from raw

coconut oil, which is made into a surfactant by mixing it with dimethylaminopropylamine. Surfactants dissolve water's surface tension, allowing dirt to be loosened and washed away. When used appropriately, most people should be safe using products that contain CAPB. The mild ingredient CAPB can be used by manufacturers to make products for babies and newborns. It isn't appropriate for skin-maintenance products, though. Irritation could arise from leaving CAPB on the skin. [13,14]

1. Coco glucoside

Coconuts are the source of coco-glucoside. The non-drying fatty alcohol derivative from coconut oil and sugar glucose are chemically reacted to create it. Coco-Glucoside is primarily derived from plants, but it can also be synthesized in laboratories. Skin and hair products can safely use coco-glucoside. Although this surfactant has very few adverse effects, some skin types may become irritated. Therefore, before using it fully, a patch test is advised. Additionally, coco-glucoside is environmentally safe. It does not clog pores or result in acne because it is non-comedogenic. It is a mild cleanser that gives the skin all of the benefits of coconut moisture. It is an emulsifying component that is extremely nourishing and moisturizes the skin, retaining moisture for a long time. Additionally, it keeps the skin from drying out by giving the goods moisturizing qualities. [15,16]

2. Alpha olefin sulphonate

Strong wetting action, foam booster, mild viscosity enhancer, and superior cleaning and degreasing qualities are all attributes of alpha olefin sulfonate. Amphoteric and non-ionic co-surfactants are among the other surfactants with which it is compatible. It is perfect for creating sulfate-free cleansing solutions because it is mild on the skin and doesn't cause dryness. These characteristics, in addition to its respectable biodegradability, contribute to alpha olefin sulfonate's widespread use as a cosmetic ingredient. Non-sulfate anionic surfactants are generally steadily taking the lead in personal care cleansing products, especially those for hair and scalp care. In cosmetics, sodium C14-16 olefin sulfonate is the most often utilized AOS. This multipurpose type can be used as a wetting agent, emulsifier, and detergent. When properly prepared, it improves foaming qualities, viscosity, and the creation of a stable lather.[17]

3. Sodium lauryl sulphate

It is an anionic surfactant that is used in both industrial and personal care products, such as toothpaste, shampoos, and soaps. SLES is a foaming agent that is both affordable and highly efficient. The cleaning and emulsifying qualities of SLS, sodium lauryl sulfate (SLS), ammonium lauryl sulfate (ALS), and sodium pareth sulfate make them surfactants that are utilized in a variety of cosmetic goods. It comes from coconut oil or palm kernel oil.[18].

Thickening Agents

1. Sodium alginate

Sodium alginate is a naturally occurring hydrophilic polymer that comes from marine brown algae. Its hues vary from an undyed to an unheroic brown. It is sold in crushed, granular, or filamentous forms.Sodium alginate, which is exactly like the most essential components derived from seaweed, calms and softens the face and, when it comes into contact with water, takes on the consistency of jelly. This water-miscible polysaccharide is typically used in food and, more recently, cosmetics, to thicken or create an emulsifier. [19,20]

2. Xanthan gum

A bacterium known as Xanthomonas campestris produces xanthan gum, a polysaccharide, which is a kind of sugar, through fermentation.

Xanthan gum is a naturally occurring microbial polysaccharide that breaks down into monosaccharides and oligosaccharides, which eventually lead to the production of carbon dioxide and water.

- Xanthan gum offers skin-conditioning qualities, which thickens the texture of skincare products. It also serves as a binder and emulsion stabilizer.
- An agent increases viscosity. It condenses into a highly viscous watery solution.[21,22,23].

FORMULATION:

S.No.	Excipients	F1	F2	F3	F4
1	Xanthan gum	4.5	4.5	4.5	4.5
2	Sodium alginate	3	3	3	3
3	Glycerine	10	10	10	10

4	Rose water	62.5	62.5	62.5	67.5
5	Optiphen ND	1	1	1	1
6	Periwinkle Extract	2	2	2	2
7	Basil Extract	2	2	2	2
8	Decyl Glucoside	10	10	-	-
9	Cocamidopropyl Betaine	5	-	-	-
10	Coco glucoside	-	-	10	-
11	Alpha olefin sulfonate	-	5	5	-
12	Sodium lauryl sulphate	-	-	-	10
13	Citric acid : water (1:1)	8 drops	8 drops	8 drops	8 drops
14	Colorant	2 drops	2 drops	2 drops	2 drops

PROCEDURE

- A mixture of 4.5% xanthan gum (thickener), 3% sodium alginate, 10% glycerine (humectant), and 62.5% rose water was made in a beaker and was mixed until it thickened.
- In another beaker a mixture of surfactants 10% decyl glucoside (non-ionic), and 5% Cocamidopropyl betaine (amphoteric) was made.
- The mixture of surfactants was poured into phase A while mixing gently to avoid lathering
- To this 1% optiphen ND (preservative), 2% basil extract, and 2% periwinkle was added dropwise and mixed gently using a stirring rod to avoid lathering.
- The pH of the resultant mixture was checked using a pH meter, it was found higher than the normal pH of skin I.e 4.7-5.75 a solution of 1:1 citric acid in water was made and a few drops of this solution was poured into the face wash until the optimum pH was achieved.
- The face wash was covered using a food wrap and was left to sit overnight to let the bubbles settle that may be formed during the mixing.
- A few drops of water-soluble dye were added to the face wash and mixed gently.
- The face wash was evaluated for various parameters.

Evaluation of Facewash

- **Viscosity determination:** The physical characteristics were identified. The Brook Field Viscometer was used to determine viscosity. All of the formulations' rheological evaluations showed pseudoplastic flow following gelling and Newtonian flow prior to gelling.
- **pH determination:** The digital pH meter was used to determine the face wash's pH. To measure pH, 1 gram of gel was dissolved in 100 milliliters of distilled water.
- **Spreadability:** Spreadability was assessed by hand. The face wash spread readily. The spreadability measurements demonstrate how quickly the gel can be spread with a small amount of shear.
- **Stability determination:** The freeze-thaw cycling method was used to verify the gels' stability. The gels were heated to 4°C for seven days, 25°C for seven days, and 40°C for seven days. Following each stage, the gels were allowed to come to room temperature and their pH, viscosity, and syneresis were observed.
- **Skin irritation**: Skin irritation tests were conducted on 150–200 g albino rats of both sexes. The animals were kept with free access to water and regular animal feed. The rats had their backs and a 2 cm2 patch on each side completely shorn of hair. A control group containing 5% sodium lauryl sulfate in distilled water was used, whereas two animals

were used for each formulation test on the other group. After three days of twice-daily gel application, the region was checked for erythema, edema, and sensitivity.

- **Washability:** The degree and simplicity of water washing were assessed after the product was applied to the skin.
- **Evaluation of foamability:** A tiny bit of face wash was mixed with water in a beaker. After recording the initial volume, the beaker was shaken ten times to record the final volume.[24].

3. RESULTS AND DISCUSSIONS

- **pH:** The developed formulations exhibit a pH range of 4.5-5.53 among the 4 different formulations. This makes all the formulations compatible with normal physiology of skin.
- **Viscosity:** The formulations show viscosity of 1412 cP to 1960 cP. They were found to be in proper range .F3 and F4 has the best viscosity when compared to marketed formulations and get ejected in uniform and desired quantity when tube is squeezed.
- **Spreadability:** The spreadability of the developed formulations were found to be from 4.87-5.37 gm.cm/sec . F3 and F4 had the best spreadability.
- **Stability:** All the developed formulations were found to be stable except F4 as it showed phase separation on the conduction of the test.
- **Skin irritation:** None of the developed formulations showed any signs of erythema, edema or sensitivity on rat model.
- **Washability:** All the developed formulations were found to be easily washable under running water.
- **Foamability:** The developed formulations F3 and F4 were found to have best foamability.

The below table shows the evaluation's findings. The colors of the formulations were pale yellowish or creamish. The consistency of formulations F1, F2, F3, and F4 was determined to be semisolid. Every composition was found to be uniform and easily washable. The pH of each formulation was slightly alkaline, making them compatible with the normal physiology of the skin.

F3 and F4 exhibited the best spreadability out of all the formulation batches. Comparatively speaking, the F3 formulation batch was more spreadable than the F1, F2, and F4 formulation batches. Additionally, it was discovered that the parameters of the F3 batch produced results that were comparable to those of the marketed formulation. As a result, the F3 batch was chosen because it out performed the other generated formulations in terms of foaming ability, consistency, and stability.

S.No.	Evaluation Parameters	F1	F2	F3	F4
1	Viscosity	1960 cP	1984 cP	1620 cP	1412 cP
2	pH	5.53	5.3	4.94	4.5
3	Spreadability	4.98 gm.cm/sec	4.87 gm.cm/sec	5.37 gm.cm/sec	5.20 gm.cm/sec
4	Stability	No syneresis or change in pH found.	No syneresis or change in pH found.	No syneresis or change in pH found.	Syneresis was observed.
5	Skin irritation	No erythema, edema or sensitivity	No erythema, edema or sensitivity	No erythema, edema or sensitivity	No erythema, edema or sensitivity
6	Washability	Easily washable	Easily washable	Easily washable	Easily washable

7	Foamability	Good	Good	Excellent	Excellent

4. CONCLUSION

Natural medications are more commonly used than synthetic ones since they are safer and have fewer side effects. The global market is seeing an increase in demand for herbal formulations. The attempt to create a herbal face cleanser with aqueous extracts of basil leaves and periwinkle is excellent. Many factors, including viscosity, pH, spreadability, washability, foamability, and skin irritation, were taken into consideration when evaluating the face wash. The same formulation was used to compare the face washes made by using different surfactants that are naturally derived , safe and effective in producing foam for cleansing action. All the surfactants used are sulphate free and are not at all harmful for the skin and they were compared against SLS for various evaluation parameters to find the best formulation for a polyherbal face wash.

During the study it was found that a combination of an amphoteric and an anionic surfactant is the best suited for a face wash formulation as the amphoteric surfactants prevents the irritation or harshness caused due to anionic surfactants , amphoteric surfactants provide good foam and provide thickness to the formulation.

Among all of the prepared formulations F3 was found to be the best during the evaluation as it has all the properties of an ideal facewash that is

- It has flowy consistency to be easily poured through a storing bottle.
- It is easily washable and does not require much water for washing off.
- It has foaming ability just as sodium lauryl sulphate can produce in synthetic face washes.

It has ideal pH that suits best for the skin.

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