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Formulation and Evaluation of Polyherbal Facewash Tablet

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Abstract: The present study focuses on the formulation and evaluation of a polyherbal facewash tablet as an eco-friendly and sustainable alternative to conventional liquid cleansers. Herbal cosmetics have gained increasing attention due to their safety, minimal side effects, and therapeutic benefits. In this study, a facewash tablet was formulated using selected herbal ingredients such as Azadirachta indica (neem), Glycyrrhiza glabra (liquorice), Rosmarinus officinalis (rosemary), Acorus calamus (vasambu), Santalum album (sandalwood), and Curcuma longa (turmeric), along with suitable excipients. The formulation was prepared by the wet granulation method to ensure uniformity, compressibility, and stability. Phytochemical screening confirmed the presence of bioactive constituents including alkaloids, flavonoids, glycosides, saponins, tannins, and phenolic compounds, which contribute to antimicrobial and skin-beneficial properties. Preformulation studies such as bulk density, tapped density, Hausner's ratio, compressibility index, and angle of repose indicated good flow properties of the granules. Post-compression parameters including weight variation, hardness, thickness, and friability were found within acceptable limits. The formulated tablets were further evaluated for physical characteristics such as appearance, pH, foamability, foam stability, and washability, all of which showed satisfactory results. Biological evaluation demonstrated significant antimicrobial activity against Staphylococcus aureus and Candida albicans. Skin irritancy studies confirmed that the formulation was safe and non-irritant. In conclusion, the developed polyherbal facewash tablet offers a natural, cost-effective, travel-friendly, and environmentally sustainable alternative to conventional facewash products, with effective cleansing and antimicrobial properties suitable for skincare applications.

Keywords: Polyherbal facewash tablet, Herbal cosmetics, Wet granulation, Phytochemical screening, Antimicrobial activity, Eco-friendly.

1. INTRODUCTION

Herbal cosmetics have gained significant popularity in recent years due to their safety, efficacy, and minimal side effects compared to synthetic products. A large proportion of the global population relies on plant-based formulations for healthcare and personal care applications. Herbal ingredients are rich in bioactive compounds such as alkaloids, flavonoids, tannins, and phenolics, which exhibit antimicrobial, anti-inflammatory, and

antioxidant properties beneficial for skin health. Conventional liquid facewash products often require the addition of preservatives to prevent microbial contamination and are commonly packaged in plastic containers, contributing to environmental pollution. Moreover, these formulations may contain synthetic chemicals that can cause skin irritation or adverse effects upon prolonged use. To overcome these limitations, there is a growing demand for innovative, eco-friendly, and travel-friendly skincare alternatives. In this context, facewash tablets have emerged as a novel solid dosage form that dissolves in water to provide effective cleansing action. These tablets reduce the need for preservatives, minimize packaging waste, and offer convenience in storage and transportation. The incorporation of herbal ingredients further enhances their therapeutic value and safety profile. The present study aims to formulate and evaluate a polyherbal facewash tablet using selected medicinal plants such as Azadirachta indica (neem), Glycyrrhiza glabra (liquorice), Rosmarinus officinalis (rosemary), Acorus calamus (vasambu), Santalum album (sandalwood), and Curcuma longa (turmeric). The formulated tablets are intended to provide effective cleansing, antimicrobial activity, and skin-friendly properties while being eco-friendly and cost-effective. The study also focuses on evaluating the physicochemical, phytochemical, and biological characteristics of the formulation to ensure its quality, safety, and efficacy for skincare applications.

STRUCTURE OF SKIN

The skin is the largest organ of the human body and acts as a protective barrier against environmental factors, microorganisms, and chemical substances. It also plays a vital role in thermoregulation, sensation, and prevention of water loss.

Structurally, the skin is composed of three main layers:

1. Epidermis

The outermost layer responsible for protection. It consists of multiple sublayers, namely stratum basale (germinativum), stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum. These layers contain keratinized cells that provide mechanical strength and barrier function.

2. Dermis

Located beneath the epidermis, the dermis contains connective tissues, blood vessels, hair follicles, sebaceous glands, and sweat glands. It provides structural support, nourishment, and elasticity to the skin. Sebaceous glands secrete sebum, which lubricates the skin, while sweat glands help in temperature regulation.

3. Hypodermis (Subcutaneous layer)

The innermost layer composed mainly of adipose tissue. It acts as an reservoir, provides insulation, and cushions the body against mechanical injury.

Thus, the skin’s multilayered structure is essential for maintaining its protective and physiological functions.

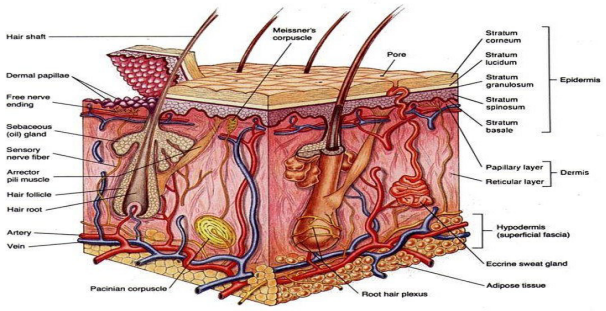


Fig: 1 Structure of skin

HERBAL COSMETICS

Herbal cosmetics are formulations containing plant-derived ingredients that provide cosmetic as well as therapeutic benefits to the skin. These products are widely preferred due to their natural origin, safety, and minimal side effects. They may include extracts, oils, powders, and active phyto constituents such as flavonoids, alkaloids, and tannins. Herbal cosmetics not only enhance appearance but also improve skin health through antimicrobial, anti-inflammatory, and antioxidant properties.

HERBAL FACE WASH TABLET

A herbal facewash tablet is a solid dosage form of facial cleanser prepared using natural ingredients and suitable excipients. It is designed to dissolve in water before use, producing foam that effectively removes dirt, oil, and impurities from the skin. Compared to conventional liquid cleansers, facewash tablets are more stable, portable, and eco-friendly, as they require minimal preservatives and reduced packaging.

Advantages

Minimal or no preservatives required

Eco-friendly and reduces plastic waste

Travel-friendly and easy to carry

Cost-effective formulation

Longer shelf life and better stability

Reduced risk of microbial contamination

Gentle on skin due to natural ingredients

Disadvantages

Limited formulation variety compared to liquids

May not suit all skin types equally

Requires dissolution before use

Slower action compared to liquid facewash

Possible variation in tablet disintegration

Applications

Removal of dirt, oil, and pollutants from skin

Prevention and management of acne and pimples

Suitable for daily skincare routine

Useful for sensitive and herbal skincare users

Pre-cleansing before cosmetic application

Can be used in treatment of minor skin conditions like irritation and inflammation.

2. AIM AND OBJECTIVE

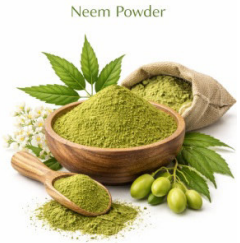
Our aim is to formulate and evaluate a polyherbal facewash tablet using herbal ingredients along with other excipients and to assess its cleansing, physiochemical and phytochemical properties for effective herbal skin care.

Objective

- To prepare a polyherbal tablet based facewash
- To gently remove dirt, oil and impurities from skin
- To reduce acne, pimples, blackheads and excess oil
- To develop a chemical-free and eco-friendly product
- To make the product easy to carry and travel friendly
- To evaluate safety and stability of the formulation

3. MATERIALS USED

HERBS AND EXCIPIENTS USED IN THE FORMULATION:

S.NO	INGREDIENTS	PICTURES
1	Neem leaf powder(வேப்பிலை) **Biological source**- Azadirachta indica **Family**-Meliaceae	
2	Rosemary leaf powder(ரோஸ்மேரி) **Biological source**- Rosmarinus officinalis **Family**- Lamiaceae	

3	Liquorice powder(அதிமதுரம்) **Biological source**- Glycyrrhiza glabra **Family**- Leguminosae	
4	Sandalwood powder(சந்தனம்) **Biological source**- Santalum album **Family**- Santalaceae	
5	Turmeric powder(மஞ்சள்) **Biological source**- Curcuma longa **Family**- Zingiberaceae	
6	Vasambu powder(வசம்பு) **Biological source**- Acorus calamus **Family**- Acoraceae	
7	Rice flour	

8	Soapnut powder	
9	Talc	
10	Starch mucilage	

4. PHYTOCHEMICAL SCREENING CHART

Table: 1

SNO	HERBAL PLANT	PHYTOCHEMICALS								
		ALKALOIDS	GLYCOSIDES	SAPONINS	FLAVONOIDS	TERPENOIDS	POLYPHENOLS	PROTEINS	AMINO ACIDS	PHENOLS
1	AZADIRACHTA INDICA	+	-	+	+	+	+	+	+	+
2	GLYCYRRHIZA GLABRA	+	+	+	+	+	-	+	+	+
3	ROSMARINUS OFFICINALIS	+	+	+	+	-	-	+	+	+
4	ACORUS CALAMUS	+	+	+	+	+	+	+	+	+

5	SANTALUM ALBUM	+	-	-	+	+	-	+	+	-
6	CURCUMA LONGA	-	+	+	+	+	+	+	+	-

5. FORMULATION OF POLYHERBAL FACEWASH TABLET

The polyherbal facewash tablet was formulated using selected herbal ingredients along with suitable excipients to achieve effective cleansing, good foaming ability, and tablet stability. The formulation was designed to ensure rapid disintegration in water and uniform distribution of active constituents.

Ingredients and Composition:

Table:2

S.NO.	INGREDIENTS	CATEGORY	FUNCTION
1	Neem (Azadirachta indica) powder	Herbal drug	Antibacterial, anti-acne
2	Liquorice (Glycyrrhiza glabra) powder	Herbal drug	Skin brightening, soothing
3	Rosemary (Rosmarinus officinalis) powder	Herbal drug	Antioxidant, anti-inflammatory
4	Turmeric (Curcuma longa) powder	Herbal drug	Antimicrobial, anti-inflammatory
5	Sandalwood (Santalum album) powder	Herbal drug	Cooling, fragrance
6	Vasambu (Acorus calamus) powder	Herbal drug	Antimicrobial
7	Soapnut powder	Natural surfactant	Cleansing and foaming agent
8	Rice flour	Diluent/Binder	Improves texture and binding
9	Starch mucilage	Binder	Provides cohesiveness
10	Talc	Lubricant	Reduces friction during compression

Method of Preparation (Wet Granulation Method):

The facewash tablets were prepared using the wet granulation technique:

1. All herbal ingredients were collected, dried, and finely powdered.

2. The powders were accurately weighed and passed through a suitable sieve for uniform particle size.

3. All dry ingredients were mixed thoroughly to obtain a homogeneous blend.

4. Starch mucilage was prepared separately and added gradually to the powder mixture to form a wet mass.

5. The wet mass was passed through a sieve to form granules.

6. The granules were dried (preferably shade drying) to remove moisture.

7. Dried granules were re-sieved for uniform size and mixed with talc as a lubricant.

8. The final granules were compressed into tablets using a tablet compression machine.

Fig: 2 Facewash Tablet

Formulation Considerations:

The tablet should disintegrate rapidly in water.

Adequate foaming should be produced for effective cleansing.

Ingredients must be non-irritant and suitable for skin application.

Proper hardness and friability should be maintained for stability.

6. PREFORMULATION STUDIES

Preformulation studies were carried out to evaluate the physicochemical properties of the powder blend prior to tablet compression. These studies help in determining the flow characteristics, compressibility, and suitability of the formulation for tablet preparation.

1. Bulk Density (BD)

Bulk density is the ratio of the mass of powder to its bulk volume. It indicates the packing ability of the powder.

Formula:

Bulk Density = Weight of powder / Bulk volume

2. Tapped Density (TD)

Tapped density is determined by mechanically tapping a measuring cylinder containing the powder until a constant volume is obtained. It reflects the maximum packing ability.

Formula:

Tapped Density = Weight of powder / Tapped volume

3. Hausner's Ratio

It indicates the flow property of the powder blend.

Formula:

Hausner's Ratio = Tapped Density / Bulk Density

Interpretation:

< 1.25 → Good flow

> 1.25 → Poor flow

4. Carr's Compressibility Index

It measures the compressibility of the powder.

Formula:

Carr's Index (%) = [(Tapped Density − Bulk Density) / Tapped Density] × 100

Interpretation:

5–15% → Excellent flow

16–25% → Good flow

> 25% → Poor flow

5. Angle of Repose (θ)

It indicates the flowability of the powder.

Formula:

$\tan \theta = h / r$

Where,

h = height of powder pile

r = radius of base

Interpretation:

< 30° → Good flow

30–40° → Passable

> 40° → Poor flow

7. POST COMPRESSION STUDIES

1. Weight Variation

20 tablets are weighed individually using an electronic balance.

The average weight is calculated and each tablet is compared with it.

The acceptable limit is ±5%.

Formula:

% Weight variation = (Individual weight – Average weight) / Average weight × 100

2. Hardness Test

Tablet hardness is measured using a Monsanto hardness tester.

It shows the tablet's ability to resist mechanical shock.

Usually 3–5 tablets are tested from each batch.

The hardness is expressed in kg/cm².

Ideal hardness: 3–8 kg/cm²

3. Friability Test

Friability is tested using a friabilator to check tablet strength during handling.

Usually 10 tablets are taken, weighed, rotated for 100 revolutions, then reweighed.

The weight loss should not exceed 0.5–1%.

Formula:

% Friability = (Initial weight – Final weight) / Initial weight × 100

4. Thickness

Tablet thickness is measured using a digital Vernier caliper.

It should be within ±5% limit to ensure uniformity.

8. EVALUATION PARAMETERS

Physical Evaluation:

1. Odour:

Odour was evaluated by heating the sample and by direct smelling by 5–6 volunteers.

2. Shape:

Shape was checked by visual and sensory examination.

3. Colour:

Colour was observed under natural daylight and against a white background.

4. Washability:

Washability was tested by applying the formulation on skin and washing with water.

5. pH:

pH was measured using pH paper or a digital pH meter.

The tablet was formulated to match skin pH and reduce irritation.

6. Foam Height:

One tablet was dissolved in 10 mL distilled water and shaken for 30 seconds in a measuring cylinder.

Foam height indicates foaming and cleansing ability.

Formula:

Foam Height = Total foam height – Liquid height

7. Foam Stability:

Foam stability shows the ability of foam to remain for a longer time without collapsing.

8. Foamability (Cylinder Shake Method):

A tablet was added to 50 mL water in a 250 mL cylinder, shaken well, and the foam volume was measured.

Biological Evaluation:

1. Irritancy Test

The formulation was applied on 1 cm^2 of dorsal skin on the left hand and observed for 1–2 hours for redness, irritation, and edema.

2. Antimicrobial Test

The polyherbal face wash tablet was powdered, extracted with water, and tested for antimicrobial activity.

A. Anti-Bacterial Activity

Test organism: Staphylococcus aureus

Standard drug: Clindamycin

Nutrient broth and nutrient agar were prepared and sterilized.

The bacterial culture was incubated at 37°C for 48 hours.

Disc diffusion method was used by inoculating agar plates and placing discs soaked with the tablet extract.

After incubation, the zone of inhibition was measured in mm.

B. Anti-Fungal Activity

Test organism: Candida albicans

Standard drug: Fluconazole

Nutrient broth and agar media were prepared and sterilized.

The fungal culture was incubated at 37°C for 48 hours.

Disc diffusion method was used to evaluate antifungal activity.

The zone of inhibition was measured in mm after incubation.

9. RESULT AND CONCLUSION

Table:3 PREFORMULATION STUDIES

SNO	PARAMETER	RESULT	NORMAL RANGE
1	BULK DENSITY	0.42 g/cm^3	0.3-0.6 g/cm^3
2	TAPPED DENSITY	0.51 g/cm^3	0.4-0.8 g/cm^3
3	HAUSNER'S RATIO	1.21	1-1.25
4	COMPRESSIBILITY INDEX	17.6%	5-20%

5	ANGLE OF REPOSE	20.4°	<30°

Table: 4 POST COMPRESSION STUDIES

SNO	PARAMETER	RESULT	NORMAL RANGE
1	WEIGHT VARIATION(mg)	505±25.25	±5%
2	HARDNESS	3.4kg/cm³	2-5kg/cm³
3	THICKNESS	2.7mm	2.5-4.5mm
4	FRIABILITY	0.52%	<1%

Table: 5 PHYSICAL EVALUATION

SNO	PARAMETER	RESULT	NORMAL RANGE
1	APPEARANCE	UNIFORM, SMOOTH,ROUND TABLETS	UNIFORM, NO CRACKS OR DEFECTS
2	COLOUR	HERBAL BROWN	NATURAL HERBAL COLOUR
3	ODOUR	PLEASANT	MILD, PLEASANT
4	WASHABILITY	EASILY WASHABLE WITH WATER	WASHABLE, NO RESIDUE
5	pH	5.9	5-7
6	FOAM HEIGHT	10cm	3-15cm
7	FOAM STABILITY	5 MINUTES	≥3 MINUTES
8	FOAMABILITY	GOOD	MODERATE TO GOOD FOAM

Table: 6 BIOLOGICAL EVALUATION

SNO	MICROBIAL STRAIN	CONCENTRATION IN µg/ml & ZONE OF INHIBITION IN mm			
		Antibiotics(standard)		20µg	40µg
		Clindamycin	Fluconazole		
1	Staphylococcus aureus	25	-	8	9
2	Candida albicans	-	12	9	9.5

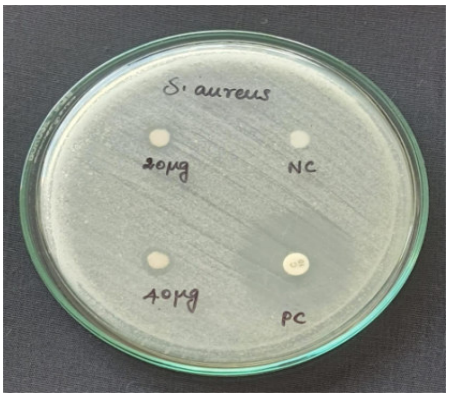


Fig:3 This image shows zone of inhibition of staphylococcus aureus against blank, polyherbal facewash tablet and standard drug

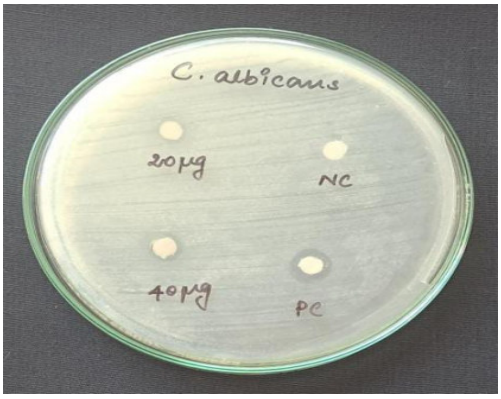


Fig:4 This image shows zone of inhibition of candida albicans against blank, polyherbal facewash tablet and standard drug

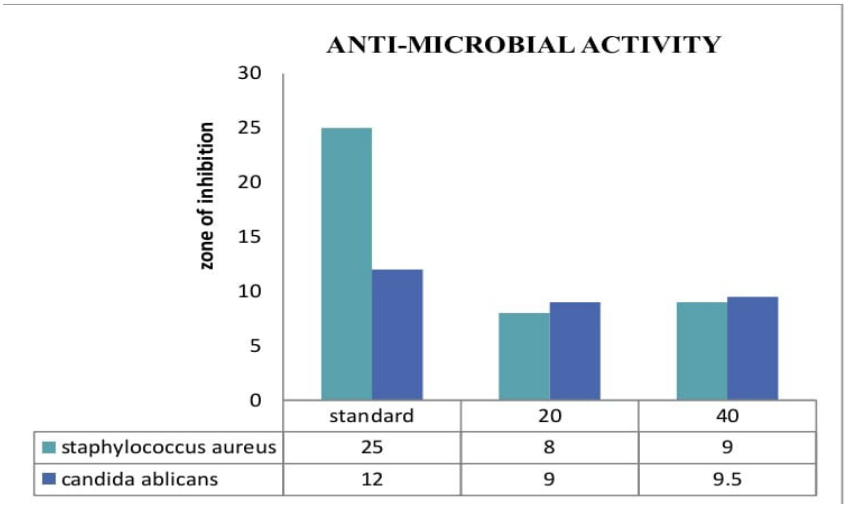


Fig: 5 This histogram shows the comparative anti-microbial activity of standard and test sample

10. CONCLUSION

The present study successfully formulated a polyherbal facewash tablet using selected medicinal herbs by the wet granulation method. Preformulation and post-compression studies indicated good flow properties, compressibility, and acceptable tablet characteristics. The formulation showed satisfactory physicochemical properties, effective cleansing action, and good foaming ability. Phytochemical analysis confirmed the presence of active constituents, and antimicrobial studies demonstrated significant activity against skin pathogens. Overall, the developed formulation is safe, effective, eco-friendly, and a promising alternative to conventional liquid facewash products for herbal skincare applications.

11.ACKNOWLEDGEMENTS

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