

OPTIMIZATION, FORMULATION AND EVALUATION OF HERBAL FACEWASH TABLET WITH ANTIOXIDANT PROPERTY

Jeslin Eliya Johnson¹, Gouthami V², Steve Sunny³, Aiswarya V S⁴, Haripriya S Nair⁵

Corresponding Author:

Mrs. Jency Abraham

M Pharm , Assistant Professor

Department of Pharmaceutics

Nazareth College of Pharmacy

Mail id: stevesunnyxyz@gmail.com

Ph no: +91 95443 72476

ABSTRACT

Traditional liquid facewashes contain synthetic preservatives, generate plastic waste, and lack portability. The development of a novel facewash tablet utilizing *Eleusine coracana* (Ragi), *Camellia sinensis* (Green tea), and *Aloe barbadensis* (Aloe vera) as active ingredients aims to provide a portable, eco-friendly, and sustainable alternative to liquid facewashes. Ragi has mild mechanical exfoliation and antioxidants (phenolic compounds, Vitamin E and flavonoids) which help improve skin texture, pigmentation, and elasticity. Green tea enhances the formulation with polyphenols, particularly epigallocatechin gallate (EGCG), which exhibits antimicrobial, strong antioxidant, and anti-inflammatory activity. Aloe vera enhances hydration, skin repair and makes the formulation suitable for irritated and sensitive skin.

Keywords: Herbal face wash tablet, Optimization method, Box-Behnken design, Tablet formulation

INTRODUCTION

Cosmetics are legally defined under Section 3 of the Drugs and Cosmetics Act, 1940 as articles intended for application to the human body for cleansing, beautifying, or enhancing appearance, including components used in cosmetic preparations. In recent years, the concept of cosmeceuticals has emerged, representing cosmetic formulations containing biologically active substances that offer additional therapeutic benefits beyond conventional cosmetic action. Facial cleansers are routinely used to remove sebum, dirt, dead cells, and environmental contaminants from the skin surface. However, many marketed liquid face wash products contain synthetic surfactants such as sodium lauryl sulphate, which have been associated with irritation, impairment of the skin barrier, and alterations in the cutaneous microbiome following repeated exposure. These concerns have driven growing consumer interest in herbal and naturally derived cosmetic products with improved safety profiles.

Traditional medicinal systems in India and other Asian countries have relied on plant-based preparations for skincare for centuries. Herbal ingredients are rich sources of phytochemicals such as phenolics and flavonoids, which exhibit antioxidant, anti-inflammatory, antimicrobial, and anti-aging properties. Ragi (*Eleusine coracana*) and green tea (*Camellia sinensis*) are recognized for their strong antioxidant potential, while aloe vera (*Aloe barbadensis*) is valued for its soothing, moisturizing, and wound-healing properties. When combined, these botanicals may provide synergistic protective effects against oxidative stress and microbial colonization of the skin. Despite widespread acceptance, liquid face wash formulations present limitations such as leakage during transport, higher preservative requirements, and susceptibility to moisture-related instability. Solid cosmetic dosage forms, such as tablets, offer advantages including improved stability, portability, reduced packaging waste, and minimized use of synthetic preservatives. Therefore, the present study focuses on the development and optimization of a novel herbal face wash tablet incorporating ragi, green tea, and aloe vera, followed by evaluation of its physicochemical characteristics, antioxidant activity, antibacterial potential, and stability.

LIST OF MATERIALS

Table No:1:List of Materials used for Preparation of Formulation

Sl. No	List of Materials	Role
1	Ragi	Antioxidant
2	Green tea	Antioxidant
3	Aloe vera	Antimicrobial
4	Reetha	Surfactant
5	Sodium starch glycolate	Disintegrant
6	Microcrystalline cellulose	Filler
7	HPMC	Binder
8	Magnesium stearate	Lubricant
9	Lavender oil	Fragrance

Materials and preparation of powder

Eleusine coracana, belonging to the family Poaceae, *Camellia sinensis*, belonging to the family Theaceae and *Aloe barbadensis*, belonging to the family Asphodelaceae, were sourced from local market and authenticated by Dr Dintu K.P, Assistant Professor, Department of Botany, Fathima Matha National College, Kollam. Reetha purchase from RK world Infocom Pvt Ltd, MCC from Bangalore fine chemicals, HPMC from shri Vilaksh enterprises, SSG from Bioven ingredients, Mg stearate from Moril fox and Lavender oil from Cargo enterprises. *Eleusine coracana* and *Camellia sinensis* were shade-dried, *Aloe barbadensis* was tray-dried at 40- 500 °C and all these were ground using a mechanical grinder and stored in a dry screw capped bottle.

FORMULATION TABLE

Table No:2: Formulation Chart of Herbal Facewash Tablet

Ingredients	<i>Eleusine coracana</i>	<i>Camellia sinensis</i>	<i>Aloe barbadensis</i>	Reetha	MCC	HPMC	SSG	Magnesium stearate	Lavender oil
F1	180 mg	110 mg	120 mg	160 mg	199 mg	74 mg	70 mg	5 mg	QS
F2	180 mg	110 mg	120 mg	120 mg	199 mg	86 mg	70 mg	5 mg	QS
F3	180 mg	110 mg	120 mg	200 mg	199 mg	74 mg	90 mg	5 mg	QS
F4	180 mg	110 mg	120 mg	200 mg	199 mg	86 mg	90 mg	5 mg	QS

F5	180 mg	110 mg	120 mg	200 mg	199 mg	74 mg	70 mg	5 mg	QS
F6	180 mg	110 mg	120 mg	200 mg	199 mg	86 mg	70 mg	5 mg	QS
F7	180 mg	110 mg	120 mg	160 mg	199 mg	74 mg	90 mg	5 mg	QS
F8	180 mg	110 mg	120 mg	160 mg	199 mg	86 mg	90 mg	5 mg	QS
F9	180 mg	110 mg	120 mg	160 mg	199 mg	80 mg	80 mg	5 mg	QS
F10	180 mg	110 mg	120 mg	160 mg	199 mg	80 mg	80 mg	5 mg	QS
F11	180 mg	110 mg	120 mg	240 mg	199 mg	74 mg	70 mg	5 mg	QS
F12	180 mg	110 mg	120 mg	200 mg	199 mg	86 mg	90 mg	5 mg	QS
F13	180 mg	110 mg	120 mg	200 mg	199 mg	80 mg	80 mg	5 mg	QS
F14	180 mg	110 mg	120 mg	200 mg	199 mg	76 mg	75 mg	5 mg	QS
F15	180 mg	110 mg	120 mg	200 mg	199 mg	84 mg	85 mg	5 mg	QS
F16	180 mg	110 mg	120 mg	240 mg	199 mg	78 mg	78 mg	5 mg	QS
F17	180 mg	110 mg	120 mg	240 mg	199 mg	82 mg	82 mg	5 mg	QS

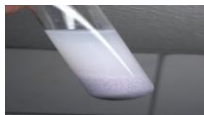
EXPERIMENTAL DESIGN

In Design Expert software, version 11, we used a 33 three-level factorial design [17] to optimize the binder, disintegrant, and surfactant. After the optimization, we formulated the tablets and evaluated for disintegration and friability.

Table No:3: Observed Values of Responses

Std	Run	Factor 1	Factor 2	Factor 3	Response 1	Response 2
		A: conc of binder (mg)	B: conc of disintegrant (mg)	C: amount of surfactant (mg)	Disintegration time (min)	Friability (%)
15	1	74	70	160	6.9	0.74
7	2	86	70	120	7.7	0.73
16	3	74	90	200	5.7	0.62
14	4	86	90	200	6.4	0.65
17	5	74	70	200	5.9	0.68
13	6	86	70	200	7	0.7
10	7	74	90	160	5.5	0.60
5	8	86	90	160	6.3	0.63
6	9	80	80	160	5.4	0.59
9	10	80	80	160	5.4	0.58
8	11	74	70	240	5.2	0.61
3	12	86	90	200	5.7	0.66
1	13	80	80	200	5.5	0.60
2	14	76	75	200	6	0.62
4	15	84	85	200	6.7	0.64
11	16	78	78	240	5.3	0.61
12	17	82	82	240	5.5	0.60

PHYTOCHEMICAL SCREENING**Table No:4: Phytochemical screening**

<u>SL.NO</u>	<u>Phytoconstituents</u>	<u>Observation</u>	<u>Inference</u>	<u>picture</u>
1	Alkaloids	Appearance of pale yellow precipitate	Presence of Alkaloids	
2	Flavonoids	Appearance of white precipitate	Presence of Flavonoids	

3	Glycosides	Appearance of bluish green to reddish brown color	Presence of Glycosides	
4	Steroids	Appearance of reddish-brown ring at the center of the liquid	Presence of Steroids	
5	Tannins	Appearance of greenish black color	Presence of Tannins	
6	Carbohydrates	Appearance of violet ring at the center of the liquid	Presence of Carbohydrates	

RESULT AND DISCUSSION

ANOVA FOR QUADRATIC MODEL- DISINTEGRATION TIME

Response 1: Disintegration time

Table No:5: Anova for disintegration time

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	8.12	9	0.9027	29	< 0.0001	significant
A-conc. Of binder	0.6737	1	0.6737	21.64	0.0023	
B-conc of Disintegrant	0.5047	1	0.5047	16.21	0.005	
C-amount of surfactant	1.18	1	1.18	37.88	0.0005	
AB	0.0025	1	0.0025	0.0795	0.7861	
AC	0.0522	1	0.0522	1.68	0.2366	
BC	0.6225	1	0.6225	20	0.0029	
A ²	0.798	1	0.798	25.64	0.0015	
B ²	0.5145	1	0.5145	16.53	0.0048	
C ²	0.0184	1	0.0184	0.5898	0.4676	
Residual	0.2179	7	0.0311			
Lack of Fit	0.2129	5	0.0426	17.03	0.0564	Not significant
Pure Error	0.005	2	0.0025			
Cor Total	8.34	16				

Table No:6: Fit Summary of Disintegration time

Source	Sequential p-value	Lack of Fit p- value	Adjusted R ²	Predicted R ²	
Linear	0.0105	0.0076	0.4659	0.3234	
2FI	0.4846	0.007	0.4505	-0.6212	
Quadratic	0.0003	0.0564	0.9403	0.7174	Suggested
Cubic	0.0564		0.9952		Aliased

Table No:7: Lack of Fit

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Linear	3.61	11	0.3286	131.45	0.0076	
2FI	2.86	8	0.3575	143	0.007	
Quadratic	0.2129	5	0.0426	17.03	0.0564	Suggested
Cubic	0	0				Aliased
Pure Error	0.005	2	0.0025			

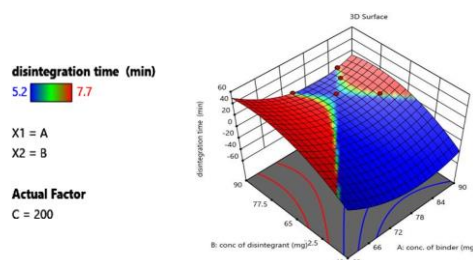


Fig No:1: 3D Surface of Disintegration time

Response 2: friability Test

Table No:8: ANOVA for friability Test

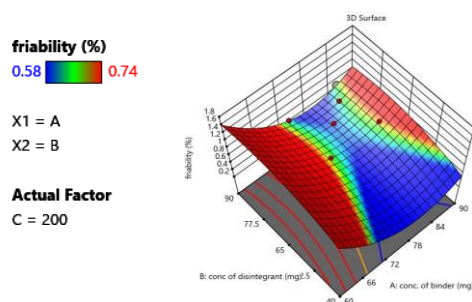
Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0367	9	0.0041	14.08	0.0011	significant
A-conc. of binder	0.0005	1	0.0005	1.62	0.2438	
B-conc of disintegrant	0	1	0	0.1094	0.7506	
C-amount of surfactant	0.0065	1	0.0065	22.45	0.0021	
AB	0.0001	1	0.0001	0.487	0.5078	
AC	0.001	1	0.001	3.32	0.1113	
BC	0.004	1	0.004	13.67	0.0077	
A ²	0.0005	1	0.0005	1.77	0.2255	
B ²	0	1	0	0.1583	0.7026	
C ²	0	1	0	0.1435	0.7161	
Residual	0.002	7	0.0003			
Lack of Fit	0.0019	5	0.0004	7.7	0.1189	not significant
Pure Error	0.0001	2	0.0001			
Cor Total	0.0387	16				

Table No:9: Fit Summary of Friability Test

Source	Sequential p-value	Lack of Fit p-value	Adjusted R ²	Predicted R ²	
Linear	0.0609	0.0243	0.2883	0.082	
2FI	0.4441	0.0229	0.2835	-1.5791	
Quadratic	0.0012	0.1189	0.8803	0.4523	Suggested
Cubic	0.1189		0.9793		Aliased

Table No:10: Lack of Fit

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Linear	0.0223	11	0.002	40.5	0.0243	
2FI	0.0172	8	0.0022	43.07	0.0229	
Quadratic	0.0019	5	0.0004	7.7	0.1189	Suggested
Cubic	0	0				Aliased
Pure Error	0.0001	2	0.0001			

**Fig No:2: 3D Surface of friability Test**

From design expert software F9 was selected as the optimized formulation. Further evaluation test was carried out for F9.

ORGANOLEPTIC EVALUATION

Table No:11: Organoleptic evaluation

SL.NO	PARAMETERS	OPTIMIZED FORMULATION
1	Shape	Round
2	Color	Light Brown
3	Odour	Pleasant
4	Texture	Smooth

**Fig No:3: Formulation of Herbal Facewash**

Table No:12: Evaluation Parameters Data

Parameters	Optimized Formulation(F9)	Mean±SD
pH	Good	6.17±0.04
Weight variation	Good	1.21±0.21
Thickness	Good	4.17±0.15
Foaming	Good	Good
Washability	Excellent	Excellent
Hardness	Good	2.00±0.20
Friability	Good	0.65±0.02
Disintegration time	Good	5.40±0.30

In vitro Antibacterial study

The *in vitro* antibacterial activity of the herbal face wash tablets was evaluated using the zone of inhibition method against *Staphylococcus aureus*. The formulations exhibited significant antibacterial activity compared to the standard tetracycline, indicating their potential effectiveness against *Staphylococcus aureus* associated skin infections.

Table No:13: Antimicrobial Activity

SL.NO	FORMULATION	ZONE OF INHIBITION
1	Sample	14.2
2	Control	15.0

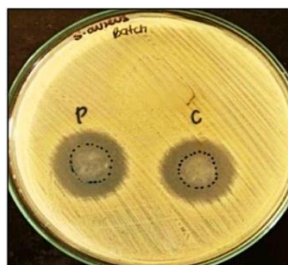


Fig No:4: Antimicrobial Activity

In vitro Antioxidant activity by DPPH assay

The herbal facewash tablet has been shown to possess antioxidant properties. Herbal Facewash Tablet extract has shown *in-vitro* antioxidant activity by DPPH assay in the current investigation. At 200 mg/ml Herbal Facewash Tablet, the inhibition percentage is 72.37% And the IC₅₀ value was found to be 35.00 mg/ml compared to the standard ascorbic acid IC₅₀ value of 15.00 mg/ml.

Table No:14: Antioxidant values

Concentrations (µg/mL)	Absorbance	Percentage of Inhibition (%)
Control	0.304	0.0000
Standard-Ascorbic acid		
12.5	0.141	53.6184
25	0.107	64.8026

50	0.081	73.3553
100	0.055	81.9079
200	0.019	93.7500
Sample code-PC		
12.5	0.179	41.1184
25	0.163	46.3816
50	0.125	58.8816
100	0.104	65.7895
200	0.084	72.3684



Fig No:5: DPPH Assay

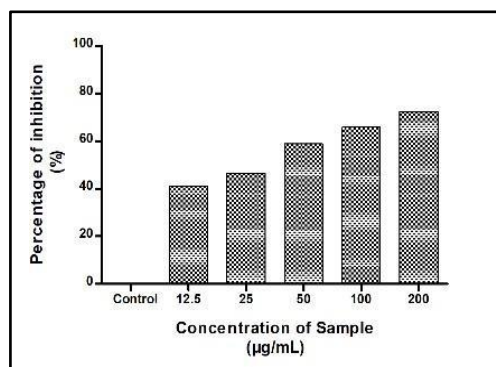


Fig No:6: Graph of Sample

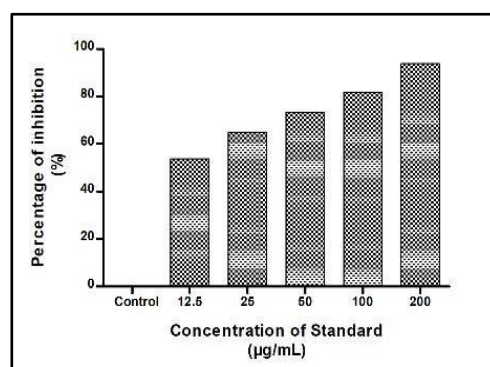


Fig no:7: Graph of Standard

CONCLUSION

The present investigation successfully developed and optimized a herbal face wash tablet containing ragi, green tea, and aloe vera with acceptable physiochemical properties, rapid disintegration, and satisfactory foaming characteristics. The formulation demonstrated significant in vitro antioxidant and antibacterial activities, likely due to the synergistic effects of its herbal constituents, compared to conventional liquid formulations, the herbal facewash tablet offers advantages such as improved stability, reduced dependence on synthetic preservatives, enhanced probability, and environmental sustainability. Further clinical studies and long-term stability evaluations are recommended to confirm its safety, efficacy and commercial applicability

REFERENCES

1. Kushwaha V, Agrawal P, Das A, Gupta PK, Goel S. Cosmeceuticals. *Int J Pharm Sci Rev Res*. 2025;85(4):42–46.
2. Drugs and Cosmetics Act, 1940 (as amended). Government of India; 1940.
3. Kligman AM. Cosmeceuticals: A proposal. *Cosmet Toilet*. 1993; 108:37–38.
4. Sreelakshmi KP, Aswathi E, Rajan AP, Fousiya K, John MA. Preparation and evaluation of herbal face wash. *Int J Pharm Sci Rev Res*. 2025;85(4):136–140.
5. Dhruv D. The study of sodium lauryl sulfate toxicity. *J Clin Toxicol*. 2023;13(4):1–4.
6. Draelos ZD. The science behind skin care: cleansers. *J Cosmet Dermatol*. 2018;17(1):8–14.
7. Ananthapadmanabhan KP, Moore DJ, Subramanyan K, Misra M, Meyer F. Cleansers and skin barrier. *Dermatol Ther*. 2020;10(4):679–693.
8. Kumar S, Singh R, Malik JK. Herbal cosmetics: formulation and quality control. *Int J Drug Dev Res*. 2012;4(2):1–10.
9. Bijauliya RK, Alok S, Chanchal DK, Kumar M. A comprehensive review on herbal cosmetics. *Int J Pharm Sci Res*. 2017;8(12):4930–4949.
10. Devi PB, Vijayabharathi R, Sathyabama S, Malleshi NG, Priyadarisini VB. Finger millet polyphenols. *J Food Sci Technol*. 2014;51(6):1021–1040.