

Herbal alchemy; Formulation and Optimization of Polybotanical Multipurpose Body Lotion

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Abstract:

Lotions are the emulsion which are used for moisturizing and providing emollient action to the skin. Herbal body lotion is prepared from herbal extracts which can be used for multipurpose and also used in dry, oily, normal skin. synthetic lotions may sometimes cause allergic reactions like scaly skin, hence development of herbal body lotion gained importance as it overcomes the limitations of skin problems .provide rapid onset of action by releasing directly to body through skin .Extract of *Musa Acuminata* and *Terminalia Chebula* obtained by maceration method and can be formulated as herbal lotion to improve antibacterial and antioxidant action the formulated were evaluated for various parameters like PH, viscosity, spreadability, washability, homogeneity, presence of foreign particles smoothness, consistency and zone of inhibition.

Keywords: Herbal Lotions, extract of *Musa acuminata*, *Terminalia chebula*, *Aloe barbadensis*, antibacterial and antioxidant action.

INTRODUCTION

According to D and C act in 1940 and rules 1945,” Cosmetics is defined as any article intended to be rubbed, poured, sprinkled, sprayed, or otherwise introduced into the human body or any part of it with the purpose of cleansing, beautifying, enhancing attractiveness, or changing the appearance, and includes any article intended for use as a component of cosmetics.

Lotions are emulsion used for enhancing moisturizing and emollient property. Herbal extract body lotion provides a relevant property in reducing all skin side effects. When the skin gets hydrated, it smoothens, softens and provides a healthy skin. Thus, the development of herbal body lotion gained an importance as it overcomes the limitations of the dry skin and oily skin. When compared to other existing type of cosmetic, topical preparations lotions are considered most effective owing to its advantages over them which includes effective in the treatments for inflamed lesions ,Used for the delivery of medications such as antibiotics, antiseptics, antifungals, corticosteroids, anti-acne agents to the skin.

Therefore, the present study focuses on the formulation and optimization of herbal body lotion followed by their evaluation of their phytochemical characteristics, antioxidant activity, antibacterial potential and stability over time.

MATERIALS AND METHODS

Table 1: List of Materials used for preparation of herbal body lotion

Sl.NO	List of materials	Role
1.	Beeswax	Thickener
2.	Borax	Emulsifier
3.	Sodium Benzoate	Preservative
4.	Almond Oil	Emollient
5.	Distilled water	Vehicle

Procurement of materials

Musa acuminata, belonging to the family Asphodelaceae, *Terminalia Chebula* belonging to family Combretaceae 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. The excipients including borax, beeswax, sodium benzoate, along with methanol was obtained in its most reliable form from Isochem Laboratories Ltd. Angamaly, Kochi.

Musa acuminata and *Terminalia Chebula* were shade-dried, *Aloe barbadensis* was tray dried at 40-50 °C and all these were powdered using mortar and pestle which was later on stored and kept in dry, air tight containers. At the time of formulation, the desired powder is taken in required grams and mixed with methanolic extract and later on filtered to yield active extract of powdered compounds.

Method of preparation of Herbal body lotion

- Preparation of oil phase: Required amount of almond oil and beeswax melted together at the temperature of 75 °C.
- Preparation of aqueous phase: Weighed quantity of borax was dissolved in about 14 ml of distilled water, and heat it to 75 °C.
- Preparation of herbal phase:

Mix the aloe vera gel with methanolic extract of banana blossom, and Inknut.

Emulsification: Maintain the oil phase and aqueous phase at a constant temperature of 70 °C and add the aqueous phase to the oily phase, gradually with constant stirring, finally cooling down the mixture to about 40 °C add the herbal phase to the above mixture and store it in an air tight container at a cool dry place away from sunlight

FORMULATION TABLE

Table 2: Formulation of herbal body wash

Formulation	Banana blossom(g)	Aloe vera(ml)	Ink nut (g)	Almond oil (ml)	Beeswax (g)	Borax (g)	Preservative (g)	Distilled water (ml)
F3	2g	3ml	1g	3ml	1g	0.10g	0.1g	q. s

OPTIMIZATION AND FORMULATION

Optimization was conducted in Design Expert Software, version 11, we used a 3³ three-level factorial design to optimize the significant actions of herbal body lotions. After optimization, we formulated the lotions and evaluated for its antioxidant, antimicrobial activity followed by other actions of lotions. **Table 3** shows the Box-Behnken design optimization of herbal body lotion

After the optimization study, the best performing experimental run F3 was selected as the optimized formulations.

Table 3: Box-Behnken design

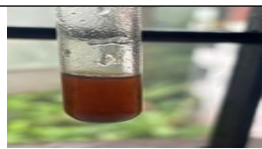
Std	Run	A: oil phase concentration %w/v	B: emulsifier concentration %w/v	C: Polyherbal extract %w/v
9	1	15	3	2
14	2	15	4.5	4
15	3	15	4.5	4
1	4	10	3	4
16	5	15	4.5	4
7	6	10	4.5	6
6	7	20	4.5	2
5	8	10	4.5	2

13	9	15	4.5	4
17	10	15	4.5	4
4	11	20	6	4
10	12	15	6	2
2	13	20	3	4
3	14	10	6	4
11	15	15	3	6
8	16	20	4.5	6
12	17	15	6	6

PRELIMINARY PHYTOCHEMICAL ANALYSIS OF POWDERS

Preliminary phytochemical screening was conducted for *Musa acuminata*, *Terminalia Chebula*, *Aloe barbadensis miller* to identify the primary, secondary metabolites present which are responsible for their significant action.

Table 4: Phytochemical screening

SL.NO	Phytoconstituents	Observations	Inference	Picture
1.	Flavonoid's	Immediate Formation of red colour	Presence of Flavonoids	
2.	Phenol	Appearance of orange-red colour	Presence of Phenol	
3.	Tannin	Formation of greenish black precipitate	Presence of Tannin	
4.	Saponin	Formation of 1cm layer stable foam is observed	Presence of Saponin	
5.	Alkaloid	Formation of reddish-brown precipitate	Presence of Alkaloid	

RESULTS AND DISCUSSION

ANOVA for QUADRATIC MODEL

ANTIMICROBIAL ACTIVITY**Table 5: Anova for quadratic Model**

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	92.27	9	10.25	8.81	0.0045	significant
A-oil phase concentration	0.3872	1	0.3872	0.33327	0.5821	
B-emulsifier concentration	4.50	1	4.50	3.87	0.09000	
C-Polyherbal extract	59.19	1	59.19	50.86	0.0002	
AB	1.0000	1	1.0000	0.8593	0.3848	
AC	1.25	1	1.25	1.08	0.3337	
BC	1.0000	1	1.0000	0.8593	0.3848	
A2	10.78	1	10.78	9.26	0.0188	
B2	8.15	1	1.23	1.06	0.3385	
C2	1.75	1	10.78	9.26	0.0188	
Residual	100.41	7	1.16			
Lack of fit	1.75	3	0.5848	0.3660	0.7824	not significant
Pure Error	6.39	4	1.60			
Cor Total	100.41	16				

- **Fit Statistic of Antimicrobial activity**

Table 6: Fit Statistics of antimicrobial activity

Std. Dev.	0.48		R2	0.9189
Mean	16.38		Adjusted R	0.8146
C.V.%	2.93		Predicted R	0.6210
			Adeq	9.1009

			Precision	
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- Fit Summary antimicrobial activity

Table 7: Fit Summary Antimicrobial activity

Source	Sequential p-value	Lack of fit p-value	Adjusted R2	Predicted R2	
Linear	0.0034	0.2499	0.5546	0.45626	
2FI	0.8054	0.1705	0.4728	0.1807	
Quadratic	0.0155	0.7824	0.8146	0.6210	Suggested
Cubic	0.7824		0.7454		Aliased

Table 8: Lack of Fit test for antimicrobial activity

Source	Sum of Squares	df	Mean Square	F-Value	p-value	
Linear	570.29	9	63.37	13.48	0.0117	
2FI	435.98	6	72.66	15.46	0.0097	
Quadratic	87.43	3	29.14	6.2	0.0551	Suggested
Cubic	0	0				Aliased
Pure Error	18.8	4	4.7			

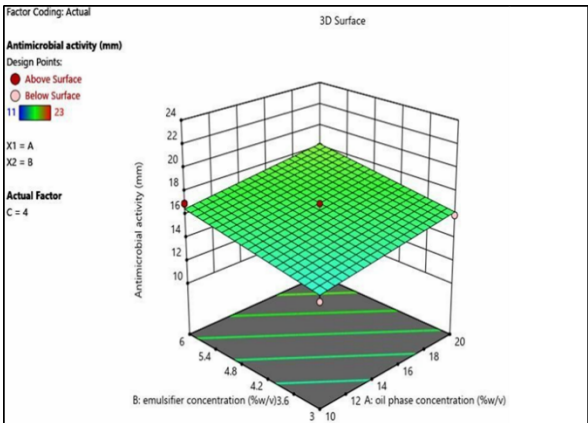
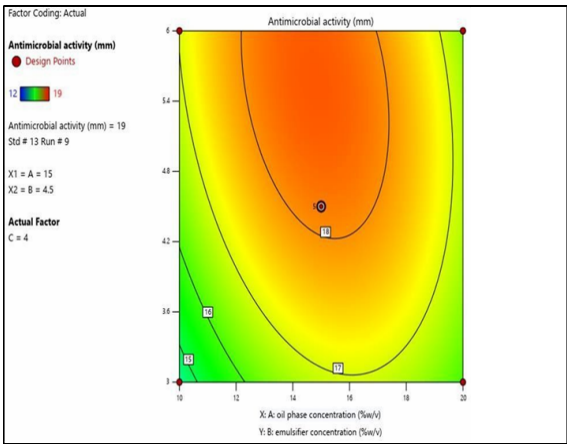


Fig No.1: Contour Plot for Antimicrobial activity

Fig No.2: 3D Surface plot for antimicrobial activity

PREFORMULATION STUDY OF HERBAL BODY LOTION

- Table 9: Preformulation of herbal body lotion

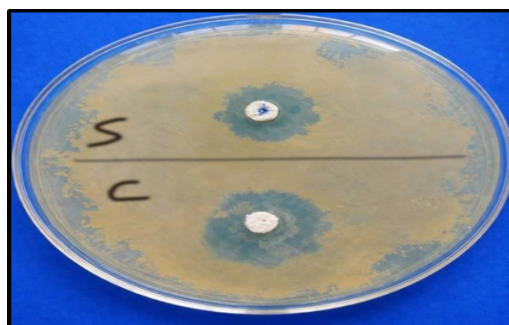
Parameters	Formulation
Colour	White
Odour	Pleasant odour
Texture	Smooth
pH	5.25 $\pm$ 0.022
Viscosity	3950 $\pm$ 0.40
Spreadability	9.85 $\pm$ 0.17

IN VITRO ANTIBACTERIAL STUDY

The *in vitro* antibacterial activity of the herbal body lotion was evaluated using the zone of inhibition technique by its action against *Staphylococcus aureus*. The formulations showcased accurate antibacterial activity when compared against the standard tetracycline. Indicating their significant action against skin infections and other skin diseases with *Staphylococcus aureus* as causative agent.

Table 10: Antibacterial activity

Optimized Formulation	Zone Of Inhibition(mm)
F3	19mm
Control	24mm

Fig no.3: Zone of inhibition of herbal body lotion against *S.aureus*

IN VITRO ANTIOXIDANT ACTIVITY BY DPPH ASSAY

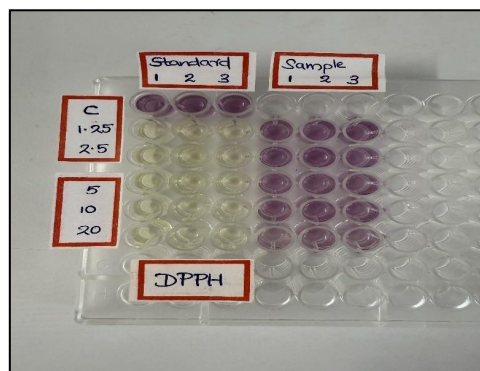


Figure No 4: Antioxidant activity by DPPH assay

The antioxidant activity of test sample was detected in comparison with ascorbic acid across the three independent experimental sets. Both the standard and the sample exhibited a concentration dependent increase in percentage inhibition over the tested range of 1,25-20 μL . Ascorbic acid demonstrated pronounced radical scavenging activity, with mean percentage inhibition values increasing from $53.50 \pm 0.62\%$ at 1.25 μL to $92.06 \pm 0.24\%$ at 20 μL . Consistent inhibition profiles were observed across all replicates, as reflected by the low standard deviation and standard error values obtained from ANOVA analysis.

The test sample also showed a progressive increase in antioxidant activity with increasing concentration. The mean percentage inhibition ranged from $50.0 \pm 0.425\%$ at 1.25 μL , although the inhibitory activity of the sample was lower than that of the standard at corresponding concentrations, reproducible responses were observed across all experimental sets.

The IC_{50} value for ascorbic acid was determined to be 1.1688 μL , whereas the test sample exhibited an IC_{50} value of 59.5601 μL , indicating lower antioxidant potency relative to the standard.

Table 11: Antioxidant activity

Concentrations (μL)	Absorbance	Percentage of Inhibition (%)
Control	0.665	0.0000
Standard- Ascorbic acid		
1.25	0.301	54.7368
2.5	0.237	64.3609
5	0.163	75.4887
10	0.114	82.8571

20	0.056	91.5789
Sample code- Sample		100.0000
1.25	0.330	50.3810
2.5	0.310	54.8920
5	0.273	59.4609
10	0.245	63.9112
20	0.216	68.4262

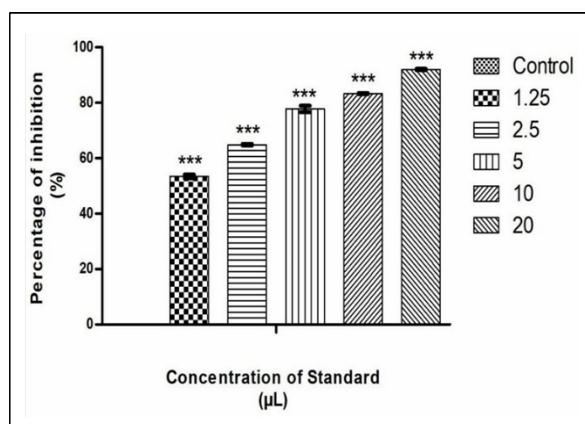


Figure No.5: Standard graph

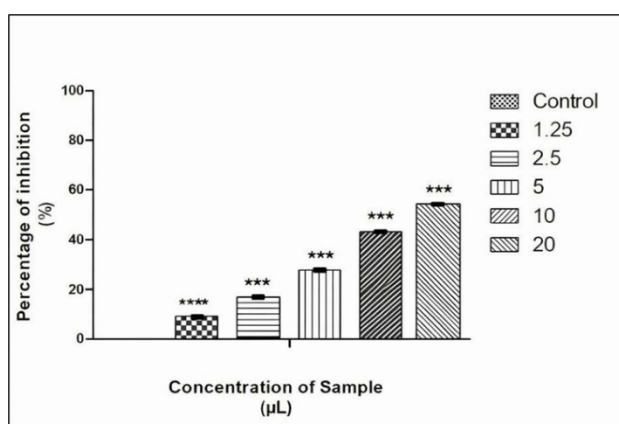


Fig no.6: Sample graph

Stability studies

Stability studies conducted on the optimized formulation F3 showed no significant changes in pH, appearance, or homogeneity during the study period, indicating acceptable formulation stability. The stability studies were conducted for a time period of 1 month in accordance with standard ICH guidelines.

Table 12: Stability studies

Parameter	initial	After 1 month
Colour	white	White
odour	Pleasant odour	Pleasant odour
Texture	smooth	smooth
pH	5.22	5.22
viscosity	3950	3950

DISCUSSION

The present study focused on the formulation and evaluation of a polyherbal body lotion containing extracts of *Musa acuminata*, *Terminalia chebula*, *Aloe vera* for topical application with antioxidant and antimicrobial potential. Formulation and optimization were carried out using Design of Experiment (DOE) Software, and formulation F3 was selected as the optimized formulation based on desirable physicochemical and biological properties. Preliminary phytochemical screening confirmed the presence of bioactive constituents such as flavonoids, phenolics, alkaloids, saponins and tannins, supporting the therapeutic relevance of the selected herbal extracts. Evaluation parameters include appearance, homogeneity, pH, viscosity, spreadability, washability, and stability. The formulation exhibited good homogeneity, smooth texture, and absence of grittiness, with a skin compatible pH of 5.22. viscosity and spreadability values (9.83 ± 0.17) indicated good consistency, ease of application, and physical stability. Antimicrobial activity against *Staphylococcus aureus* demonstrated significant inhibitory effects, while antioxidant activity assessed by the DPPH assay confirmed notable free radical scavenging potential. Stability studies showed no significant changes in physicochemical characteristics. Overall, the optimized polyherbal body lotion F3 demonstrated satisfactory physicochemical properties, effective antioxidant and antimicrobial activity, and good stability, indicating its suitability for topical application and further pharmaceutical development.

CONCLUSION

In the present study, a herbal body lotion was successfully formulated using extracts of *Musa acuminata*, *Terminalia chebula*, and *Aloe barbadensis* Miller, selected for their antioxidant and antimicrobial properties. The herbal approach to skin care primarily focuses on cleansing, nourishing and moisturizing effects. Along with the herbal extracts, viscosity enhancers were incorporated to enhance the overall stability and performance of the formulation.

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