

**FORMULATION, DEVELOPMENT AND EVALUATION OF DUAL-PURPOSE
ANTIMICROBIAL POLYHERBAL GEL: FACEWASH AND HANDWASH**

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ABSTRACT

Nosocomial infection has emerged as a critical issue in hospital care outcome, resulting in substantial morbidity and mortality. The hands of healthcare workers are the primary routes of transmission of infection to patients. Hence it brings up the use of antiseptic for handwashing purposes. Many of the antiseptic available in market are alcohol-based sanitizers which have some shortcomings or adverse effects and their frequent use can lead to skin irritation. Carica papaya is one of the most widely used and well documented medicinal plant in the world. This study is aimed to formulate effective herbal handwash using Manilkara zapota, Trigonella foenum-graecum and Carica papaya seed extracts with emphasis on safety and efficacy and to avoid risk occurred by synthetic antimicrobials. Evaluation of antimicrobial activity of prepared polyherbal gel was performed against skin pathogens using disc diffusion method. Its efficacy was checked and compared with commercial product. Results of this study revealed that formulated gel as a skin cleanser was more efficient in reducing the number of microorganisms from human skin than the commercial antiseptic soaps, so it can be used as an antiseptic with less or no side effects. Also some of the in vitro evaluations tests were also performed on prepared formulation and this study was compared with some marketed herbal formulations.

KEYWORDS: Polyherbal gel, handwash and facewash, Carica papaya, Manilkara zapota, Trigonella foenum-graecum.


1. INTRODUCTION





The skin is the largest organ of the body, accounting for about 15% of total adult body weight. It performs many vital functions, including protection against external, physical, chemical and biological assailants, as well as prevention of excess water loss from the body and role in thermoregulation. The skin is continuous, with the mucous membranes lining the body's surface. To keep skin healthy, clear, glossy, a balanced nutrition is

required. Apart from the balanced nutrition, hormonal changes especially during puberty in both sexes cause many changes in the body. Among various changes, dryness, roughness and pimples are most common. The pathogenesis of this are bacterial over growth and inflammation. To overcome this problem the use herbal remedies such as aloe vera, papaya, chikoo, fenugreek face wash gel has been formulated.^[1,2]

2. MATERIAL AND METHODS

Material

Sr. No.	Ingredients	Skin benefit	Figure
1.	Aloe vera (<i>Aloe vera</i> (L.) <i>Burm</i> , <i>Asphodelaceae</i>)	Moisturising agent, fight acne and smoothing effect to skin, also acts as antibacterial agent. ^[3]	

2.	Papaya (<i>Carica papaya</i> L., <i>Caricaceae</i>)	Removes dead skin cells from skin, act as antifungal and antibacterial agent. ^[4,5]	
3.	Chikoo (<i>Manilkara zapota</i> (L.) P Royen, <i>Sapotaceae</i>)	Used to remove warts and fungal growth on the skin. ^[6]	
4.	Fenugreek (<i>Trigonella foenum-graceum</i> L. <i>Fabaceae-Papilionaceae</i>)	Moisturizes the skin act as superb skin cleanser. Contain antioxidant and saponins. ^[7]	
5.	Hibiscus (<i>Hibiscus rosa sinensis</i> L. <i>Malvaceae</i>)	Gives Anti-Ageing effect to skin. ^[8]	

Chemicals

Chemicals Carbopol 934 (Merk Ltd), Methyl paraben and Propyl paraben (Fischer scientific India Pvt. Ltd.), Propylene glycol 400; Triethanolamine and Sodium Lauryl Sulphate (SD fine chemicals Ltd.) were collected from store room of college.

Plant collection and authentication

The plants like aloe vera and hibiscus flowers used for research work was collected from medicinal plant garden of Dr. Vithalrao Vikhe Patil College of Pharmacy, Ahmednagar (Viladghat). Fenugreek, Papaya seeds and Chikoo leaves powder were purchased from local market of Ahmednagar. The collected plants and plants parts were authenticated from Department of Botany, Radhabai Kale Mahila Mahavidhyalaya, Ahmednagar (M.S.) 414001

Preparation of plant extracts

Seeds of Papaya, Fenugreek and Chikoo leaves were grind separately to form coarse powder. Desired quantity of each herb was measured and macerated with distilled

water in conical flask. With addition of small amount of chloroform mix with water by moderate shaking of conical flask for 3 days. After 3 days content was filtered out by using simple filtration method and filtrates were collected separately. Freshly collected aloe vera and hibiscus flower sliced and extracts was prepared using grinder separately. Evaporation of plants extracts were done by using electronic water bath at 60⁰c separately, until desired concentration was obtained.^[2]

Method of Preparation of topical gel

Step-1: Preparation of gel base.

1.5 gm of Carbopol 940 dispersed in 50 ml of distilled water kept the beaker aside for 6 hours to complete swelling of Carbopol to form gel. Take 10 ml of distilled water in beaker and add propyl paraben and methyl paraben in it dissolved by heating on water bath. After complete dissolution solution was cooled and propylene glycol and sodium lauryl sulphate were added in required amount. This mixture was added in Carbopol 940 with continuous stirring.

Step-2: Preparation of polyherbal gel.

Sufficient quantity of gel base was taken in beaker and required amount of extracts as per formulation was added with continuous stirring. Extract of hibiscus act as coloring agent and perfume were added. Triethanolamine was added dropwise in formulation for adjustment of required pH and to obtained consistent gel.

Composition of polyherbal gel**Table 1: composition of gel base.**

Sr.no	Ingredient	Quantity
1.	Carbopol 940	1.5 gm
2.	Propyl paraben	0.2 gm
3.	Methyl paraben	0.1 gm
4.	Polyethylene glycol 400	5 ml
5.	Triethanolamine	1 ml
6.	Sodium lauryl sulphate	0.5 gm
7.	Distilled water	Q.S.

Table 2: Composition of Developed formulation.

Sr. No.	Ingredient Name	F1 (%w/w)	F2 (%w/w)
1.	Aloe vera extract	4%	8%
2.	Papaya seeds extract	3%	5%
3.	Chikoo leaves extracts	3%	5%
4.	Fenugreek seeds extract	5%	5%
5.	Hibiscus flower extract	2%	2%
6.	Perfume	0.1%	0.1%
7.	Gel Base	Q.S. (Up to 100 %)	Q.S. (up to 100%)

Marketed formulation

Himalaya neem herbal facewash.

3. Evaluation of Polyherbal Gel**Evaluation Parameters****A. Physical Evaluation**

Physical parameters such as colour, consistency was checked manually.

B. Washability

The product was applied on hand was observed under running water.

C. pH

pH of 1% aqueous solution of the formulation was measured by using a calibrated digital pH meter at constant temperature.^[9]

D. Viscosity

The measurement of viscosity of prepared polyherbal gel was done with Brookfield viscometer reading was taken at 100 rpm using spindle no.64.^[10]

E. Spreadability

500mg of the cream was sandwiched between 2 slides. A weight of 100gm was placed on upper slide. The weight was removed and extra formulation was scrapped off. The lower slide was fixed on board of apparatus and upper slide was fixed with nonflexible string on which 20g load was applied. Time taken by upper slide to slip off was noted down.^[11]

F. Extrudability

The gel formulation was filled in standard capped collapsible aluminium tubes and sealed by crimping to the end. The weight of tubes was recorded and the tubes were placed between two glass slides and were clamped. 500 gm was placed over the slides and then the cap was removed. The amount of extruded gel was collected and weighed. The percent of extruded gel calculated as

1. When it is greater than 90% then extrudability is excellent.

2. When it is greater than 80% then extrudability is good.

3. When it is 70% then extrudability is fair.^[12]

G. Irritancy Test

The cream was applied on left hand dorsal side surface of 1sq.cm and observed in equal intervals up to 24 hours for irritancy, redness and edema.^[13]

H. Stability of Polyherbal gel

Stability of the base and formulation were studied at different storage condition and assed for their physical characteristics like color, appearance and odor for 30 days. The results are shown in the table no: 4^[14]

I. Antimicrobial activity of polyherbal gel

Antimicrobial activity of polyherbal gel was done against microbial culture of *E. coli* and *S. aureus*, by using agar well diffusion method as described in research article. Marketed formulation of handwash used as a positive control and the gel base without extract used as a negative control. The formulations batches of F1 (Comp-1) and F2 (Comp-2) are evaluated for its antimicrobial activity. The zone of inhibition was calculated.^[15,16]

4. RESULT AND DISCUSSION

The prepared formulation was evaluated for the various evaluation parameter. The result of evaluation was displayed in Table 3.

Table 3: Result of evaluation parameter of polyherbal gel.

Formulation batch	Colour	Consistency	Washability	pH	Viscosity	Spredability	Extrudability	Skin Irritation
Marketed Formulation	Yellowish Green	Semisolid	Easily washable	6.22	19000 cp	Good	Good	No Sign
F1	Reddish green	Semisolid	Easily washable	6.43	19700 cp	Good	Good	No Sign
F2	Reddish green	Semisolid	Easily washable	6.15	18500 cp	Good	Good	No Sign

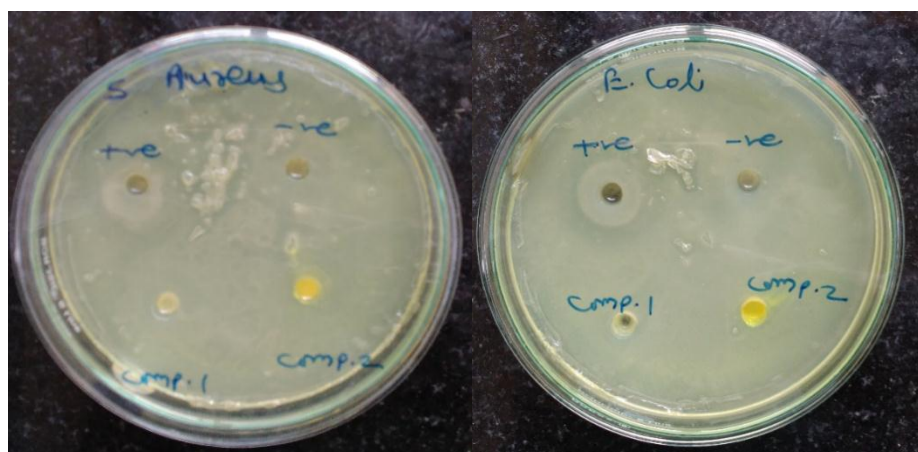
Developed polyherbal formulation was reddish green in colour; colour obtained due to hibiscus extract. whereas marketed formulation is yellowish green in colour. F1 and F2 formulation found to be semisolid consistency. All formulation was found homogeneous easily washable with slightly acidic pH which was compatible with skin physiology. Viscosity of polyherbal gel was determined by Brookfield viscometer and ranging between 18000-20000 cp. Spredability indicates that gel easily spreadable by small amount of shear. the result of skin

irritation studies indicate that prepared gel was free from various dermatological reaction.

Stability study of prepared polyherbal formulation was done at different storage condition Physical characteristics was assessed like colour, appearance and odour. The result is shown in Table 4. Formulation F2 showed no significant changes in colour, odor and appearance.

Table 4: Physical stability study of prepared polyherbal formulation.

Duration	Storage condition	Parameter					
		Appearance		Colour		Odor	
		F1	F2	F1	F2	F1	F2
7 days	8°C	Semisolid	Semisolid	Reddish green	Reddish green	Characteristic	Characteristic
	40°C	Semisolid	Semisolid	Reddish green	Reddish green	Characteristic	Characteristic
15 Days	8°C	Semisolid	Semisolid	Reddish green	Reddish green	Characteristic	Characteristic
	40°C	Semisolid	Semisolid	Reddish green	Reddish green	Characteristic	Characteristic
30 Days	8°C	Semisolid	Semisolid	Reddish green	Reddish green	Characteristic	Characteristic
	40°C	Slightly Liquid	Semisolid	Green	Green	Characteristic	Characteristic



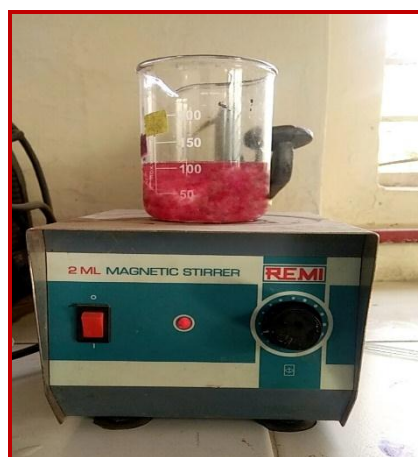
A. Antimicrobial activity against *S.Aureus* B. Antimicrobial activity against *E.Coli*

Figure 1 : Zone of inhibition of polyherbal Formulation against *S.aureus* and *E.coli*, +ve control used marketed formulation, -ve control used gel base and Comp-1&2 are F1 and F2 respectively.

Table 5: Antimicrobial sensitivity result of Polyherbal Formulation.

Test Organism	Zone of Inhibition(mm)			
	-ve Control	+ve Control	F1(Comp-1)	F2 (Comp-2)
<i>S. aureus</i>	1.96±0.1527	12.06±0.2516	4.03±0.2081	5.63±0.2081
<i>E. coli</i>	1.56±0.2081	11.53±0.2516	2.53±0.3055	4.9±0.2645

The result obtained in the antimicrobial activity of polyherbal gel formulation F1 and F2 against test microorganism *S. aureus* and *E. coli* are shown in the Table 5 and Figure 1 A and B shows the zone of inhibition of polyherbal gel. Formulation F2 shows better zone of inhibition as compare to F1. Because of varying concentration of extracts.

**Figure 2: Polyherbal Gel Formulation.**

5. CONCLUSION

Herbal formulation had a growing demand in world market. Formulations like face wash and hand wash are prepared separately. We try to formulate a single skin cleanser having a dual action for hand washing and as a face wash due to the ingredients used in it and optimized pH of formulation. It is inferred from result formulation have good appearance, homogeneity and spreadability. The results of antimicrobial activity show gel F2 having a better zone of inhibition. And the optimized formulation after stability study is formulation F2. After all evaluations it is conclude that F2 formulation having good effect like marketed formulation neither show any side effect on skin like skin irritation.

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