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## Development and Evaluation of Antibacterial Polyherbal Soap



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**Pravin V. Gomase<sup>\*</sup>, Mo. Javed Ahamad, Mohd Danish Salahuddin, Deshmukh N. I, Khan G. J.**

*Ali Allana College of Pharmacy Akkalkuwa,  
Nandurbar, Maharashtra*

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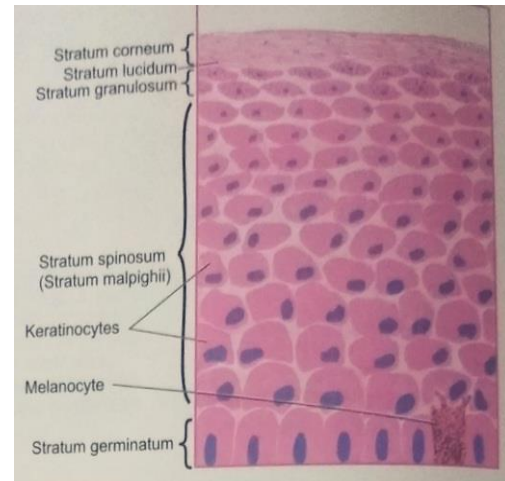
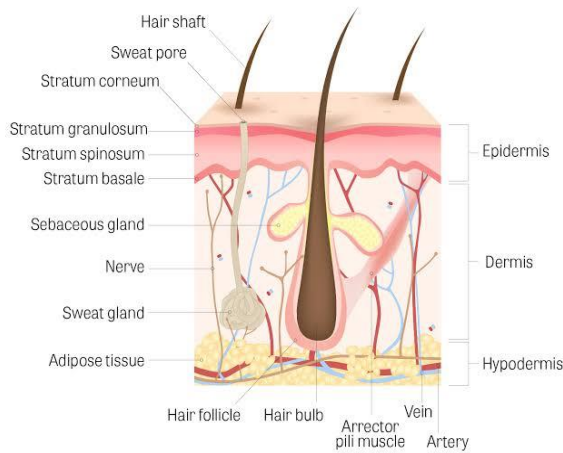
**Keywords:** *Curcuma longa*, *Azadirachta indica*, *Allium sativum*, *Staphylococcus aureus*, Herbal Soap

### ABSTRACT

Bacterial skin infections are most common amongst people, requiring significant attention for treatment and also to maintain healthy skin. Some herbal plant extracts have antibacterial activity. The aim and objective of the present study is to formulate antibacterial poly herbal bath soap using *Curcuma longa*, *Azadirachta indica*, *Allium sativum*. The antibacterial activity of the prepared formulation was tested using agar well diffusion method against the organism *Staphylococcus aureus*, *Escherichia coli*, *Aspergillus flavus*, and *Aspergillus niger*. The prepared polyherbal formulations exhibited a good antibacterial effect. The prepared formulations were evaluated for various physicochemical parameters for which good characteristics were observed. The easy availability of plant and their effectiveness helps manufacturers with cost-effective benefits and with less or no side effects.

## INTRODUCTION

The skin or cutaneous membrane covers the external surface of the body. It is the largest organ of the body in surface area and weight. The function of the skin is body temperature regulation, a reservoir for blood, protection from the external environment, cutaneous sensations, excretion and absorption, and vitamin D synthesis.<sup>1</sup>



**Figure No. 1: Components of skin**

**Figure No. 2: Normal epidermis cell**

Skin is the most exposed part of the body to the sunlight, environmental pollution and also to some protection against the pathogens. The most common skin disorders are eczema, warts, acne, rashes, psoriasis, allergy, etc.<sup>2</sup> *Staphylococcus aureus* (*S. aureus*) is a Gram-positive bacterium that can live as a commensal organism on the skin and in the nose and throat. Approximately 30% of healthy people are asymptotically colonized by *S. aureus*. *S. aureus* causes a range of infections, from minor skin infections to abscesses, endocarditis, and sepsis. *S. aureus* is also a major cause of food poisoning induced by heat resistant enterotoxin A and is a leading cause of nosocomial infections.<sup>3</sup>



**Figure No. 3: Skin infection**



**Figure No. 4: Skin infection**

To protect the skin from infectious microorganisms and their spreading the hand hygiene plays an important role to avoid the contagious diseases.<sup>4</sup> Many of the chemicals antiseptics are now available in the market as alcohol-based sanitizers, Chlorohexidine products, etc. This polyherbal soap or solution help reduce healthcare-associated transmission of contagious disease more effectively but they have some shortcomings or adverse effects.<sup>5</sup> Plants with medicinal properties are being used as a traditional medicine from times immemorial. The extract from the leaves, stem, and roots of various medicinal plants have been employed as a natural remedy in curing various ailments and diseases. Even though many plant-based products have been replaced by synthetic chemicals, the safety and efficacy of ayurvedic products could not find their match.<sup>6</sup> The advantage of using herbal drugs is that they are cheap, easily available and has fewer side effects in comparison to chemical products.<sup>7</sup> Therefore research has been increased tremendously towards making natural products with improved quality yet less expensive and no side effect over chemical products.<sup>8</sup> However, if these substances are isolated from herbs, their systematic use as herbal soap singly or in combination can become easier. Some such immensely beneficial herbs such as tea, soya, flax seed, tomato, ginseng, garlic, turmeric, neem oil, fenugreek, etc.<sup>9</sup> We, therefore, prepared herbal soap using plants extract like *Curcuma longa*, *Azadirachta indica*, *Allium sativum*. They have different medicinal and chemical properties useful for formulating poly herbal soap. The aqueous leaf extract exhibits various pharmacological properties such as anti-bacterial, anti-fungal as well as anti-inflammatory activities.<sup>10</sup> The extract with the best antibacterial and antioxidant activities was incorporated into a solid soap preparation.<sup>11</sup>

The *Allium sativum* (Garlic) is used as carminative, expectorant, stimulant and disinfectant in the treatment of pulmonary conditions. Allicin has antibacterial activity.<sup>12</sup> Almost all parts of the neem are medicinally useful. In traditional medicine, products prepared from neem are used for the treatment of diseases ranging from skin infections and cardiovascular disorder to diabetes even cancer. Neem kernel oil is useful in some chronic skin disease and ulcer. The oil is reported to have antiasthmatic, antiseptic and antifungal activities.<sup>13</sup> *Azadirachta indica* (Neem oil) possesses a wide spectrum antibacterial activity and has been extensively used in Ayurveda, Unani and Homoeopathic medicine.<sup>14</sup> *Curcuma longa* (Turmeric) rhizome has been traditionally used as an antimicrobial agent as well as an insect repellent. Several studies have reported the broad-spectrum antimicrobial activity for curcumin including antibacterial, antiviral, antifungal, and antimalarial activities.<sup>15</sup>

## **MATERIALS AND METHODS:**

### **Collection of Sample**

The fresh bulb of *Allium sativum* were collected from Akkalkuwa market and *Azadirachta indica* oil and *Curcuma longa* powder were collected from the laboratory of Ali Allana College of Pharmacy Akkalkuwa.

### **Preparation of Extracts**

The *Curcuma longa* powder was subjected for hot continuous extraction with 70 % of alcohol and 30 % of the water in the Soxhlet apparatus for 6 hours. After complete extraction, the solvent was evaporated and concentrated to dry residue.<sup>16</sup> The fresh bulb of *Allium sativum* was subjected for aqueous extraction in this the bulbs were crushed with mortar and pestle and filtered with a clean cloth and then poured into a closed airtight container.

### **Preparation of Formulations**

These three extracts that are *Curcuma longa*, *Azadirachta indica*, *Allium sativum* exhibited antimicrobial activity were prepared in combinations that are 250 mg each (750 mg) and these combinations of extracts were incorporated in the prepared formulation.

## Preparation of Basic Glycerin Soap

Table No. 1: Formulation of Glycerin Soap

Sr. No.	INGREDIENT	QUANTITY
1.	Distilled Water	32.7 gm
2.	Sodium Hydroxide	15.7 gm
3.	Palm Oil	34.0 gm
4.	Coconut Oil	35.3 gm
5.	Castor Oil	34.0 gm
6.	Glycerine	19.6 gm
7.	Ethyl Alcohol	38.0 gm
8.	Sugar	23.6 gm
9.	Distilled Water	17.0 gm

### Procedure for Basic Glycerin Soap

The lye solution was prepared by taking sodium hydroxide (15.7 gm) in distilled water (32.7 gm) into a non-metallic pan and heated at below 50°C temperature until the clear solution was obtained and then cooled. The solution of oil and fats was prepared, in which palm oil, coconut oil, and castor oil were heated at low temperature with occasional stirring and the lye solution was added in it. Place the lid on the slow cooker and allow the soap mixture to cook for several hours (around 3 hours) until it starts to get transparent. Mixed the alcohol and glycerine together and added them into the soap. Allowed the soap to cook, covered and sealed, for around 30 minutes. The sugar solution was prepared, in which sugar completely dissolved in the water at low to medium heat. After 30 minutes sugar solution was gently mixed with soap. Then cleared the foam of the soap, and carefully poured the soap into the soap molds. Then allowed to solidify at room temperature.<sup>17</sup>

### Preparation of Herbal Soap:

**Table No. 2: Formulation of Herbal Soap**

Sr. No.	INGREDIENT	QUANTITY
1.	Basic Glycerin Soap	22.44 gm
2.	Ethanol	100 ml
3.	Stearic Acid	0.66 gm
4.	Cinnamon Oil	20.0 ml
5.	Almond Oil	20.0 ml
6.	Drug Extract	30.0 gm

### Procedure for Herbal Soap:

The prepared basic glycerine soap was broken down into small pieces. Put into the pan and melted on the water bath below 60°C. The prepared extract combinations (30 gm) were added. Then 100 ml of ethanol was added. Then 0.66 gm of stearic acid, 20 ml of cinnamon oil and 20 ml of almond oil was also added into the melted soap. The all ingredients mixed for about 30 minutes. The liquid was poured into the molds then allowed to solidify at room temperature and observed the many changes in characteristics of prepared soap.<sup>18</sup>

### Evaluation of Physicochemical Parameters of the Prepared Formulation

#### Organoleptic evaluation

Organoleptic evaluation (color, and clarity) was done by sensory and visual inspection.

#### Determination of pH

The pH of prepared herbal formulation (soap) was determined by using a digital pH meter.

#### Determination of percentage free alkali

Dissolved 5 gm of prepared herbal soap in 50 ml of neutralized alcohol in a conical flask. Then boiled under the reflux on a water bath for 30 minutes. Then cooled and added 1 ml of phenolphthalein solution as an indicator. Then the solution was titrated with 0.1 HCL.

### **Foam Height**

Dissolved 0.5 gm of prepared soap in distilled water then make up the volume up to 50 ml with distilled water in 100 ml measuring cylinder. Measured the foam height, above the aqueous volume by given 25 strokes.

### **Foam Retention**

Prepared the 25 ml of the 1% soap solution and transferred into the 100 ml of measuring cylinder. Then the cylinder was shaken 10 times. The volume of foam was recorded at one minute for 4 to 5 minutes.<sup>19</sup>

### **Alcohol Insoluble Matter**

Dissolved 5 gm of prepared soap in warm ethanol. Then filter the solution with a tared filter paper. Then dried filter paper at 105°C. Then the weight of the dried paper was taken and calculated than % alcohol insoluble matter.

**Percentage of alcohol insoluble matter = weight of residue × 100 / weight of the sample**

### **RESULTS AND DISCUSSION:**

The evaluation of antibacterial poly herbal soap was performed successfully. The physicochemical parameters of polyherbal soap such as color, odor, appearance, pH were performed. The formulation has a dark brown color, aromatic odor, good appearance as well as the pH was found to be 7.5 which is desired pH. Other parameters like %Free Alkali, foam height, foam retention, and alcohol insoluble matter were also performed successfully that was found to be 0.35, 26cm, 3 min, and 10.6 % respectively.

**Physicochemical Parameter of Herbal Soap Formulation:**

**Table No. 3: Physicochemical Parameter of Herbal Soap Formulation**

Sr. No.	PARAMETER	RESULT
1.	Formulation	Soap
2.	Colour	Dark Brown
3.	Odor	Aromatic
4.	Appearance	Good
5.	pH	7.5
6.	% Free Alkali	0.35
7.	Foam Height (cm)	26 cm
8.	Foam Retention (min)	03 min
9.	Alcohol Insoluble Matter	10.6 %

**Antimicrobial testing of the prepared formulations:**

Preliminary antimicrobial sensitivity screening tests finding shown in the table that is given below. The antibacterial poly herbal soap formulation proved to be beneficial and had excellent activity against all tested organisms. A significant result obtain against *Staphylococcus aureus*, *Escherichia coli*, *Aspergillus flavus*, and *Aspergillus niger* was found to be 6 mm, 9 mm, 2 mm and 4 mm respectively.

**Table No. 4: Antimicrobial Testing on Herbal Soap**

Sr. No.	Sample Code	Microorganism			
		<i>E.coli</i>	<i>S. aureus</i>	<i>A. flavus</i>	<i>A. niger</i>
1.	Distilled water (Negative Control)	-	-	-	-
2.	Soap solution (1 %)	9	6	2	4



## CONCLUSION:

The plants *Curcuma longa*, *Allium sativum*, and *Azadirachta indica* were selected for the preparation of antibacterial polyherbal soap. According to this research, it was found that the extract of *Curcuma longa*, *Allium sativum*, and *Azadirachta indica* could be an effective alternative and economic than the other antibacterial soap. The alcoholic soxhlet extract indicated the highest percentage yield and the best antibacterial activity. The soap was subjected to antimicrobial screening. Results revealed that most of the 1% soap solution exhibited antibacterial effect and exhibited maximum activity with zones of inhibition from on *Staphylococcus aureus*, *Escherichia coli* that is 06 and 09 mm respectively. The prepared formulations when tested for antibacterial activity exhibited zones of inhibition 06 and 09 mm which was far better than the zones of inhibition of individual extracts. Further, the prepared soap formulations were standardized by evaluating various physicochemical properties such as pH, clearance, appearance, %Free Alkali, foam height, foam retention, alcohol-insoluble matter in which they exhibited satisfactory characters. However, these formulations need to be further standardized as good antibacterial and antifungal activity.

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