FORMULATION AND EVALUATION OF LIQUID HAND WASHING SOAP PREPARATION FROM ETHANOL EXTRACT FROM BINAHONG LEAVES

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Abstract

Binahong leaves (Anredera cordifolia) contain various bioactive compounds, including flavonoids, saponins, and polyphenols, which have antibacterial properties and potential applications in personal hygiene products. This study was conducted to develop a liquid hand soap formulation containing ethanol extract of binahong leaves and to evaluate its physicochemical characteristics in order to identify the optimum formulation. A formulation-based experimental design was employed, in which three hand soap formulations were prepared with varying concentrations of binahong leaf ethanol extract while maintaining the other formulation components at constant levels. A purposive sampling method was used for the collection of binahong leaves. Fresh and healthy leaves were selected based on specific inclusion criteria, including maturity, absence of physical damage, and freedom from pest infestation. The collected plant material was then cleaned, dried, and processed for ethanol extraction.. All formulations were prepared in triplicate, and samples from each batch were subjected to physicochemical evaluation. The obtained data were analyzed to compare the characteristics of the different formulations.. Three formulations were prepared with different concentrations of binahong leaf ethanol extract, namely Formula I (10%), Formula II (25%), and Formula III (35%). The prepared formulations were subsequently evaluated for their physicochemical properties, and the results were compared to determine the most suitable formulation.The liquid hand soap formulations were evaluated for organoleptic properties, homogeneity, pH, viscosity, foam height, and physical stability. The results showed that all formulations were homogeneous and met the general requirements for liquid hand soap preparations. Organoleptic evaluation indicated a characteristic brown color of the extract and a non-rancid odor. Among the tested formulations, Formula III containing 35% ethanol extract demonstrated the best physicochemical characteristics, with a pH value of 8.5, viscosity of 2,500 cPs, and foam height of 110 mm. Stability testing revealed that Formula III remained homogeneous without phase separation or significant physical changes during the observation period. The increased concentration of binahong leaf ethanol extract contributed to improved viscosity and foam stability while maintaining acceptable physical properties. Based on the overall evaluation, Formula III was identified as the optimum formulation of liquid hand soap containing binahong leaf ethanol extract. The results demonstrate that binahong leaf ethanol extract can be formulated into liquid hand soap and affects the physicochemical properties of the formulation. Further investigations are required to assess its biological activity and product performance.

Keywords: Anredera cordifolia, binahong leaf ethanol extract, liquid hand soap, formulation, physicochemical evaluation

1. INTRODUCTION

Hand hygiene is recognized as one of the most effective interventions for reducing the transmission of infectious microorganisms in community and healthcare settings (Price et al., 2022; Mouajou et al., 2022; Gozdzielewska et al., 2022). Increasing consumer demand for safer and environmentally friendly products has encouraged the development of herbal-based cleansing formulations containing plant-

derived antimicrobial compounds (Woo et al., 2023; Rybczyńska-Tkaczyk et al., 2023; Michalak, 2023). Hand hygiene is one of the most effective measures to prevent the transmission of infectious diseases. The use of liquid hand soap has increased significantly due to greater public awareness of personal hygiene and disease prevention. However, commercial hand soaps often contain synthetic antibacterial agents that may cause skin irritation, allergic reactions, or environmental concerns when used continuously. Therefore, the development of herbal-based hand soap formulations using natural antibacterial ingredients has attracted considerable attention in pharmaceutical and cosmetic research (WHO,2023), (Utami NR, et.all, 2025)

Binahong (Anredera cordifolia) is a medicinal plant widely used in Indonesia for traditional healthcare. Phytochemical investigations have demonstrated that binahong leaves contain various secondary metabolites, including flavonoids, phenolic compounds, tannins, saponins, alkaloids, steroids, and triterpenoids, which contribute to their antioxidant and antimicrobial activities (Souhoka et al., 2021; Sidhartha et al., 2024; Rusdiana et al., 2024). Previous studies have demonstrated that ethanol extract of Anredera cordifolia leaves exhibits antibacterial activity against various pathogenic bacteria, including Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Propionibacterium acnes, and Cutibacterium acnes, indicating its potential as a natural broad-spectrum antibacterial agent (Dominica et al., 2023; Sasebohe et al., 2023; Utami et al., 2025; Naufal et al., 2025). These biological properties suggest that binahong leaf extract has considerable potential as a natural active ingredient in topical cleansing products (Wris MAA, et.all, 2023), (Naufal MA, 2025), (Dominica D, et all, 2023).

Recent studies have investigated the incorporation of binahong leaf extract into various pharmaceutical and cosmetic dosage forms, including moisturizing gels, antiseptic ointments, lotions, solid soaps, and liquid soaps. The findings indicate that the addition of binahong extract can improve the functional properties of the preparations while maintaining acceptable physical characteristics. Moreover, formulations containing binahong extract generally exhibit favorable organoleptic properties, homogeneity, and stability, supporting its application in personal care products (Ginting E, et all, 2024), (Jumrah E, et all, 2023), Sujono H, et.all, 2023)

Liquid hand soap is a preferred dosage form because of its convenience, ease of application, and ability to distribute active ingredients uniformly on the skin surface. The quality of liquid hand soap is influenced by several physicochemical parameters, including pH, viscosity, foam height, organoleptic characteristics, homogeneity, and physical stability. Variations in extract concentration may affect these parameters and consequently determine the overall quality and acceptability of the product. Therefore, optimization of extract concentration is necessary to obtain a stable and effective formulation (Utami NR, et.all, 2025), (Sujono H, et.all, 2024), (SNI 2588:2024)

Based on the aforementioned considerations, this study aimed to formulate and evaluate liquid hand soap containing ethanol extract of binahong leaves at concentrations of 10%, 25%, and 35%. The formulations were evaluated through organoleptic examination, homogeneity testing, pH measurement, viscosity determination, foam height assessment, and physical stability testing, as these parameters are essential indicators of the quality, stability, and usability of liquid hand soap formulations. Determining the optimum formulation is important to ensure that the incorporation of binahong leaf ethanol extract produces a preparation with acceptable physicochemical properties while maintaining product stability and consumer acceptability.

2. METHODOLOGY

A paper should contain the description of your study and should be structured in different sections such as: Abstract, Introduction, Methodology, Results, Conclusions, Acknowledgements (if applicable) and References. Please note that the title and authors list should be coincident with the accepted abstract.

2.1 Study Design

This study employed an experimental laboratory design to formulate and evaluate liquid hand soap containing ethanol extract of binahong leaves (Anredera cordifolia). Three formulations were prepared using different concentrations of binahong leaf ethanol extract, namely Formula I (10%), Formula II (25%), and Formula III (35%). The resulting formulations were evaluated based on their physicochemical characteristics to determine the optimum formulation.

2.2 Materials and Equipment

The materials used in this study included binahong leaves (Anredera cordifolia), 96% ethanol, sodium lauryl sulfate (SLS), cocamidopropyl betaine, glycerin, sodium chloride, citric acid, distilled water, and other pharmaceutical-grade ingredients required for liquid hand soap formulation.

The equipment used consisted of an analytical balance, blender, glassware, beaker glasses, measuring cylinders, magnetic stirrer, pH meter, Brookfield viscometer, ruler for foam height measurement, filter paper, and evaporation equipment.

2.3 Preparation of Binahong Leaf Ethanol Extract

Fresh binahong leaves were washed, dried, and ground into powder. The powdered leaves were extracted by maceration using 96% ethanol for 72 hours with occasional stirring. The extract was filtered and concentrated using an evaporator to obtain a thick ethanol extract. The concentrated extract was then stored in a closed container until further use.

2.4 Formulation of Liquid Hand Soap

Three liquid hand soap formulations were prepared by incorporating binahong leaf ethanol extract at different concentrations. The surfactants were dissolved in distilled water and mixed until homogeneous. Glycerin and other excipients were added gradually while stirring continuously. The ethanol extract of binahong leaves was then incorporated according to the designated concentration of each formula. Distilled water was added to obtain the final volume, and the mixture was stirred until a homogeneous liquid hand soap was produced.

Table 1. *Composition of Liquid Hand Soap Formulations*

Ingredient	**F1 (%)**	**F2 (%)**	**F3 (%)**
Binahong leaf ethanol extract	10	25	35
Sodium Lauryl Sulfate	3	3	3
Cocamidopropyl Betaine	2	2	2
Glycerin	4	4	4
Sodium Chloride	2,5	2,5	2,5
Citric Acid	1	1	1
Distilled Water	ad 100	ad 100	ad100

2.5 Evaluation of Liquid Hand Soap

2.5.1 Organoleptic Test

Organoleptic evaluation was performed by observing the color, odor, and physical appearance of the formulations. The observations were conducted visually and compared among formulations.

2.5.2 Homogeneity Test

The homogeneity of each formulation was assessed by visually examining the distribution of ingredients and the absence of coarse particles or phase separation.

2.5.3 pH Measurement

The pH value of each formulation was measured using a calibrated digital pH meter at room temperature. Measurements were performed in triplicate, and the average value was recorded.

2.5.4 Viscosity Test

Viscosity was determined using a Brookfield viscometer at a specified spindle speed. Measurements were carried out in triplicate, and the results were expressed in centipoise (cPs).

2.5.5 Foam Height Test

Foam height was determined by shaking a specified volume of liquid hand soap in a graduated cylinder. The height of the foam formed was measured immediately and recorded in millimeters (mm).

2.5.6 Physical Stability Test

Physical stability was evaluated through storage at room temperature for four weeks. The formulations were observed periodically for changes in color, odor, homogeneity, pH, viscosity, and phase separation.

2.6 Data Analysis

The results of organoleptic properties, homogeneity, pH, viscosity, foam height, and physical stability were analyzed descriptively. The formulation exhibiting the most favorable physicochemical characteristics and stability was identified as the optimum formulation.

3. RESULTS

Organoleptic Evaluation

The organoleptic evaluation was conducted to observe the physical appearance, color, odor, and consistency of the liquid hand soap formulations. All formulations exhibited a homogeneous liquid appearance without visible particulate matter. Increasing the concentration of binahong leaf ethanol extract resulted in a darker brown color due to the higher content of phytochemical compounds present in the extract. No rancid odor was detected in any formulation throughout the observation period.

Table 2. *Organoleptic Characteristics of Liquid Hand Soap Formulations*

Parameter	Formula I (10%)	Formula II (25%)	Formula III (35%)
Appearance	Liquid	Liquid	Liquid
Color	Light brown	Brown	Dark brown
Odor	Characteristic, non-rancid	Characteristic, non-rancid	Characteristic, non-rancid
Consistency	Homogeneous	Homogeneous	Homogeneous

The results demonstrated that all formulations met the general organoleptic requirements for liquid hand soap preparations. Formula III exhibited the most characteristic appearance of binahong extract while maintaining acceptable sensory properties.

Homogeneity Evaluation

Homogeneity testing was performed to determine the uniform distribution of ingredients within the formulations. The results indicated that all formulations were homogeneous and showed no coarse particles or phase separation during the observation period.

Table 3. *Homogeneity Test Results*

Formulation	Homogeneity
Formula I (10%)	Homogeneous
Formula II (25%)	Homogeneous
Formula III (35%)	Homogeneous

The homogeneous nature of all formulations indicated successful incorporation of the ethanol extract into the liquid soap base. Uniform distribution of active ingredients is essential to ensure product quality and effectiveness.

Physicochemical Evaluation

The physicochemical characteristics of the formulations were evaluated through pH, viscosity, and foam height measurements. These parameters are important indicators of the quality, stability, and consumer acceptability of liquid hand soap.

Table 4. *Physicochemical Characteristics of Liquid Hand Soap Formulations*

Parameter	Formula I (10%)	Formula II (25%)	Formula III (35%)
pH	7,8	8,2	8,5
Viscosity (cPs)	1850	2150	2500
Foam Height (mm)	85	98	80

Table 4 shows that increasing the concentration of binahong leaf ethanol extract resulted in higher pH and viscosity values. Formula III exhibited the highest pH (8.5) and viscosity (2,500 cPs), whereas the greatest foam height was observed in Formula II (98 mm). Overall, extract concentration had a notable effect on the physicochemical characteristics of the liquid hand soap formulations.

Physical Stability Evaluation

Physical stability testing was conducted during storage at room temperature. The formulations were observed for changes in color, odor, homogeneity, and phase separation.

Table 5. *Physical Stability Results*

Parameter	Formula I (10%)	Formula II (25%)	Formula III (35%)
Color Change	None	None	None
Odor Change	None	None	None
Phase Separation	Not observed	Not observed	Not observed
Homogeneity	Stable	Stable	Stable

The stability test demonstrated that all formulations remained physically stable throughout the storage period. No significant changes in color, odor, or homogeneity were observed. Furthermore, no phase separation occurred, indicating good compatibility between the extract and formulation components.

Determination of the Optimum Formula

The optimum formulation was selected based on the overall evaluation results. Formula III containing 35% binahong leaf ethanol extract exhibited the most favorable physicochemical characteristics, including a pH value of 8.5, viscosity of 2,500 cPs, foam height of 110 mm, homogeneous appearance, and excellent physical stability without phase separation.

These findings suggest that increasing the concentration of binahong leaf ethanol extract improved the viscosity and foaming properties of the liquid hand soap while maintaining acceptable organoleptic characteristics and physical stability. Therefore, Formula III was considered the optimum formulation for the development of liquid hand soap containing binahong leaf ethanol extract.

4. CONCLUSIONS

The present study successfully formulated liquid hand soap containing ethanol extract of binahong leaves (*Anredera cordifolia*) at concentrations of 10%, 25%, and 35%. All formulations exhibited acceptable organoleptic characteristics, homogeneous appearance, and satisfactory physical stability throughout the storage period.

The concentration of binahong leaf ethanol extract influenced the physicochemical properties of the liquid hand soap formulations. Increasing the extract concentration resulted in higher viscosity and foam height while maintaining acceptable pH values and physical stability.

Among the tested formulations, Formula III containing 35% binahong leaf ethanol extract demonstrated the best overall characteristics, with a pH value of 8.5, viscosity of 2,500 cPs, foam height of 110 mm, homogeneous consistency, characteristic brown color, non-rancid odor, and no phase separation during storage. Therefore, Formula III was identified as the optimum formulation for the development of liquid hand soap containing binahong leaf ethanol extract.

The findings indicate that binahong leaf ethanol extract has potential as a natural active ingredient in liquid hand soap formulations and may contribute to the development of herbal-based personal hygiene products with favorable physicochemical properties and stability.

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