

PH Characteristics, Foam Stability, and Organoleptic Properties of Natural Dishwashing Soap Based on Pandan (*Pandanus Amaryllifolius*) And Lime (*Citrus Aurantifolia*)

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ABSTRAK

Sabun cuci piring merupakan produk pembersih rumah tangga yang digunakan secara rutin untuk menghilangkan minyak, sisa makanan dan kotoran pada peralatan dapur. Pengembangan sabun berbasis alami menjadi alternatif untuk menghasilkan produk yang lebih ramah lingkungan dengan memanfaatkan sumber daya lokal. Daun pandan (*Pandanus amaryllifolius*) dan jeruk nipis (*Citrus aurantifolia*) merupakan bahan alami yang berpotensi digunakan dalam formulasi sabun karena mengandung senyawa bioaktif seperti flavonoid, saponin, limonen dan minyak atsiri yang berperan dalam memberikan karakteristik aroma serta aktivitas biologis. Penelitian ini bertujuan untuk mengetahui karakteristik fisik sabun cuci piring alami yang berbasis ekstrak daun pandan dan jeruk nipis berdasarkan parameter pH, stabilitas busa dan organoleptik. Penelitian ini menggunakan metode deskriptif dengan pendekatan pengujian sederhana pada satu sampel sabun cuci piring berkode #001. Hasil penelitian menunjukkan bahwa sabun cuci piring alami berbasis ekstrak daun pandan dan jeruk nipis memiliki nilai rata – rata pH sebesar 5,34 dari tiga kali pengukuran. Nilai stabilitas busa yang di peroleh sebesar 96,15%, menunjukkan kemampuan sabun dalam mempertahankan busa dengan baik selama waktu pengamatan. Hasil pengujian organoleptik memperoleh total skor 20 dari 20 dengan kategori sangat baik, ditunjukkan melalui nilai karakteristik warna hijau bening, aroma khas daun pandan dan jeruk nipis, tekstur cair, bentuk sediaan cair, serta tampilan homogen tanpa endapan. Kombinasi kedua bahan alami tersebut berpotensi dikembangkan sebagai bahan tambahan dalam formulasi sabun cuci piring ramah lingkungan.

Kata Kunci : Sabun Cuci Piring, Daun Pandan, Jeruk Nipis, pH, Stabilitas Busa

ABSTRACT

Dishwashing soap is household cleaning product used to remove oil, food residues, and dirt from kitchen utensils. The development of natural-based soap provides an environmentally friendly alternative by utilizing local resources. Pandan (*Pandanus Amaryllifolius*) and lime (*Citrus Aurantifolia*) extracts have potential as soap ingredients due to bioactive compounds such as flavonoids, saponins, limonene, and essential oils that contribute to aroma and biological activity. This study aimed to evaluate the physical characteristics of natural dishwashing soap formulated with pandan and lime extracts, including pH, foam stability, and organoleptic properties. A descriptive method was applied using a single sample (code #001). Results showed that the soap had an average pH of 5,34, foam stability of 96.15%, and an organoleptic score of 20 out of 20. The soap exhibited very good quality with clear green color, distinctive pandan and lime aroma, liquid texture, appropriate consistency, and homogeneous appearance. The combination of pandan and lime extracts demonstrates potential for developing environmentally friendly natural dishwashing soap.

Keywords : Dishwashing Soap, Pandan, Lime, pH, Foam Stability

I. INTRODUCTION

1. Background

Dishwashing soap is a household cleaning agent that plays a crucial role in maintaining the cleanliness of kitchenware such as plates, glasses, spoons, pans, and other utensils. It is used to remove various types of soil, particularly grease, food scraps, and organic residues. Frequent use necessitates a soap product that is effective, safe, and possesses desirable physical characteristics (Arrazi, Nisah, and Arfi 2021). Consequently, soap development focuses not only on cleaning efficacy but also on physical quality attributes such as foam stability, pH, and visual appearance that influence user satisfaction (Handayani, Rezki, and Fahmi 2022). The cleansing ability of soap is derived from surfactants, which lower the surface tension of water, allowing oil and dirt to disperse and be removed more easily. Components such as sodium lauryl sulfate (SLS) are widely used in soap formulations because they generate foam and facilitate the emulsification of dirt (Sianiar et al. 2021). In addition to surfactants, soap formulations may incorporate supplementary ingredients such as thickeners, fragrances, colorants, or natural additives to improve physical characteristics and enhance the product's functional value. The use of these additives is a factor influencing the stability and final quality of the soap product. Dermawan et al. 2023);(Mastura 2021). Growing awareness of environmental issues and product safety is driving the development of natural-based soaps. The use of plant extracts is a widely pursued approach, as they contain secondary metabolites such as flavonoids, saponins, tannins, alkaloids, and essential oils that offer potential biological activity and enhance product characteristics (Dina et al. 2024). Various community service studies indicate that natural dish soap formulations are increasingly being developed due to their eco-friendliness and ease of production, as well as their utilization of local plants with economic value. The use of pandan leaves and key limes is one such alternative widely adopted at both the household and community group levels (Pengabdian et al. 2023); (Puspitasari et al. 2026). Pandan leaves (*Pandanus amaryllifolius*) and key limes (*Citrus aurantifolia*) have potential as ingredients in natural soap formulations. Beyond providing natural aroma and color, pandan leaves contain bioactive compounds that support antibacterial activity (Kelor, Sumber, and Hijau 2021). Key limes contain limonene, flavonoids, saponins, and essential oils, which contribute to aroma, oil removal, and antimicrobial activity (Mulyani and Sartika 2022);(Sari 2017). Furthermore, phytochemical analysis and thin-layer chromatography indicate that key limes contain various secondary metabolites such as flavonoids, alkaloids, phenolics, and essential oils across different extraction methods. These compounds function as antioxidants and antimicrobials (Darjati et al. 2024);(Cam and Traditional 2007). Consequently, this chemical composition supports the potential use of key limes as an active ingredient in natural-based cleaning product formulations (Kasim et al. 2025). The use of pandan leaves and key limes as dishwashing agents has been implemented in various community empowerment initiatives. These ingredients are considered easily accessible and economical, and they yield a soap with a natural aroma that appeals to the public (Arif et al. 2023). Combining pandan leaf and key lime extracts in dishwashing soap can produce a product with a distinctive aroma, stable foam, and effective cleaning capabilities (Rahmah et al. 2025);(Busa et al. 2025). However, evaluations of the physical characteristics of soap based on this combination specifically regarding pH, foam stability, and organoleptic properties remain limited. Therefore, this study was conducted to determine the characteristics of natural dishwashing soap formulated from pandan leaf and key lime extracts.

2. Problem Formulation

Based on the background information provided above, the problem addressed in this study is how to properly conduct the research titled "pH Characteristics, Foam Stability, and Organoleptic Properties of Natural Dishwashing Soap Based on Pandan (*Pandanus amaryllifolius*) and Lime (*Citrus aurantifolia*)" in accordance with established procedures.

3. Research Objectives

The objective of this study is to obtain research findings for the project titled "pH Characteristics, Foam Stability, and Organoleptic Properties of Natural Dishwashing Soap Based on Pandan (*Pandanus amaryllifolius*) and Lime (*Citrus aurantifolia*)."

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3. Research Benefits

The benefits of this research include: providing scientific information regarding the study titled "pH Characteristics, Foam Stability, and Organoleptic Properties of Natural Dishwashing Soap Based on Pandan (*Pandanus amaryllifolius*) and Lime (*Citrus aurantifolia*)," as well as offering implications for relevant future research..

II. RESEARCH METHOD

This study employs a descriptive method with a simple laboratory based approach to evaluate the physical characteristics of a natural dishwashing soap formulated from *Pandanus amaryllifolius* (pandan) leaf and *Citrus aurantifolia* (lime) extracts. The evaluation is conducted based on three main parameters, pH, foam stability, and organoleptic properties without varying the formulation. Approaches for evaluating physical characteristics, such as pH testing and stability assessment, are widely used in research on natural liquid soap formulations (Handayani et al. 2022);(Hamzah et al. 2023). Testing based on physical and organoleptic observations was also used to assess the quality and acceptability of the characteristics of the produced soap (Sarnita et al. 2024).

Research Design

The research was conducted in June 2026 at the Biology Laboratory of Universitas Tangerang Raya, Tangerang, Indonesia, under standard laboratory conditions to ensure the consistency of measurement results.

Research Target/Subject

This study aims to determine the physical characteristics of a natural dishwashing soap based on pandan leaf and lime extracts, evaluated against pH, foam stability, and organoleptic parameters. The sample used was a single natural dishwashing soap designated as #001. The sample was stored in a sealed container and homogenized prior to testing to ensure the constituent components were evenly mixed.

Research Procedure

pH testing procedure

A 10 mL sample was mixed with 50 mL of clean water or distilled water and stirred until homogeneous. Measurements were performed in triplicate, and the results were averaged to obtain the final pH value (Handayani et al. 2022);(Lambers et al. 2006). The pH testing was conducted based on the physical stability evaluation method for liquid soap, utilizing a stress test approach commonly employed to assess product stability during storage. A relatively constant pH value indicates that the formulation possesses good physical stability. According to (Purnamasari et al. 2023) minimal pH fluctuation during testing indicates that the soap's constituent components remain stable and do not undergo significant degradation.

Foam stability testing procedure

A 10 mL sample was mixed with 50 mL of water and shaken for 30 seconds; the initial foam height was then measured using a ruler. The sample was left to stand for five minutes, after which the final foam height was measured. Foam stability was calculated using the formula: $\text{Foam stability (\%)} = (\text{Foam height after 5 minutes} / \text{initial foam height}) \times 100\%$ (Mulyani and Sartika 2022).

Organoleptic testing procedure

This test is conducted through direct observation of color, aroma, texture, dosage form, and visual homogeneity. Organoleptic scores ranging from 1 to 4 are assigned for each parameter and then summed to determine the overall category (Sari 2017);(Budi and Arif 2025);(Ali and Yosipovitch 2013).

Instruments, and Data Collection Techniques

The instruments used in this study included a digital pH meter, graduated cylinders, a ruler, clear bottles, sample containers, a stirring spoon, labels, and tissues. The materials utilized consisted of dishwashing soap based on pandan leaf and lime extracts, distilled water, and supplies for cleaning laboratory equipment. Data were collected through direct observation in the laboratory. pH data were obtained from measurements using a digital pH meter; foam stability data were derived from measuring foam height before and after a five-minute resting period; and organoleptic data were obtained by observing color, aroma, texture, product form, and homogeneity using an observation sheet.

Data analysis technique

The data were analyzed descriptively. pH measurement results are presented as the average of three measurements, while foam stability is expressed as a percentage based on the ratio of initial foam height to foam height after five minutes. Organoleptic test results are presented both descriptively and numerically, based on observation scores for each parameter. This descriptive analysis method is commonly used to evaluate the physical characteristics of soap formulations and to characterize the quality of the resulting product (Fitri, Mustikawati, and Afianty 2020). Furthermore, relevant findings from previous studies regarding the formulation and characteristics of soaps made from natural ingredients (Rahmah et al. 2025);(Nipis 2025)..

III. RESULT AND DISSCUSION

Observations were obtained from pH, foam stability, and organoleptic testing of a single sample of natural dishwashing soap based on pandan leaf and lime extracts (sample code #001). The test results are presented in the following table.

pH Test Result of Natural Dishwashing Liquid

Table 1. pH Test Results of Natural Dishwashing Liquid

Sample Code	Measurement 1	Measurement 2	Measurement 3	Average pH
Sample #001	5.37	5.35	5.31	5.34

Based on Table 1, pH measurements for sample #001 yielded values of 5.37, 5.35, and 5.31, resulting in an average pH of 5.34. The relatively small variation between measurements indicates that the formulation possesses good pH stability. A pH value of 5.34 indicates that the formulation is sufficiently stable and does not undergo significant pH changes; the soap remains in a mildly acidic state, aligning with the pH range that approximates the skin's natural condition. Human skin typically has a pH of 4–6, which plays a role in maintaining the acid mantle, moisture levels, and protective function (Lambers et al. 2006); (Ali and Yosipovitch 2013). These results are consistent with studies (Mastura 2021);(Amani 2024);(Fitri et al. 2020). showing that soaps formulated with natural extracts are generally evaluated for pH to ensure user safety and comfort. The inclusion of pandan leaf and lime extracts can also influence the product's pH due to the presence of active compounds. Research by (Hamzah et al. 2023) demonstrated that adding pandan extract to soap affects its physicochemical characteristics, including pH. These findings indicate that the combination of pandan leaf and lime extracts yields a soap formulation with a pH suitable for household use while maintaining the product's physical stability.

Foam Stability Test Results of Natural Dishwashing Liquid

Table 2. Foam Stability Test Results of Natural Dishwashing Liquid

Sample Code	Initial foam height	Foam height after 5 minutes	Foam stability (%)
Sample	13.0 cm	12.5 cm	96.15

#001			
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Test results indicate that sample #001 exhibited a foam stability of 96.15%, with a foam height reduction of only 0.5 cm after 5 minutes. This value demonstrates that the soap formula effectively maintains its foam structure. Foam stability is influenced by the composition of surfactants and additives, as well as interactions between components within the formulation. Although foam volume does not directly determine cleaning efficacy, foam stability remains a crucial parameter due to its impact on user experience. These findings align with research by (Arrazi et al. 2021), which explains that altering formula composition can affect the physical characteristics of liquid soap, including its foam retention capability. The distinctive pandan and lime aroma observed in this study is consistent with findings from the production of natural dishwashing soap, which demonstrated a high level of public acceptance (Arif et al. 2023). The saponin content found in certain plants can also facilitate foam formation, as saponins possess properties similar to natural surfactants. Furthermore, the use of plant extracts such as pandan and lime can influence the physical characteristics of the product through their secondary metabolite content (Yusra et al. 2024);(Al-aamri et al. 2018).The results of this study demonstrate that the combination of pandan leaf and lime extracts not only imparts a natural aroma but also maintains foam stability at levels exceeding 95%, thereby offering the potential to enhance the quality of natural dishwashing soap.

Organoleptic Evaluation Results of Natural Dishwashing Liquid

Table 2. Organoleptic Evaluation Results of Natural Dishwashing Liquid

Parameter	Observation Result	Score	Description
Color	Clear green	4	Excellent
Aroma	Distinct aroma of pandan leaf and lime	4	Excellent
Texture	Liquid	4	Excellent
Dosage form	Liquid	4	Excellent
Visual homogenitas	Homogenitas with no visible sediment	4	Excellent
Total score		20	Excellent category

Organoleptic testing results indicate that the sample achieved a total score of 20, placing it in the "excellent" category. These characteristics are evidenced by a clear green color, a distinctive aroma of pandan and lime, a liquid texture, and a homogeneous appearance free of sediment. These sensory characteristics are influenced by the use of natural extracts in the formulation. Pandan leaves impart a distinctive aroma through their volatile compounds, while limes provide a fresh scent derived from essential oil components such as limonene. Research by (Rahmah et al. 2025) reports that combining pandan and lime in dishwashing soap yields a pleasant aroma and enhances the product's appeal. These findings are further supported by community empowerment initiatives utilizing pandan leaves and limes to produce natural dishwashing soap. Studies by (Arif et al. 2023) and (Hariono et al. 2025) report that the resulting products possess a natural aroma and are readily accepted by the community. Research by (Sari 2017) and (Fitri et al. 2020) highlights that organoleptic evaluation is a crucial aspect of assessing soap formulations, as it directly relates to initial user acceptance.

IV. CONCLUSION

The results of this study indicate that pandan leaf and lime extracts have the potential to be utilized as natural ingredients in dishwashing soap formulations with favorable physical characteristics. These findings can serve as a basis for developing more eco-friendly household cleaning products by leveraging local biological resources. Furthermore, the results can provide a reference for future research aimed at developing formulations with

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varying extract concentrations and evaluating antibacterial activity as well as oil-cleaning efficacy. The natural dishwashing soap based on pandan leaf and lime extracts (sample code #001) exhibited favorable physical characteristics regarding pH, foam stability, and organoleptic properties. The average pH value of 5.34 indicates a mildly acidic condition compatible with the skin's pH range. Foam stability reached 96.15%, with minimal reduction in foam height observed after five minutes. Additionally, the product achieved a perfect organoleptic score of 20 out of 20 rated as "excellent" based on color, aroma, texture, physical form, and homogeneity. These findings support previous studies indicating that the use of pandan leaf and lime extracts can yield eco-friendly dishwashing soaps with good physical characteristics (Kecamatan and Wardhani 2025); (Hariono et al. 2025).

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