

---

## **LERAK SUBSTITUTION ON THE ANTIMICROBIAL EFFECTIVENESS AND ACCEPTABLE QUALITY OF 3IN1 HYGIENE PRODUCT WITH THE ADDITIONAL OF PINEAPPLE PEEL EXTRACT**

**Natasha Viandra Ayu, Yosep Suprianto, Siti Nurhayati, Hanifah Sakha, Juan Abu Dhom  
Dhom, Fenny Aprilliani\***

Subang State Polytechnic, Subang City

\*Corresponding author: natasha.10309042@student.ac.id,

### ***Abstract***

Hygiene products commonly contain SLS (Sodium Lauryl Sulfate) which can trigger skin irritation or cause dandruff. Through innovation and technological advancements, a 3in1 soap is planned to create a natural soap effective and beneficial for skin health. This research aims to determine the antimicrobial effectiveness and acceptable quality of the 3in1 hygiene product based on sapindus (*Sapindus rarak*) and pineapple peel extract. The research method used is the RAL (Randomized Complete Block Design) with 2 factors: sapindus concentration (A=15%, 22.5%, and 30%) and pineapple peel extract (B=9%, 18%, and 27%) with 3 replications. Testing parameters include antimicrobial effectiveness (*S.aureus* and *E.coli*) and acceptable quality of 3in1 hygiene product. The results show that variations in treatment have a significant effect. The sample A3B3 (sapindus rarak 30% and pineapple extract 27%) shows largest clear zone of  $7 \pm 1$  mm for *E.Coli* and sample A2B2 (sapindus rarak 22.5% and pineapple extract 18%) shows largest clear zone of  $5.67 \pm 1.63$  mm for *S.aureus*. For the acceptable quality, the panelist showed the highest acceptance in sample A3B3.

**Keywords:** Antimicrobial, Lerak, Pineapple peel, 3in1 soap.

## **INTRODUCTION**

Shampoo, face wash, and body wash are hygiene products commonly used to maintain personal cleanliness. Currently, liquid hygiene products are widely favored because they are practical for travel, easy to use, and remain effective as a means of sanitation. As time goes by, comfort and speed have become important factors in carrying out activities, including personal hygiene. Therefore, it is necessary to develop an innovation 3in1 hygiene products as a practical and efficient solution to meet personal hygiene and self-care needs. In addition, this 3in1 hygiene products is more practical and safe to use, as it can maintain the cleanliness of hair, face, and body just by using this 3in1 hygiene product. Hygiene products generally contain SLS (Sodium Lauryl Sulfate) compounds that can trigger skin irritation or cause dandruff on the scalp. Through innovation and technological development, the 3in1 soap is planned to be studied to create an effective natural soap that contains natural ingredients beneficial for skin health. The production of SLS-free natural soap is driven by the increasing public awareness of gentle and skin-friendly skincare products. Many people are looking for more natural alternatives free from aggressive chemical like SLS. Additionally, sensitivity to SLS and the potential for skin irritation are important reasons for creating natural soap free from that ingredient. The aim of this research is to determine the physicochemical characteristics and microbial inhibition properties contained in the 3in1 hygiene product made from lerak and pineapple peel extract as an innovation of SLS-free hygiene products.

## LITERATURE REVIEW

Lerak is known to contain 28% saponin, which can produce foam when used. In addition, lerak also contains alkaloids, steroids, anthraquinones, flavonoids, polyphenols, and tannins (Wijayanti *et al.*, 2020). Pineapple peel extract itself is utilized because it contains bromelain, which can be used as an antimicrobial and has already been applied to inhibit dandruff growth (Noviana *et al.*, 2019). The selection of pineapple peel extracts is made as an advantage of the 3in1 hygiene product because it can enhance the utility of pineapple product waste by processing it to a beneficial product. Pineapple peels are generally only considered waste, whereas pineapple peels still contain very beneficial compounds such as bromelain. Aloe vera is added as a humectant that can serve as a natural moisturizer in the 3in1 hygiene products produced. In addition, aloe vera also contains saponins that can enhance the effectiveness of the dirt removal process on the skin and function as an antiseptic (Muti'ah *et al.*, 2023). Exfoliate dead skin and provide nutrition to lemon and sunflower oil are added to help the skin due to their antioxidant content (Susanti *et al.*, 2020). Further studies are needed on the effect of substituting soapberry with the addition of pineapple peel extract in the production of 3in1 hygiene products.

## RESEARCH METHOD

This study uses a laboratory experimental method with a completely randomized design (CRD). The research was conducted to examine the effect of varying concentrations of lerak (*Sapindus rarak*) and pineapple peel extract (*Ananas comosus*) on the physicochemical characteristics and antimicrobial activity of 3in1 hygiene products. The independent variables in this study are the concentration of soapberry (15%, 22.5%, and 30%) and the concentration of pineapple peel extract (9%, 18%, and 27%). Each treatment combination was repeated three times. The data collected in this study includes quantitative and qualitative data. Quantitative data in the form of viscosity measurements, specific gravity, foam stability, and pH. Qualitative data were obtained from the observation of inhibition zones against the bacteria *Escherichia coli* and *Staphylococcus aureus*. Primary data were obtained directly from laboratory test results, while the research materials in the form of sap were obtained from farmers in Bandung and pineapple peels were by products from MSME pineapple processing in Subang.

Sample preparation is carried out through several stages. The sapindus extract was obtained by soaking the sapindus fruit in hot water at 50°C for 24 hours, followed by extraction. Meanwhile, the pineapple extract is obtained by cutting and grinding the pineapple peel, followed by a maceration process using a solvent for 24 hours, filtration, and extraction at a temperature of 50°C. All raw materials, including aloe vera extract, sunflower oil, and lemon juice, are mixed into the hygiene product formulation using a heating method at 60-80°C to maintain product stability. The testing of physicochemical characteristics was conducted using the following methods: viscosity is measured using an Oswald viscometer, specific gravity is measured with a pycnometer, foam stability is tested by agitating water and measuring the foam height at the first and fifth minutes, and pH is measured using a pH meter. Microbial inhibition testing was conducted using the disk diffusion method, which involves dipping a paper disk into the sample solution, placing it on a solid medium inoculated with bacteria, and measuring the diameter of the inhibition zone that forms. The obtained data were analyzed using analysis of variance (ANOVA) to determine the effect of the treatment on the test parameters. If significant differences are found, further testing is conducted using the Tukey method

to compare treatments. Result validation is carried out by comparing the values of physicochemical parameters with the SNI 4085:2017 standard, while the effectiveness of microbial inhibition is compared with the antibacterial reference value.

## RESULTS AND DISCUSSION

This study aims to examine the effect of substituting lerak on the quality of 3in1 hygiene products enriched with pineapple peel extract as an active compound. Based on the analysis of the physicochemical and microbiological tests conducted, there are several relevant findings regarding the tested parameters, such as viscosity, specific gravity, foam stability, pH, and inhibition against *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*) bacteria. The viscosity test results show that the concentration of lerak and pineapple peel extract has a significant effect ( $P < 0.05$ ) on the product's viscosity. The treatment with 30% lerak concentration (A3) and 18% pineapple peel extract (B2) resulted in the highest viscosity ( $10.57 \pm 0.05$  cp), indicating that the increase in lerak concentration enhances the product's viscosity. Lerak, which contains natural polymers such as gum, helps form a three-dimensional structure in the solution, contributing to the increase in viscosity (Wijayanti *et al.*, 2020).

Table 1. Results of physicochemical analysis

| Quality Parameter       | Concentration of Pineapple Peel Extract (B) | Lerak Concentration (A)  |                          |                         |
|-------------------------|---------------------------------------------|--------------------------|--------------------------|-------------------------|
|                         |                                             | A1                       | A2                       | A3                      |
| Physical Quality        |                                             |                          |                          |                         |
| Viscosity (cp)          | B1                                          | 8,38±0,22 <sup>ab</sup>  | 8,73±0,09 <sup>bc</sup>  | 10,21±0,52 <sup>d</sup> |
|                         | B2                                          | 10,85±0,30 <sup>df</sup> | 10,57±0,05 <sup>de</sup> | 11,18±0,19 <sup>f</sup> |
|                         | B3                                          | 8,23±0,17 <sup>a</sup>   | 8,83±0,18 <sup>c</sup>   | 8,86±0,20 <sup>c</sup>  |
| Specific Gravity (g/ml) | B1                                          | 26,02±0,07               | 24,44±2,85               | 26,05±0,19              |
|                         | B2                                          | 26,15±0,11               | 25,99±0,09               | 26,14±0,18              |
|                         | B3                                          | 25,61±0,19               | 25,87±0,19               | 26,16±0,19              |
| Chemical Quality        |                                             |                          |                          |                         |
| Foam Stability (%)      | B1                                          | 50,33±0,58 <sup>a</sup>  | 66,00±1,00 <sup>d</sup>  | 55,57±0,02 <sup>b</sup> |
|                         | B2                                          | 50,33±0,58 <sup>a</sup>  | 71,27±0,25 <sup>e</sup>  | 63,17±0,21 <sup>c</sup> |
|                         | B3                                          | 57,10±0,08 <sup>c</sup>  | 55,57±0,02 <sup>b</sup>  | 75,00±0,01 <sup>f</sup> |
| pH                      | B1                                          | 3,74±0,41 <sup>ab</sup>  | 3,92±0,03 <sup>c</sup>   | 3,67±0,28 <sup>a</sup>  |
|                         | B2                                          | 3,87±0,48 <sup>c</sup>   | 4,01±0,10 <sup>c</sup>   | 3,84±0,48 <sup>b</sup>  |
|                         | B3                                          | 3,89±0,26 <sup>c</sup>   | 4,06±0,33 <sup>d</sup>   | 3,88±0,17 <sup>c</sup>  |

The specific gravity test showed that there were no significant differences between treatments ( $P > 0.05$ ). This is due to the good density stability of the soap made from sapindus extract and pineapple peel, where the temperature used for testing tends to maintain the stability of the specific gravity (Suhendy *et al.*, 2022). This test provides an overview of the physical quality of the produced soap. Foam stability shows significant variation between treatments. The treatment with 30% lerak concentration and 27% pineapple peel extract (A3B3) produced the highest foam stability (75%), indicating better foam quality compared to other treatments. The strong influencing factor on foam stability is the homogeneity of the material mixture, which enhances the resistance of foam bubbles to damage (Murti *et al.*, 2017). The pH value of the 3in1 soap shows significant variation between treatments ( $P < 0.05$ ). The treatment with a higher concentration of pineapple peel extract (27%) resulted in a higher pH (4.06), which was caused by the citric acid content in the lemon juice in the

formula. Citric acid has acidic properties that help lower the pH of the product, making it more skin-friendly (Erfando *et al.*, 2018).

Table 2. Results of microbial contamination analysis

| Quality Parameter                        | Concentration of Pineapple Peel Extract (B) | Lerak Concentration (A) |                      |                      |
|------------------------------------------|---------------------------------------------|-------------------------|----------------------|----------------------|
|                                          |                                             | A1                      | A2                   | A3                   |
| Microbial Contamination Quality          |                                             |                         |                      |                      |
| Clear Zone <i>e. coli</i>                | B1                                          | 5±0,00 <sup>a</sup>     | 5±0,00 <sup>a</sup>  | 8±2,33 <sup>b</sup>  |
|                                          | B2                                          | 7±2,33 <sup>ab</sup>    | 5±0,00 <sup>a</sup>  | 6±1,52 <sup>ab</sup> |
|                                          | B3                                          | 8±1 <sup>b</sup>        | 5±0,00 <sup>a</sup>  | 7±1,41 <sup>ab</sup> |
| Clear Zone <i>Staphylococcuss aureus</i> | B1                                          | 6±1,41 <sup>ab</sup>    | 4±0,57 <sup>ab</sup> | 4±0,57 <sup>ab</sup> |
|                                          | B2                                          | 6±1,52 <sup>ab</sup>    | 6±1,41 <sup>ab</sup> | 3±0,57 <sup>a</sup>  |
|                                          | B3                                          | 4±0.57 <sup>ab</sup>    | 7±1.41 <sup>b</sup>  | 6±1.52 <sup>ab</sup> |

In the inhibition test against *E. coli* and *S. aureus*, the soap product with a combination of sapindus concentration and pineapple peel extract showed a significant effect ( $P < 0.05$ ). Products with a concentration of 27% pineapple peel extract (B3) showed a larger inhibition zone against *E. coli*, indicating that the antibacterial compounds in pineapple peel extract, such as bromelain and flavonoids, are effective in inhibiting bacterial growth (Aminah & Abdilantri, 2021). Similarly, the product with a 22.5% sapindus concentration and a 27% pineapple peel extract (A2B3) showed a larger inhibition zone against *S. aureus*, thanks to the antibacterial properties of the flavonoids in the pineapple peel extract (Husniah & Gunata, 2020). Based on the results of physicochemical and microbiological tests, it can be concluded that the substitution of lerak in the 3in1 soap formulation has a positive impact on product quality. Treatment with a 22.5% concentration of sapindus (A2) and 18% pineapple peel extract (B2) resulted in the best quality product, with a viscosity of  $10.57 \pm 0.05$  cp, foam stability of  $71.27 \pm 0.25\%$ , pH of  $4.01 \pm 0.10$ , and significant inhibition against *E. coli* and *S. aureus*. This product has great potential to be used as an effective and skin-friendly natural soap.

## CONCLUSION

The conclusion of this study emphasizes that the substitution of lerak with the addition of pineapple peel extract has a significant impact on the physicochemical quality and microbial inhibition of 3in1 hygiene products. The best formulation, A2B2, meets the SNI 4085:2017 standards with optimal viscosity, foam stability, and pH values, as well as adequate microbial inhibition zones. These findings indicate that the combination of natural ingredients, such as sapindus and pineapple peel, not only effectively replaces the use of SLS but also introduces innovation in enhancing the antibacterial benefits of personal care products. The analytical framework used in this study successfully illustrates the relationship between treatment variables and product quality parameters. Nevertheless, several limitations in this study, such as the lack of analysis on the potential toxicity of materials with long-term use, need further attention. Future research could expand the scope of the study by considering product stability tests in more varied environmental conditions, more complex additive analyses, and clinical user testing to ensure product safety and effectiveness.

## ACKNOWLEDGEMENT

The author expresses the deepest gratitude to all parties who have provided support and assistance during the process of writing this article. Sincere thanks are extended to Politeknik Negeri Subang, especially the Agricultural Department of the D3 Agroindustry Study Program and its lecturers, for all the guidance, advice, and support that have been very meaningful. Without the assistance and cooperation provided, the completion of this article would not have been realized well.

## REFERENCES

- Aminah, S., & Abdilantri, D. (2021). Anti-Bacterial Activity Testing Of Ethanol Extract 96% Painage Skin (*Ananas Comosus* (L.) Merr) Against *Escherichia Coli* Bacteria. *Jurnal Farmasi*, 4(2), 64–71. <http://ejournal.medistra.ac.id/index.php/JFM>
- Erfando, T., Rita, N., & Cahyani, S. R. (2018). Identification Of Potential Kaffir Lime As Demulsifier To Separate Water From Oil Emulsion In Riau's Oil Field. *Jurnal Kimia Mulawarman*, 15(2), 117–121.
- Husniah, I., & Gunata, A. F. (2020). Pineapple Peel Extract as an Antibacterial. *Jurnal Penelitian Perawat Profesional*, 2(1), 85–90. <http://jurnal.globalhealthsciencegroup.com/index.php/JPPP>
- Murti, I. K. A. Y., Putra, I. P. S. A., Suputri, N. N. K. T., Wijayanti, N. P. D., & Yustiantara, P. S. (2017). Optimization Of Olive Oil Concentration On The Physical Stability Of Liquid Soap Formulations. *Jurnal Farmasi Udayana*, 6(2), 15–22.
- Muti'ah, N., Muliawati, E. S., & Suryaningrum, D. A. (2023). Production of Natural Soap from Aloe Vera and Curcuma Giring Using the Cold Process Method. *Journal of Applied Agriculture, Health, and Technology*, 1(2), 43–53. <https://doi.org/10.20961/jaht.v1i2.481>
- Noviana, A., Nilamsari, A. M., Yuniarti, R., Rizqi, M., Baani, K., & Afifah, D. N. (2019). PKK Group Empowerment in Processing Pineapple Rind into Shampoo in Belik, Pemalang, Central Java. *Agrokreatif*, 5(3), 181–187.
- Suhendy, H., Wulan, L. N., & Hidayati, N. L. D. (2022). The Influence Of Specific Weight On The Total Flavonoid And Phenol Content Of Ethyl Acetate Extracts From Purple Sweet Potato Tubers (*Ipomoea batatas* L.). *Journal of Pharmacopolium*, 5(1), 18–24.
- Susanti, Y., Purba, A. V., & Rahmat, D. (2020). An Antioxidant and a SPF of Combination of Sesame Seed Oil (*Sesamum indicum* L.) and Sunflower Seed Oil (*Helianthus annuus* L.). *Majalah Farmaseutik*, 16(1), 107–110. <https://doi.org/10.22146/farmaseutik.v16i1.52243>
- Wijayanti, F., Sari, M., Suprayitno, R., & Aminin, D. (2020). The Gel Soap with Raw Materials of Lerak Fruit (*Sapindus rarak* DC). *Stannum: Jurnal Sains Dan Terapan Kimia*, 2(1), 1–6. <https://doi.org/10.33019/jstk.v2i1.1618>