Physical Properties of Liquid Soap using Katuk Leaf Extract (sauropus androgynus (l) merr.) as an Alternative to Natural Surfactants

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Abstract. Katuk leaves (Sauropus androgynous (L) Merr.) contain saponins that can potentially act as natural surfactants to replace Sodium Lauryl Sulfate (SLS). This study aims to determine the variation in the concentration of katuk leaf extract (Sauropus androgynous (L) Merr.) On the results of testing the physical properties of liquid soap formulations and to determine the potential of katuk leaf extract as an alternative to natural surfactant substitute (Sauropus androgynous (L) Merr) in the formulation. Liquid soap preparations. The liquid soap formulation of katuk leaf extract with concentrations of 1%, 3%, 5%, 7%, and 9% was replicated 5 times. The physical properties test carried out were organoleptic testing, pH, foam height, specific gravity, and viscosity. Based on the research that has been done, it can be concluded that the variation in the concentration of katuk leaf extract affects the physical properties of liquid soap includes organoleptic, pH, high foam, specific gravity, and viscosity. The liquid soap formulation uses katuk leaf extract has potential as an alternative to natural surfactants instead of surfactants. It can be known that the three formulas, namely F1, F2, and F3 as a whole meet SNI standards.

1. Introduction

Liquid bath soap is a primary requirement in daily activities. Increasing of the human population every year results in the use of bath soap also increasing. Soap is generally defined as the alkaline salt of long-chain fatty acids. When the fat or oil is saponified, sodium or potassium salts are formed from long-chain fatty acids called soap. Bath soap is a preparation used by the community to clean the skin. Soap is produced from two main ingredients, namely alkalis and triglycerides [1]. Generally, the bath soap used today uses synthetic chemicals as surfactant active ingredients [2].

The surfactant that is usually used in liquid bath soap formulation is Sodium Lauryl Sulfate (SLS). Sodium Lauryl Sulfate (SLS) is a widely used anionic surfactant in various nonparenteral pharmaceutical and cosmetic formulations [3]. Sodium Lauryl Sulfate (SLS) is not a carcinogen when applied to the skin but, based on SLS research it can irritate the skin and face when applied for a long time and continuously [4], SLS and ALS can cause severe skin irritation and both of these substances can be easily absorbed into the body. Once absorbed, these substance deposits will be present in the brain, heart, lungs, and liver which will become a long-term health problem. SLS and ALS also have the potential to cause cataracts and interfere with eye health. Synthetic active ingredients can cause negative effects for humans with sensitive skin, which can cause irritation. A solution of just 2% SLS can increase skin thickness, cause irritation, inflammation [5] and increase other forms of immune
activity in the skin [6]. SLS can cause an increase in enzyme levels in the skin, leading to redness and swelling [7]. It can also lead to dryness, roughness and even flaking of the skin.

Therefore, it is necessary to research to find alternatives to natural surfactants derived from natural ingredients. The production of natural surfactants aims to minimize the negative impact on the body caused by SLS. Natural ingredients that can potentially be used as natural surfactants are those containing saponins. Saponin is a glycoside that has an aglycone in the form of sapogenin. Saponins can reduce the surface tension of the water so that it will result in the formation of foam on the surface of the water after being shaken. This property has in common with surfactants. The decrease in surface tension is caused by the presence of soap compounds that can damage the hydrogen bonds in water. This soap compound has two parts that are not the same polarity [8]. In this research, research was conducted to see the physical properties of liquid bath soap from katuk leaf extract. The use of katuk leaves because they contain saponin compounds which can be potential as natural surfactants to replace Sodium Lauryl Sulfate (SLS).

2. Material and Method

2.1. Materials
Katuk leaves, Alcohol 70%, Olive oil, Sodium Lauryl Sulfate (SLS), Cocamid DEA, Na-CMC, NaCl, Na-Benzoic Stearic Acid Katuk leaves, Alcohol 70%, Olive oil, Sodium Lauryl Sulfate (SLS), Cocamid DEA, Na-CMC, NaCl, Na-Benzoic Stearic Acid, KOH 20%, Vitamin E, and Aquadest.

2.2. Katuk leaf 70% ethanol extract preparation
500 grams of katuk leaf powder was extracted using 5 liters of 70% ethanol solvent by the maceration method. Katuk leaves are put in a brown bottle then added 75 parts of 70% ethanol (3750 ml), and left to stand for 5 days. After 5 days of repeated shuffling. Macerate is filtered and the residue is squeezed. The residue was added with 25 parts of 70% ethanol (1250 ml), then stirred and obtained 100 parts of the entire juice. The extract obtained is concentrated with a rotary evaporator until a thick extract is obtained. The remaining solvent is evaporated on a water bath until it is solvent-free.

2.3. Preparation of Liquid Soap Formula for katuk leaf extract
Olive oil and stearic acid are heated at 500 °C, adding 20% potassium hydroxide little by little to form a paste. then added Na CMC and NaCl which have been dissolved with a little water until homogeneous. The mixture was transferred to a beaker then added with katuk leaf extract, stirring until homogenous. then add cocamide DEA and sodium benzoate, stirring until homogeneous. The manufacture of liquid soap for the ethanol extract of katuk leaves was adjusted to each concentration. After that, the quality test of the ethanol extract of katuk leaves liquid soap was carried out by organoleptic test, pH, foam height, specific gravity, and viscosity.

| Bahan                | SLS | Katuk Leaf Extract | Cocamid DEA | Olive oil | Na-CMC | Na Benzoat | Stearic Acid |
|----------------------|-----|--------------------|-------------|-----------|--------|------------|-------------|
| F<sub>SLS</sub>     | 2   | 2                  | 2           | 20        | 3      | 0,1        | 2           |
| F1                   | 1   | 3                  | 2           | 20        | 3      | 0,1        | 2           |
| F2                   | 3   | 5                  | 3           | 20        | 3      | 0,1        | 2           |
| F3                   | 5   | 7                  | 3           | 20        | 3      | 0,1        | 2           |
| F4                   | 7   | 9                  | 3           | 20        | 3      | 0,1        | 2           |
| F5                   | 9   | 7                  | 3           | 20        | 3      | 0,1        | 2           |

Table 1. Variations of katuk leaf extract concentration
3. Formatting the title, authors and affiliations

In this study, the natural ingredients to be used are Katuk leaves. The use of katuk leaves because they contain saponin compounds which can have the potential as a natural surfactant to replace Sodium Lauryl Sulfate (SLS). Surfactants, or surface-active agents, are amphiphilic molecules. Their heads are polar, or hydrophilic, and their tails hydrophobic. They are soluble in both organic solvent and water. The surfactant reduces the surface tension of water by adsorbing at the liquid-gas interface.

The organoleptic test results on the F SLS sample show that the soap is liquid, has a white color, has a strawberry smell. This smell is caused by the addition of strawberry scent to the formulation, the color of F1 and F2 samples are light green while the F3, F4, and F5 formulas are dark green. The green color of the liquid soap indicates the presence of katuk leaf extract in the formulation. Then, the color difference at F3, F4, and F5 is getting darker green due to the increased concentration of katuk leaf extract. from the results of the organoleptic test, all samples have complied with SNI standards.

![Figure 1. pH at the variation of katuk leaf extract concentration](image)

The comparison of the results of pH testing of liquid bath soap formulations using SLS and using katuk leaf extract can be seen in Figure 1. The pH test is one of the requirements for the quality of liquid soap. This is because liquid soap is in direct contact with the skin and can cause problems if the pH does not match the skin's pH. In general, liquid soap products have a pH that tends to be alkaline. This is due to the basic ingredients of the liquid soap, namely KOH which is used to produce saponification reactions with fats or oils or synthetic detergents that have a pH value above neutral pH.

More the concentration of katuk leaf extract is added, the pH will decrease. pH changes occur because Katuk leaf extract has an acidic pH of 4.5. Formulations that meet the standard of liquid bath soap are formula F1 (pH = 10.4) F2 (pH 9) and F3 (pH 8). Formulations that do not meet the standards within the range of SNI criteria are formula F4 (pH 7.6 ±) and formula (F5 pH 7). Changes in pH on the preparation are influenced by the increase in the variation of the katuk leaf extract in liquid bath soap. In addition, a decrease in pH can also be caused by other ingredients that make up soap, namely stearic acid, which is acidic [9].
The increased concentration of liquid soap, the less foam is produced. There is a decrease in the height of the foam because the height of the foam is influenced by pH, so that the lower the pH, the less foam is produced. F1, F2, and F3 have met the SNI standard for foam height (Fig 2). There is a decrease in the height of the foam because the height of the foam is influenced by pH, so that the lower the pH, the less foam is produced. Foam stability is influenced by the concentration and viscosity of the preparation [10]. Based on the results obtained in the F1 formula, the foam height obtained was 23.4 ± 2.07 mm, the F2 formula for the foam height obtained was 20 ± 1.41 mm and the F3 formula for the foam height obtained was 15.6 ± 0.89 mm which met soap standards. In the formula F4, the foam height obtained is 4.8 ± 1.79 mm and F5 the foam height obtained is 2 ± 0.00 mm, not according to what is stipulated by SNI 06-4085-1996.

From the observations, it was obtained that the specific gravity in the F1 formula was 1.04 g / ml, the specific gravity in the F2 formula was 1.032 g / ml, the specific gravity in the F3 formula was 1.03 g / ml, the specific gravity in the F4 formula was 1.022 g / ml and the specific gravity in the F5 formula was 1.016. g / ml. The specific gravity test of each has decreased the specific gravity value...
but is still within the criteria range. The building weight value of a constituent material and its physical properties. the decrease in specific gravity is caused by the presence of fat or ethanol in the solution.

\[ \text{viscosity (cP)} \]

![Figure 4. Viscosity at the variation of katuk leaf extract concentrations](image)

Fig 4 shows the results of the study from the comparison of the viscosity value of liquid bath soap formulations using SLS and katuk leaf extract. The viscosity test used the viscometer Lamy Rheology, from the results of observations on the F1 formula the results were 2478 cP, the F2 formula got 2929.6 cP, the F3 formula got 3699.2 cP, the F4 formula got 3140.6 cP and the F5 formula got 2330 results cP. Katuk leaf extracts liquid soap in the formula F1, F2, F3, F4 and F5 have met the viscosity standard of liquid soap. With the balance of the composition between fatty acids and bases, the saponification process runs perfectly, so that the resulting soap product becomes thicker. Also, other factors that cause changes in the viscosity value are the length of stirring in the liquid soap formula and the temperature used in the process of making liquid soap formulas.

4. Conclusion

Based on the research that has been done, it is known that the concentration of katuk leaf extract has an effect on the physical liquid soap including organoleptic, pH, high foam, specific gravity, and viscosity. The liquid bath soap formula for katuk leaf extract that meets all physical properties standards is F1, F2, and F3. Based on these results, it can be seen that liquid soap formulation using katuk leaf extract has the potential as an alternative to natural surfactants to replace SLS.

Acknowledgement

The completion of this study could not have been possible without the support of laboratory team of Buana Perjuangan Karawang University.

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