

Aromatherapy Soap Innovation from Clove Leaves as an Android-based Booklet Media in Applied Chemistry Learning

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DOI: [10.29303/jppipa.v8i2.1167](https://doi.org/10.29303/jppipa.v8i2.1167)

Article Info

Received: November 25, 2021

Revised: February 20, 2022

Accepted: March 13, 2022

Published: April 30, 2022

Abstract: The essential oil content of cloves can be used as a base for aromatherapy soap. The manufacturing process is an example of implementing applied chemistry in everyday life that utilizes local Maluku wisdom. The purpose of this study was to create an aromatherapy soap innovation from clove leaves as a valid android-based booklet media in applied chemistry learning. This research was conducted by making aromatherapy soap from clove leaves and testing the quality of the soap and then making an android-based booklet with materials for making aromatherapy soap to support applied chemistry learning. The android-based booklet media that was created was validated by experts and then analyzed using the content validity coefficient formula according to Gregory. The results showed that aromatherapy soap from clove leaves met the quality standards of hand-washing liquid soap. And the best treatment of aromatherapy soap is at a concentration of 15% with a pH of 6.98, free alkali of 0.02%, and total plate count of 6.00×10^0 . The results of the content validity analysis obtained information that the android-based booklet media in applied chemistry learning has met the criteria valid where the overall content validity coefficient is 75%. The resulting android-based booklet media can make it easier for students to learn applied chemistry online and offline.

Keywords: Aromatherapy soap; Android based booklet; Applied chemistry

Citation: Nirmala, M., Nisa, K. R., & Hulopi, F. (2022). Aromatherapy Soap Innovation from Clove Leaves as an Android-based Booklet Media in Applied Chemistry Learning. *Jurnal Penelitian Pendidikan IPA*, 8(2), 429-435. <https://doi.org/10.29303/jppipa.v8i2.1167>

Introduction

Coronavirus Diseases 2019 (COVID-19) is a new type of disease that attacks the world community, Indonesia is no exception. Researchers are competing to find ways to prevent transmission until they find an antiviral for Covid-19. One way to prevent the transmission of the COVID-19 virus is to wash your hands as often as possible with soap (Purbosari, 2021). The use of antiseptic in hand soap is very useful so that the Covid-19 virus is not easily transmitted. Maluku, which is rich in spices such as cloves, can be used for its plants in the

form of fruit, stems, and leaves to be used as aromatherapy soap.

Aromatherapy soap is good and safe to use if it meets the quality requirements for hand soap, which has a pH of around 4-10, a maximum free alkali of 0.05, and a maximum free fatty acid of 1 (BSN, 2017). The process of making clove-based aromatherapy soap is one of the uses of chemistry in everyday life which is learned in applied chemistry learning that utilizes local Maluku wisdom. Research by (Lomboan et al., 2021) on a test for antibacterial activity provision of liquid soap ethanol extract of clove leaves against *Staphylococcus aureus* bacteria showed that the use of clove leaf extract in

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liquid soap could inhibit *Staphylococcus aureus* bacteria with the greatest inhibition zone at concentrations 15%, research by (Rifqi et al., 2021) on the manufacture of antibacterial solid soap from the stevia leaf and clove flower extracts showed that the more stevia leaf and clove flower extracts in soap making, the greater the inhibition zone for bacterial growth and research by (Najiah et al., 2021) regarding the effectiveness of clove leaf extract natural hand sanitizer against MRSA, it was found that the greater the clove leaf extract concentration (20%), the greater and better the inhibition of MRSA will be. Based on previous research, it can be concluded that clove leaf extract is very good for use in making aromatherapy soap.

The concept for making aromatherapy soap from clove leaves in applied chemistry courses is very useful during the Covid-19 pandemic, especially in the health sector. Students are easier to understand and apply the material in this learning in everyday life. Learning during a pandemic requires lecturers or teachers to develop and apply technology in conducting online or online learning. One of the interesting and fun ways to apply applied chemistry learning during a pandemic is to use booklets. A booklet is a small book that has at least one page but no more than forty-eight pages outside the cover count. The booklet contains important information, the contents of which must be clear, firm, easy to understand, and will be more interesting if the booklet is accompanied by pictures (Muzdalifah, 2018).

The advantages of Booklet media in the booklet content section are related to real problems so that students will learn contextually. This can make students understand in learning activities. Students can apply their knowledge in solving real problems in the surrounding environment (Tiffany, Pribadi, 2018). Android-based booklet media is a booklet that can be used in android smartphones. Android-based booklets apply today's technology so that they are easy to use and carry anywhere for learning purposes. Android-based booklet media can stimulate students in the classroom to be more interested in participating in the learning process and students can issue constructivism ideas so that new knowledge is developed called cognitive knowledge (Pujiasih et al., 2021).

The purpose of this research is the manufacture of aromatherapy soap according to SNI standards and the manufacture of valid android-based booklet media in applied chemistry learning.

Method

The research was conducted using an experimental method with qualitative analysis in the form of organoleptic analysis and quantitative analysis in the form of testing the quality requirements of soap. The location of this research is at the Chemical Laboratory of

UIN Alauddin Makassar and the Chemical Laboratory of Baristand Ambon.

This research includes several procedures, namely:

1. Analysis of fatty acid content in VCO oil and Clove oil

Oil component analysis was carried out using Shimadzu QP 2010 ULTRA Gas Chromatography-Mass Spectrometry (GC-MS) by injecting 2 µL of the sample using a BD5 column and MS detector. This test produces chromatograms and compounds contained in VCO oil and essential oil from clove leaves (Widyasanti et al., 2017).

2. Aromatherapy soap from clove leaves

Vegetable oil is heated at a temperature of ±70°C, then added with 30% KOH solution. Every 15 minutes, other additives were added, such as glycerin to moisturize the skin, surfactant sodium lauryl sulfate as an emulsifier, butyl hydroxytoluene (BHT) as an antioxidant, and citric acid to adjust the pH of soap and clove essential oil. Liquid soap quality testing is divided into two types, namely physicochemical quality tests according to SNI (BSN, 2017) and organoleptic tests (Santoso et al., 2020).

3. Making Android-based booklet media using the Adobe Animate CC application

4. Android-based booklet media validation by experts.

Validation was carried out by two experts, then the results of the assessments of the two experts were analyzed quantitatively using the Gregory formula (K.A. Nalasari et al., 2021) in Figure 1.

| | | Validator I | |
|--------------|------------------------|------------------------|----------------------|
| | | Irrelevant Score (1-2) | Relevant Score (3-4) |
| Validator II | Irrelevant Score (1-2) | A | B |
| | Relevant Score (3-4) | C | D |

Figure 1. Agreement Model Between Two Validators

$$\text{Content validity coefficient} = \frac{D}{(A+B+C+D)} \dots\dots\dots(1)$$

To state that an assessment instrument has a fairly high degree of validity, the results of the assessments of the two validators have strong relevance (3 or 4). If the content validity coefficient value is greater than 75% ($x > 0.75$), it can be stated that the measurement or intervention carried out is valid (Nirmala & Ramlawati, 2018)

Result and Discussion

Aromatherapy Soap from Clove Leaves

Liquid soap is one of the pharmaceutical preparations used to clean the skin from dirt and bacteria. Soap is produced from the reaction between

fatty acids and a strong base which functions to wash and clean dirt (Lomboan et al., 2021). Aromatherapy soap is made from clove leaf oil which was previously distilled from clove leaves. Aromatherapy soap with the aroma of cloves can be made with the formula in Table 1.

Table 1. Aromatherapy Soap Formulation from Clove Leaves

| Material | Function | Treatment | | | |
|---------------------------|--------------------|---------------|----------------|----------------|----------------|
| | | A (0% b/b) | B (15% b/b) | C (20% b/b) | D (25% b/b) |
| VCO (mL) | Active Ingredients | 50.00 | 42.50 | 40.00 | 37.50 |
| Clove Leaf Oil (mL) | fat base | 0.00 | 7.50 | 10.00 | 12.50 |
| KOH 40% (mL) | Alkali | 25.00 | 25.00 | 25.00 | 25.00 |
| Gliserin (g) | Moisturizing Skin | 1.00 | 1.00 | 1.00 | 1.00 |
| Sodium Lauryl Sulfate (g) | Emulsifier | 1.00 | 1.00 | 1.00 | 1.00 |
| BHT (g) | Antioxidant | 1.00 | 1.00 | 1.00 | 1.00 |
| Citric Acid (g) | pH regulator | 1.00 | 1.00 | 1.00 | 1.00 |
| Aquades (mL) | Solvent | 40.00 | 40.00 | 40.00 | 40.00 |

Aromatherapy soap from clove leaves is made with 4 concentrations, namely 0%, 15%, 20%, and 25%. Based on the results of the study (Lomboan et al., 2021), the liquid soap preparation of clove leaf ethanol extract at a concentration of 15% had the greatest inhibitory power for *Staphylococcus aureus* bacteria so in this study it was made with the addition of 20% and 25% aromatherapy soap concentrations. The addition of the concentration of aromatherapy soap preparations aims to test the quality of soap according to the quality requirements of liquid soap.

Aromatherapy soap is made by a saponification reaction of a saponification reaction. The saponification reaction or commonly called the saponification reaction is a reaction that is generally used to synthesize soap. The reaction equation is as follows:

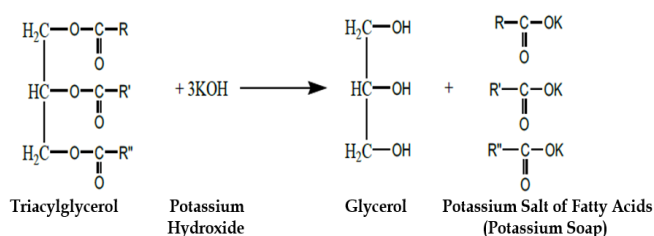


Figure 2. Saponification Reaction

The reaction shows that 1 mole of triglyceride is reacted with 3 mol of KOH to form a mixture of potassium carboxylate and glycerol. The reaction equation shows that the soap formed is a salt composed of a mixture of carboxylate as the anion and potassium as the cation. The formation of the mixed anion is because the triglyceride molecule has various fatty acid residues, which come from the fat or the triglyceride oil itself (Santoso et al., 2020).

The results of the saponification reaction of clove aroma which can be referred to as aromatherapy soap from clove leaves can be seen in Figure 3.

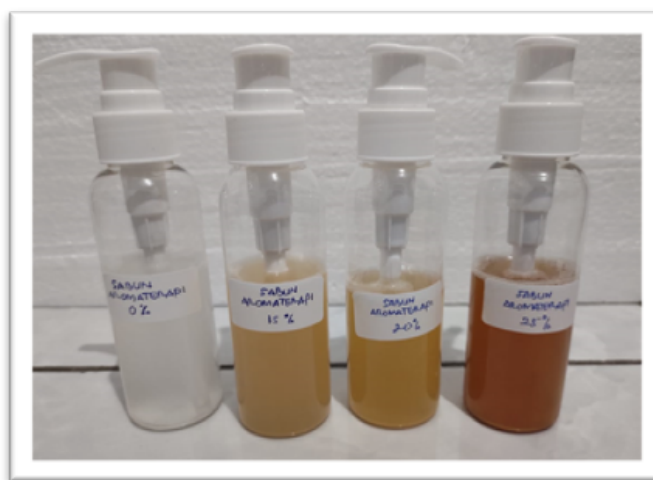


Figure 3. Aromatherapy Soap from Clove Leaves

Aromatherapy Soap Component Analysis

Clove leaf essential oil contains several types of chemical components that make up the oil. The chemical components that make up the oil will give the characteristic properties that characterize an essential oil. The aroma of essential oils is formed by all of its constituent chemical components, both major and minor components. The different compositions of essential oils make each oil have a different aroma and color (Pratiwi et al., 2016). Mass spectrometry data from GC-MS shows the molecular mass of each compound and its fragmentation pattern. The compounds that make up the essential oil are interpreted based on the fragmentation pattern and the percent similarity to the database (>90%). The compounds contained in clove leaf oil can be seen in Table 2.

Table 2. Content of Clove Leaf Oil Compounds

| Compound Name (based on MS library) | Percentage (%) |
|-------------------------------------|----------------|
| Eugenol | 60.88 |
| Caryophillene | 21.08 |
| Humulene | 4.95 |
| Eucalyptol | 0.02 |

Based on the results of GC-MS analysis, the main compound contained in clove leaves is eugenol with a percentage of 60.88% followed by Caryophillene at 21.08%. Other compounds found in clove leaf oil were Humulene at 4.95% and eucalyptol at 0.02%. In addition to clove leaf oil, in making aromatherapy soap, virgin coconut oil (VCO) is also used as the main raw material. The compounds contained in VCO oil can be seen in Table 3.

The results of the GC-MS analysis showed that the most abundant fatty acid contained in VCO was lauric acid with a percentage of 32.69%. In addition, in VCO, there are octanoic acid, palmitic acid, oleic acid, capric acid, and myristic acid. Lauric and palmitic acids can be found in coconut oil and palm oil, which are raw materials commonly used in soap making. Lauric acid

functions to clean, produce foam, and provide softness. While palmitic acid serves to stabilize the foam.

Table 3. Fatty Acid Content of VCO

| Compound Name (based on MS library) | Percentage (%) |
|-------------------------------------|----------------|
| Oktanoat acid | 19.76 |
| Kaprat acid | 8.82 |
| Laurat acid | 32.69 |
| Miristat acid | 8.41 |
| Palmitat acid | 9.98 |
| Oleat acid | 9.41 |

Source: (Widyasanti et al., 2017)

Organoleptic Test

The organoleptic test was carried out by looking at the color, aroma, shape, thickness, moisturizing the skin, the amount of foam, and smoothing the skin from the aromatherapy soap preparation from clove leaves. The results of organoleptic observations can be seen in Figure 4.

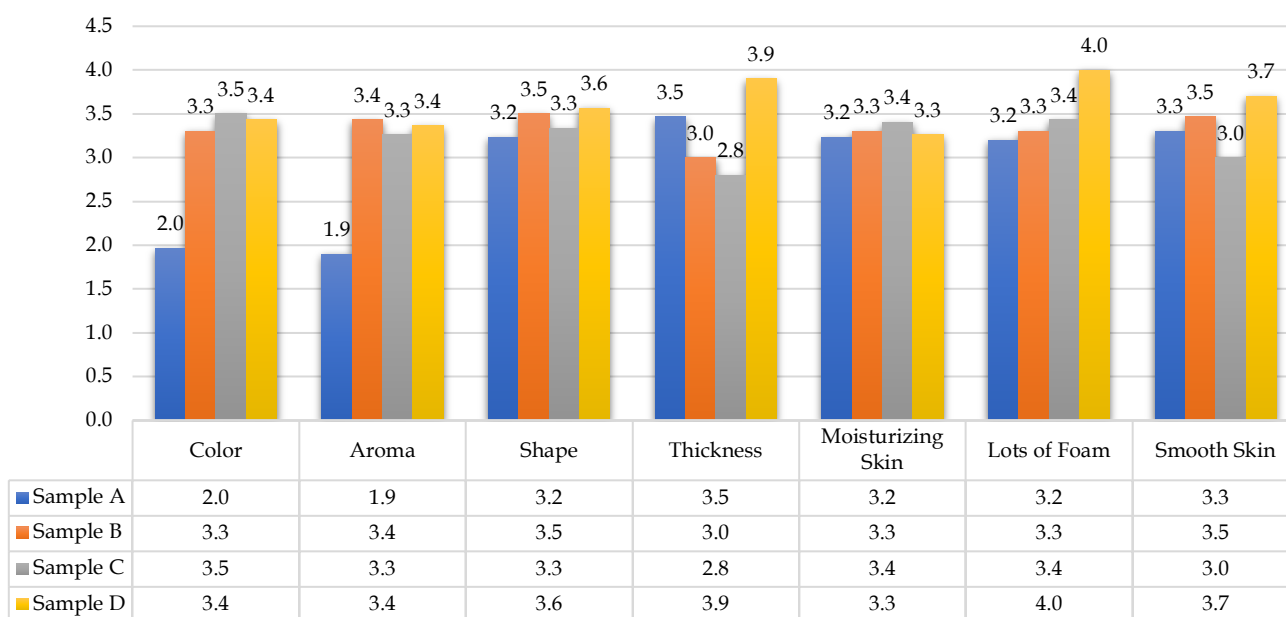


Figure 4. Organoleptic Test Results

The organoleptic test aims to see the appearance or physical appearance of a preparation which includes shape, color, and odor. Standards set by SNI, standards for organoleptic testing of liquid soap, form namely liquid, odor and color that has a distinctive odor and color. Organoleptic test on aromatherapy soap from clove leaves in the form of color, aroma, form of viscosity, and a lot of foam. Additional properties included in the organoleptic test are moisturizing the skin and smoothing the skin.

The color and aroma produced from aromatherapy soap is the color and aroma of cloves. The concentration of clove leaf oil that is added affects the color of the aromatherapy soap produced, which is yellow to brownish. The form of aromatherapy soap produced in this study is liquid. Based on organoleptic tests on 30 panelists, the average level of preference for aromatherapy soap was in the third category, namely "like". In the color and aroma indicators, sample A gets a level of preference with a value of 2, namely "dislike".

Physicochemical Test

a. pH

The pH test was carried out to determine the pH of aromatherapy soap from clove leaves made according to the SNI 2588: 2017 standard. The results of the pH test can be seen in Table 4.

Table 4. pH Aromatherapy Soap from Clove Leaves

| Sample | Soap Concentration (%) | pH | SNI 2588:2017 |
|--------|------------------------|------|---------------|
| A | 0 | 6.99 | 4-10 |
| B | 15 | 6.98 | |
| C | 20 | 6.98 | |
| D | 25 | 6.98 | |

The pH test is one of the quality requirements for liquid soap. This is because liquid soap will interact directly with the skin and can cause problems if the pH is not in accordance with the skin pH (Korompis et al., 2020). Based on the pH test results in the laboratory, the aromatherapy soap from clove leaves produced has a pH that is in accordance with the quality standard of hand washing liquid soap. The average pH of the four aromatherapy soaps is at a neutral pH of 6.98.

High pH can cause skin irritation because it has a high level of free radicals. The level of free alkali in this soap is due to the presence of alkali which does not react with fatty acids in the saponification process. The amount of alkali in each formula is the same, so the pH between the formulas does not have a significant difference (Hutauruk et al., 2020)

b. Alkali Free

One of the quality requirements of liquid soap is Alkali-Free. Free alkali is an alkali in soap that is not bound as a compound. The free alkali test was carried out to determine the percentage of free alkali in aromatherapy soap made according to the SNI 2588: 2017 standard. The results of the free alkali test can be seen in Table 5.

Table 5. Alkali-Free Aromatherapy Soap from Clove Leaves

| Sample | Soap Concentration (%) | Alkali Free (%) | SNI 2588:2017 |
|--------|------------------------|-----------------|---------------|
| A | 0 | 0.017 | Max 0.05 |
| B | 15 | 0.026 | |
| C | 20 | 0.034 | |
| D | 25 | 0.043 | |

Based on the test results, the percentage of free alkali in aromatherapy soap from clove leaves was below 0.05 so the aromatherapy soap produced was in accordance with the established quality standard of liquid soap. Free alkali test is a measurement of alkali in soap that is not saponified or does not react with fatty acids. The high percentage of free alkali value indicates

that the soap can cause irritation (Widyasanti et al., 2017).

c. Total Plate Count

The Total Plate count is one of the quality requirements for liquid soap which shows the number of mesophilic aerobic bacterial colonies found in the aromatherapy soap test sample. The results of the total plate number test can be seen in Table 6

Table 6. Total Plate Count of Aromatherapy Soap from Clove Leaves

| Sample | Soap Concentration (%) | ALT (Coloni/mL) | SNI 2588:2017 |
|--------|------------------------|------------------------|---------------------|
| A | 0 | 4.00 x 10 ⁰ | 1 x 10 ³ |
| B | 15 | 6.00 x 10 ⁰ | |
| C | 20 | 7.00 x 10 ⁰ | |
| D | 25 | 6.00 x 10 ⁰ | |

Based on the test results, the mesophilic aerobic bacterial colonies in aromatherapy soap from clove leaves were below 1 x 10³ colonies/g so it can be said that the aromatherapy soap produced was in accordance with the established quality standard of liquid soap.

Android Based Media Booklet

The android-based booklet media was created with the aim of making it easier for students to understand applied chemistry, one of which is making aromatherapy soap from clove leaves that utilize local Maluku wisdom. The booklet generated from this research can be seen in Figure 5.



(a)



(b)

Figure 5. (a) Cover of Media Booklet. (b) Contents of Media Booklet

The resulting media booklet is then given to two validators in parallel. The results of both are used as material for revision. The results of the validation of the booklet media by experts were then analyzed using Gregory's content validity analysis. The results of the content validity calculation are summarized in Table 7

Table 7. Description of Content Validity of Android-Based Media Booklet

| Validator Rating | Content Validity | Category |
|------------------|------------------|----------|
| Theory Aspect | 1.00 | Valid |
| Media Aspect | 1.00 | Valid |
| Rata-Rata | 1.00 | Valid |

Validity means the extent to which the accuracy and accuracy of a measuring instrument (test) in carrying out its function. The value of content validity has reflected the overall content that should be mastered proportionally from the opinion of experts or experts.

Based on the results of the content validity analysis in Table 7, information is obtained that the android-based booklet media in applied chemistry learning has met the valid criteria where the overall content validity coefficient is > 0.75 or 75%. This means that the validator gives an assessment that the items in the developed booklet media have relevance to what is being measured.

Conclusion

Based on the results of research that have been carried out, aromatherapy soap from clove leaves meets quality standards as hand washing liquid soap with the best treatment at a concentration of 15%. The results of this study are stated in a media booklet that has been declared valid by experts and can be used in applied chemistry learning. Applied chemistry learning is easier to do by using an android-based booklet media that is produced because it contains important information in making liquid soap from clove leaves, is easy to carry, and is used in online and offline learning. The results of this study can be used in learning chemistry related to soap making. In addition, the results of this study can also be used as a reference by the Maluku people in making soap from clove leaves during the Covid-19 pandemic.

Acknowledgments

This research was supported and funded by KEMDIKBUD-RISTEK. Therefore, we are grateful to LLDIKTI Region XII for providing the PDP grant so that this research can be carried out until its publication. We also thank all those who have helped until this research is well completed.

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