The Effect of Varying NaOH Levels on the Physical Properties of Solid Soap with a Combination of Oils as a Student Learning Resource

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Abstract. Students need learning resources related to everyday life so that students are helped in the learning process. Soap is a product that is linked to chemicals that exist in everyday life. The saponification process with the main ingredients NaOH and fat can be carried out with varying NaOH levels to determine the soap's good quality. This aims to determine the proper NaOH levels so that it can produce soap products of good quality. According to the chemistry learning curriculum, students can also understand the soapmaking process's material. Based on the research results, the soap-making process that produces good quality soap after testing is soap with a NaOH content of 32%. Based on the curriculum distribution of school chemistry teaching materials and soap analysis as a student learning resource, it is hoped that students can study macromolecules (fats), lipids (saponification reactions), etc., from soap making.

Keywords: Soap, NaOH Ratio, Saponification, Curriculum.

1 Introduction

Education is needed because it has many benefits [1]. Education plays a vital role in increasing potential and competence and shaping the character of the Indonesian nation [2]. Therefore, the government is trying to improve the quality of education by optimizing the curriculum. In the 2013 curriculum, teachers must present integrated thematic learning using a scientific approach and appropriate learning models [3]. The 2013 curriculum is expected to trigger questions, observations, analysis, reasoning and communication that arise during the learning process, especially in the field of learning. Chemistry[4]. Educators forget that chemistry learning in SMA/MA focuses on aspects of understanding and knowledge and requires analysis, synthesis and application to develop creativity in reasoning and problem-solving [5]. Therefore, creativity is needed when using learning media by conducting experiments in the school laboratory.

Learning chemistry is one of the chemical concepts that students consider difficult [6]. Therefore, synergistic procedures and practices must be supported [7]. The saponification reaction in laboratory experiments becomes a sub-material in classroom learning, especially lipid material [8]. Soap is a chemical reaction between sodium bases or potassium bases. With fatty acids. Acids that are used to clean the body and do not harm the body [9]. Soap is made by soaping fat or oil using an alkaline solution which releases glycerol [10]. Solid soap, in principle, does not require complicated materials and equipment compared to with other cleaners [11]. So students can make solid soap without having to go to the school laboratory.

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The fat or oil used can be animal or vegetable fat, wax, or marine fish oil [11]. Fat becomes an interesting chemical material when taught to students through the practical method of making soap in everyday life so It is hoped that it can increase student interest [12]. Fatty acids are the main components of fats and oils, so choosing the type of oil to make soap is essential [13]. The raw materials for making soap used in this research are coconut palm oil, olive oil and candlenuts. Palm oil contains around 43-53% lauric acid,, producing soap foam, and around 40-45% palmitic acid,, producing soap hardness [14]. Candlenut (Aleurites moluccana) is a plant in Indonesia that has spread to Southeast Asia [15]. Arlene's research (2013) stated that candlenut meat contains high levels of unsaturated fatty acids (oleic acid) [14].

The iodine number is 136-167, meaning that candlenut oil has a high content of unsaturated fatty acids, making it a drying oil [16]. Olive oil contains high levels of folic acid. Olive oil processed into soap is considered the best medicine for dry skin [13]. Processing palm oil, olive oil, and candlenut oil into solid soap is easy using chemical reactions [17].

NaOH is diverse because it is the essential ingredient for making soap and is the main ingredient in the saponification process, where oil or fat is converted into soap [18]. The concentration of NaOH affects the quality of soap because it can affect the pH of soap, free fatty acids, free alkali, fraction levels unsaponifiable, free fatty acids, and water content [19]. The perfection of the saponification process is influenced by the high and low concentration of NaOH, which indirectly affects the quality of the soap produced [20]. Therefore, research was carried out on The Effect of Varying NaOH Levels on the Physical Properties of Solid Soap with a Combination of Oil as a student learning resource. The NaOH concentrations used were 20%, 32%, and 40%.

2 Research Methods

The research method for the effect of varying NaOH levels on the physical properties of solid soap with a combination of oils as a student learning resource uses experimental methods. The ingredients used to make soap are NaOH, palm oil, coconut oil, candlenut oil and olive oil. Soap making uses a hot process method, namely heating the saponification process between NaOH and oil [9] by comparing the results of observations of sample groups that have been given action. The sample used in this research was solid soap with a combination of oils (palm oil, olive oil and candlenut oil) which used NaOH as an alkali source with varying concentrations of 20%, 32% and 40%. Solid soap formulations with a combination of oils (palm oil, olive oil and palm oil) can be seen in Table 1.

Table 1. A solid soap formulation with a combination of oils (palm oil, olive oil, and palm oil).

Composes	**F1 (20%)**	**F2 (32%)**	**F3 (40%)**
Coconut oil palm	28 grams	28 grams	28 grams
Olive oil	2 grams	2 grams	2 grams
Candlenut oil	25 grams	25 grams	25 grams
NaOH	10 grams	16 grams	20 grams
VCO	3 grams	3 grams	3 grams
Aquades	50 ml water	50 ml water	50 ml water
PG	1 grams	1 grams	1 grams

Saline Solution 50%	7 ml water	7 ml water	7 ml water
Essential oil vanilla	2 grams	2 grams	2 grams
TOTAL	128 grams	134 grams	138 grams

2.1 Tools and materials

The tools used in this research were knives, scissors, scales, basins, measuring cups, stirrers, soap moulds and bottles. Meanwhile, the ingredients used in this research were palm oil, olive oil, candlenut oil, NaOH, VCO, Aquades, PG, salt solution, and vanilla essential oil.

2.2 Varying the NaOH Concentration

To make Formula 1 (20% NaOH), weigh 10 grams, dissolve in 50 mL of distilled water, and stir until homogeneous. Cool the NaOH solution for one day before use. Repeat the same steps to make Formula 2 (NaOH 32%) and Formula 3 (40%).

2.3 Make Solid Soap

First, prepare the necessary raw materials, additional materials and tools. After that, weigh the ingredients according to the formula. Weigh the ingredients for palm oil, olive oil, candlenut oil and VCO in one container, stir, then add the NaOH formula that has been made. Stir until evenly mixed and a sediment forms. Add PG, then stir until smooth. Add the Salt Solution until soft, then add vanilla essential oil. The pH test should be carried out after 3-5 days for maximum results.

2.4 Test pH

The pH value is an indicator and benchmark for the degree of acidity of a soap preparation [21]. One gram of solid soap is dissolved in 10 mL of distilled water. Then, the PH value is measured by dipping the universal pH and leaving it for a few moments until the colour changes. [9].

2.5 Organoleptic Test

In research (Mutmainnah et al., 2016) a visual test was carried out on each formula by observing the soap using the five senses including texture, color and smell of solid soap preparations with a combination of oils (palm oil, olive oil and candlenut oil). [22].

2.6 Foam Height Test

The foam height test is carried out to see the foam power produced by the soap. One gram of solid soap is dissolved in 10 mL of distilled water [23] then shaken by inverting the test tube for 1 minute. The initial foam height was measured with a ruler and the results were recorded. The final foam height was measured after leaving it for 5 minutes, 10 minutes, 20 minutes and 30 minutes [24].

3 Result and Analysis

3.1 Analyze the viscosity of soap using the NaOH ratio

In this research, soap was made with various NaOH formulations to determine the optimal NaOH concentration to produce soap products with SNI standards. After the storage period, the

quality of the soap is evaluated through several tests, including organoleptic tests, pH and foam height.

3.1.1 Organoleptic

This test is carried out using a method that looks at the hardness, shape and color of the soap. Observations were made to see that there was no physical change in the lumpy soap. This test is carried out five days after making the soap so that the saponification process is more complete.

Language Indonesia: F1	F2	F3

Figure 1. Variations of NaOH blocked by soap

Table 2. Organoleptic test data

Concentration	**F1 (20%)**	**F2 (32%)**	**F3 (40%)**
Forming	Dense	Dense	Dense
Color	Cream concentrate	Cream	Cream
Texture	Hard soft	Hard	Hard

Soap hardness is a parameter of resistance, namely a substance that can exert pressure on the body. If the soap is too soft, it will dissolve easily and break down quickly. Saturated fatty acids affect the hardness of the soap and the amount of NaOH base used [25]. Soap hardness Day 0, all the formula is still soft or not dense enough. Furthermore, the soap solidifies or hardens due to the levels of saturated fatty acids and NaOH [26]. F1(20%) is not yet fully formed, or there are still some soft parts. This is because a saponification reaction occurs. This is not perfect [27]. The experimental results show that the specific gravity of the soap and the concentration of NaOH are increasing. However, if too much NaOH is used, then the soap foam will decrease, whereas if too little NaOH is added, then the type of soap will not be solid. [28]. The choice of type of fatty acid also affects the characteristics of the soap produced, because every kind of fatty acid will provide different properties to soap [29]. The final colour result of processed soap which is solidified with a combination of oils (palm oil, olive oil and candlenut oil), has a cream colour for F2 and F3, while F1 has a dark cream colour. The organoleptic test results show that solidified soap with a NaOH concentration of 32% (F2) is the best soap formula.

3.1.2 Acidity level (pH)

Test the pH of solid soap. This has been done three times. The pH test aims to determine the degree of acidity of the soap produced. The pH value of soap is one of the critical parameters for assessing the quality of soap. According to SNI (1994), the pH value of standard soap ranges from 9-11. Meanwhile, the pH of human skin ranges between 4.5-7, and it is perfect for product health if it is close to the skin's pH [17]. Soap with a pH that is too low (acid) can irritate the skin. Meanwhile, soap with a pH that is too high (alkaline) can stimulate the swelling of keratin in the skin, making it easier to enter the skin because the skin becomes chapped and dry [20]. Based on the evaluation of the soap's pH, the results are shown in the table below.

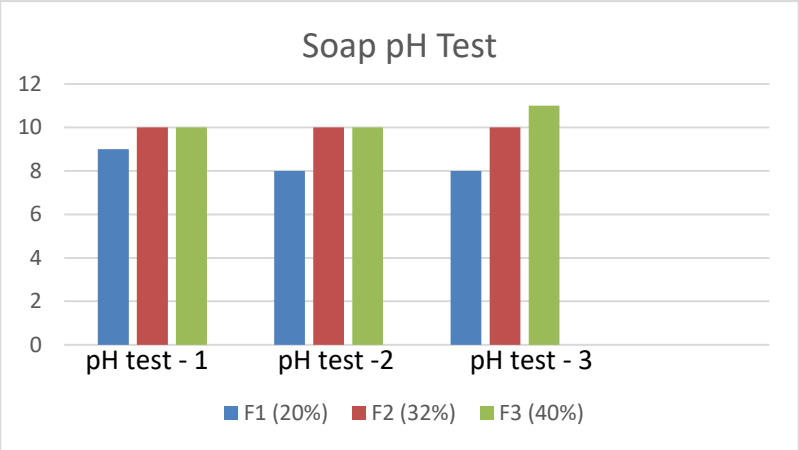

Table 3. Ph soap

The pH value of the solid obtained in this study ranged from 8-11. With these results, the pH value of the research soap is by SNI standards. The amount of alkali in soap affects the pH value significantly and slightly. So, the higher the pH value, the greater the alkali contained in the soap [30].

3.1.3 High Foam

One important indicator of solid quality soap that consumers like is foam stability testing. Foam testing functions to determine the ability, height, and stability of foam in soap solids determined by SNI, namely 1.3-22 cm. Foam is a structure composed of air pockets trapped in layers, and its properties are stable [8]. The results of testing the height of foam soap are shown in the following table.

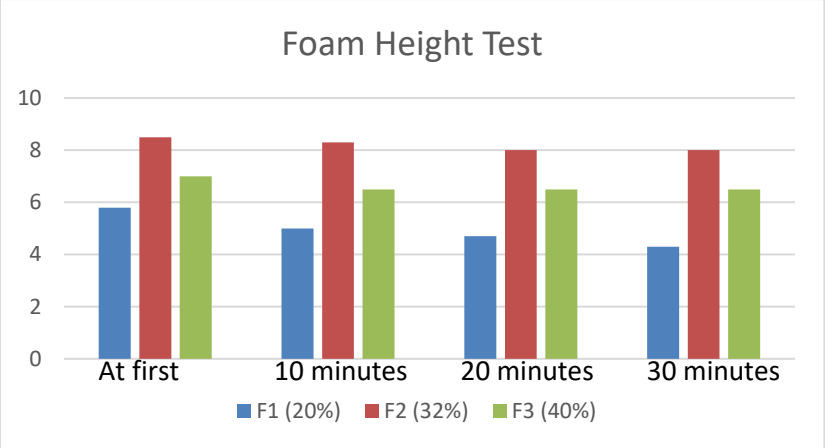

Table 4. Foam Height Test

3.2 Curriculum Analysis

An analysis of the SMA/MA Chemistry curriculum was carried out to determine the competencies and achievements related to students' learning the soap-making process at school. [4], The 2013 curriculum focused on the competency and character of students, in the form of guidelines for knowledge, skills and attitudes that can be demonstrated to students as a form of understanding of the concepts they learn contextually [31]. Therefore, educators can apply contextual learning to achieve their goals. This statement is based on the analysis of SMA/MA chemistry learning curriculum materials distributed to classes X, XI, and XII.

Material	Performance
Basic knowledge of chemistry	Understand scientific work methods, safety and security, and the role of chemistry in life.
Colloid	Definition of Colloids, Types of Colloids, and Properties of Colloids
Ester	Naming esters and ester reactions
Lipid	Learn the Saponification reaction between NaOH and the fat contained in soap.
Macromolecules	Understanding the types of fatty acids contained in oil can affect the quality of soap. Understand the types of fatty acids contained in oil that can affect the quality of soap.

The 2013 curriculum can support learning with a simple test method for making solid

soap with varying levels of NaOH oil combinations. This can be seen from the distribution of the material. Chemistry learning begins in class X, students are taught various basic chemical knowledge, which will later be needed for advanced-level learning in classes XI Furthermore, in class XI, students are taught the nature of experimental learning in the laboratory, so that the knowledge obtained in class X is excellent. They need Padda to know this. In class XII, students are given learning material, a continuation of learning material at the previous level. Based on this, the conclusion that can be obtained from the 2013 curriculum is that the distribution of material related to learning the knowledge needed in soap making tests has been evenly distributed so that students have sufficient knowledge to test soap making with varying levels of NaOH oil combinations which can later be used as a source. students learn to understand the nature of contextual learning better. This test also requires direct achievement targets from the 2013 curriculum. Namely, students are required to be able to apply their knowledge in everyday life. Starting from the 2013 curriculum, students are required to be able to use their skills in everyday life.

4 Conclusion

Based on the research results, the amount of NaOH levels greatly influences the quality of soap, this can be seen from the tests carried out, namely the organoleptic test, pH test and foam height test. Good quality soap can be produced with a NaOH content of 32%. The results of the curriculum analysis show that the distribution of chemistry learning material in accordance with soap making material is structured and constructive so that students can understand the learning.

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