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Refinery technology of used cooking oil by utilizing coffee dregs and sugar cane bagasse as raw materials for making antiseptic transparent soap of guava leaf extract

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Abstract

Cooking oil is an important basic ingredient in the frying process with the main function as a medium for conducting heat, adding savory taste, in-creasing nutritional value and heating food ingredients. The massive use of cooking oil also has an impact on the waste produced, namely used cooking oil (UCO), which is more increasing. The sustainable use of used cooking oil can damage health. The aim of this study was to obtain purification of used cooking oil with coffee dregs and bagasse as raw materials for making antiseptic transparent soap with guava leaf extract. Preparation of raw materials, extraction of guava leaves, oil refining process, production of antiseptic transparent soap with guava leaf extract, and sample quality analysis are the stages of research. The data from the analysis was then tested with ANOVA. Purification of used cooking oil using bagasse adsorbent produced oil with a pH value of 6.43-6.86, moisture content of 0.67-0-769%, free fatty acids of 0.301-1.982% and acid value of 2.3-3.490%, while for the type of coffee dregs adsorbent produced oil with a pH value of 6.60-6.83, moisture content of 0.068-0.549%, free fatty acids of 0.292-0.921 and acid value of 1.120-5.850. The antiseptic transparent soap formulation results obtained a pH value of 11.427-13,687, moisture content of 27.78-36.505, foam height of 19-21.5 mm and antiseptic power of 2-12 colonies.

Keywords: Bagasse, Coffee dregs, Purification, Transparent soap, Used cooking oil

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INTRODUCTION

Indonesia is world's fourth most populous nation after Republic of China, India and the United States of America. The population of Indonesia reached around 267 million people in 2019 (Bappenas 2018). It makes the basic need for food sources increased. One of them is the need for cooking oil. Cooking oil is an important basic ingredient in the frying process with the main function as a medium for conducting heat, adding savory taste, increasing nutritional value, and heating food ingredients (Ketaren 2005b). The data of Global Agricultural Information Network USDA 2019 shows that Indonesia's consumption of cooking oil reached 13,110 thousand metric tons at most.

The widespread use of cooking oil has an effects on waste production, including the increasing of used cooking oil. Used cooking oil (UCO) is the repeated use of cooking oil result. Consuming used cooking oil is extremely hazardous to one's health. The use of cooking oil regularly and continuously in the frying process causes a degradation response, lowering the quality of the cooking oil (Nasrun et al. 2017). The sustainable use of used cooking oil might be harmful to one's health (Ningrum and Kusuma 2013). Used cooking oil can deposit fat in blood vessels, and liver cancer (Guenther 1987). However, if the used cooking oil is disposed of, it pollutes the environment.

There are three approaches that may be employed to improve the environment concerning used items, they are Reduce, Reuse, and Recycle. The Recycle technique can be utilized to make efforts relating to used cooking oil. Recycling used cooking oil may be accomplished by reprocessing discarded cooking oil into commodities that still have economic worth (Susilawaty et al. 2017).

Since it still contains free fatty acids and a high peroxide value, as well as other impurities, used cooking oil cannot be directly utilized as raw material. Therefore, it is necessary to do treatment to minimize some of these substances by utilizing absorbents. Some materials that can be used as adsorbents are bentonite (Rahayu and Purnavita 2014), zeolite (Alamsyah et al. 2017), activated carbon (Riyanta and Nurniswati, 2016; Rosita and Widasari, 2009; Yusriana et al. 2014), Coffee dregs (Hayati et al. 2012), bagasse (Hajar et al. 2016; Trisnaliani et al. 2019; Wannahari and Nordin 2012) and many others.

Transparent soap is a type of soap that is used for the face and body which can produce a softer foam on skin and has a shinier appearance compared to other types of soap (Hambali et al. 2005). Transparent soap is made by melting the fat phase and preparing water to dissolve sucrose, glycerin, and preservatives. Both of these phases were reacted by an alcoholic solution of caustic soda under controlled heating. After the reaction is complete, the soap is ready to be colored, fragranced, or treated with an active anti-bacterial component. The soap is then poured into separated molds or glasses and allowed to set before being packaged (Butler 2001).

The addition of antibacterial chemicals or components to soap can improve its ability and use, allowing it to be used as an antiseptic soap. One of the anti-bacterial components that can be combined with transparent soap to produce antiseptic soap is an ingredient derived from guava leaves (*Psidium guajava* Linn). Guava leaves contain 9-12% tannin compounds, essential oils, fatty oils and malic acid (Yuliani et al. 2003). The aim of this study was to obtain the purification of used cooking oil with coffee dregs and bagasse as raw materials for making antiseptic transparent soap with guava leaf extract.

MATERIALS AND METHODS

Materials and Equipment

The equipment used was a titration tool, hot plate, stirrer, Erlenmeyer flask, glass beaker, dropper, thermometer, oven, filter paper, funnel, VCO bottle, analytical balance, blender, sieve, measuring cup, pH meter, petri dish and spatula. Meanwhile, the ingredients used include used cooking oil derived from Palm Oil, Sugarcane Bagasse, Coffee Dregs, NaOH, Citric Acid, Stearic Acid, PP Indicator, Glycerin, Ethanol, Aquadest, Sugar and Fragrance.

Raw Material Preparatiaon

a. Bagasse Processing

Bagasse was obtained from sugar cane juice sellers around the city of Malang. The residue from the sugarcane juice mill was washed thoroughly and then dried in the blazing sun. Furthermore, the dried bagasse was ground by grinding and sifting to obtain bagasse powder (Ramdja et al. 2010).

b. Coffee Dregs Processing

Coffee dregs were collected from coffee shops across Malang as a result of filtering coffee beverages. The coffee dregs were washed and dried in the sun's heat. The dry coffee dregs should then be ground to produce softer, more homogeneous pulp particles (Baryatik et al. 2019). The selection of coffee grounds from the same sort of coffee is vitally necessary in order to generate the same coffee powder.

Guava Leaf Extraction

Extraction of guava leaves using a modified maceration method (Ningsih et al. 2014). Extraction was carried out by maceration with 70% ethanol as solvent. A total of approximately 200 grams of guava leaves which had been ground were soaked in 650 ml of 70% ethanol, closed and then stirred using a stirrer with a rotation speed of 120 rpm for 1 and 2 hours.

Oil Refining Process

Sample as much as 100 ml of used cooking oil obtained from street vendors and put it in an Erlenmeyer. Then the oil was heated at temperatures of 50 °, 60 ° and 70° C and absorbent was added to the oil, then the sample solution was stirred with rotational speeds of 50, 100 and 150 rpm. The results of the purification process were then filtered to separate it from the absorbent material and clear oil. Then the analysis was carried out and the best purified oil was selected based on the determined parameters.

Making Antiseptic Transparent Soap of Guava Leaf Extract

The addition of guava leaf extract was carried out with variations in concentrations of 1, 2 and 3%. The available dough is then stirred at a constant speed at a temperature of 70-80° C until all ingredients were perfectly mixed and appear transparent.

Sample Quality Analysis

pH

The pH value is also known as the degree of acidity. pH is used to assess the level of acidity or alkalinity of a material.

Moisture Content

Determination of water content is done by gravimetric method. The gravimetric procedure begins with weighing 5 grams of the sample in a petri dish whose weight is known, then the sample is heated in a drying cabinet at a temperature of 105°C for 2 hours until the weight remains constant.

FFA Content

Free fatty acids are determined as the fatty acid content mostly found in a particular oil.

Acid value

The sum of the acid numbers in the oil is the total fatty acids, either sodium-bound fatty acids or free fatty acids plus neutral fatty acids (triglycerides or unsaponifiable fat).

Saponification value

The saponification value shows the relative size of the fatty acid molecules contained in the glycerides. The saponification rate is expressed as the number of mg of KOH required to completely saponify the oil from 1 gram of the oil.

Organoleptic analysis

Sensory or organoleptic analysis in this study used a hedonic scoring test on 6 formulated products. Tests were carried out on the attributes of taste, aroma, texture, color, and overall. The score scale used was a five-point category scale, in which 1 = strongly dislike to 5 = strongly like. The panelists used were 30 untrained panelists, who were students of the Malang Agricultural Institute

Antiseptic power test

Antiseptic power testing was carried out using a modified replica method and was carried out at the Biomedical Laboratory, Faculty of Medicine, Muhammadiyah University, Malang. The steps taken are by washing hands with water and followed by soap. Respondents wash their hands properly using water for 60 seconds, then dry them by shaking them for 75 seconds. Fingers were attached to nutritional medium to form a zigzag line in a petri dish. Furthermore, responders followed the test stage by first waiting for 60 seconds to see the percentage of bacterial reduction. Respondents placed another finger on the soap surface according to the type of formula on different fingers

Data Analysis

The data from the analysis were then tested with ANOVA, further tests were carried out using the DMRT (Duncan Multiple Rang Test) test at a level of 0.05.

RESULTS AND DISCUSSION

Purification of used cooking oil with adsorbent

The main objective of this study was to obtain used cooking oil as a result of purification using bagasse and coffee dregs as raw materials for making antiseptic transparent soap with guava leaf extract. Purification of used cooking oil was carried out as an effort to eliminate or reduce the content that interferes with the next goal process. The main process in soap making is saponification. The saponification process is the reaction of triglyceride fatty acids with alkali and producing glycerol as a by-product, while the neutralization process does not produce glycerol. The use of cooking oil increases the amount of free fatty acids in the oil, which might hinder the saponification process (Hambali et al. 2005). Free fatty acids are the most common characteristics used as oil quality control because these fatty acids affect the physical, chemical, and stability of the oil during the frying process (Patty et al. 2017). The high content of free fatty acids is caused by the repeated use of cooking oil at high temperatures. In addition, the changes that occur include physicochemical properties (oil damage) such as color, aroma and increasing peroxide value (Ketaren 2005a). Such cooking oil is no longer suitable for use, especially for consumption because it can cause diseases such as cancer, narrowing of blood vessels and itchy throat. As a result, refining used cooking oil should be sought with the goal of saving money while not harming health and being simple to perform. Efforts to process spent cooking oil may be accomplished in a variety of ways, one of which is by adsorption. Adsorption was chosen since it is simple to execute and cost-effective (Oko et al. 2020).

Bagasse is efficient and effective in the process of used cooking oil adsorption (Hajar and Mufidah, 2016; Trisnaliani et al. 2019). The use of bagasse as an absorbent which is able to bind impurities in used cooking oil is like other types of absorbents used in oil refining such as bleaching earth and bleaching carbon. (Ramdja et al. 2010). The use of bagasse in the refining of used cooking oil produced a chemical quality in the form of a significant decrease in the value of free fatty acids, the peroxide value and moisture content that were in accordance with the quality standards of cooking oil chemically were 0.3 of the maximum free fatty acid content, 1 for the maximum peroxide value, 0.3 for the maximum moisture content (Sulung et al. 2019).

Another type of absorbent which could be used for oil refining was coffee dregs. The results showed that the purification of used cooking oil with coffee dregs as an adsorbent for a soap product had an average moisture content of 13.82%, pH 9, foam height 3.5 cm, fatty acids of 46.82%, and free alkali of 0.09% (Riyanta and Nurniswati, 2016).

In this study, used cooking oil was purified by using bagasse and coffee dregs as absorbents through the variations of temperature treatment (50, 60, 70 °C) and rotational speed (50, 100, 150 rpm) in the absorption process. The analysis was carried out on the purified oil samples. The analysis parameters are pH, moisture content, free fatty acids and acid value. The main result of this stage is that the most effective treatment in refining used cooking oil is purification using bagasse with a temperature and rotation speed of 70° C and 150 rpm. The data from the analysis of the used cooking oil purification samples are presented in Table 1.

of 5 (Misrawati et al. 2015). The requirement for the quality of palm cooking oil pH according to SNI are 6.5-8 (IS: 6357-1971), so that the used cooking oil purified using bagasse in this study is included in the SNI quality category.

The analysis of variance showed that the use of the absorbent type with the treatment of temperature factors and stirring rotation speed resulted in P values = 0.614 and 0.520 (P>0.005), meaning that the temperature factor and stirring rotation speed had no significant effect on the pH parameters produced at the 5% level.

Table 1. Data analysis results of used cooking oil purification samples

No	Adsorbent Type	Temperature	Rotation Speed	Parameter			
				pH	Moisture Content	Free Fatty Acids	Acid Value
1	Sugar cane Bagasse	50	50	6.800a	0.703cb	1.982cc	2.335ac
2	Sugar cane Bagasse	50	100	6.775a	0.769cc	1.556cb	2.300aa
3	Sugar cane Bagasse	50	150	6.590a	0.276ca	0.397ca	2.300ab
4	Sugar cane Bagasse	60	50	6.710a	0.243bb	0.905bc	2.310bc
5	Sugar cane Bagasse	60	100	6.520a	0.357bc	0.652bb	2.310ba
6	Sugar cane Bagasse	60	150	6.430a	0.067ba	0.360ba	2.335bb
7	Sugar cane Bagasse	70	50	6.860a	0.438ab	0.668ac	3.490cc
8	Sugar cane Bagasse	70	100	6.620a	0.152ac	0.567ab	2.335ca
9	Sugar cane Bagasse	70	150	6.610a	0.247aa	0.301aa	2.300cb
10	Coffee Dregs	50	50	6.830a	0.101cb	0.921cc	1.120ac
11	Coffee Dregs	50	100	6.630a	0.458cc	0.830cb	2.335aa
12	Coffee Dregs	50	150	6.740a	0.071ca	0.745ca	2.310ab
13	Coffee Dregs	60	50	6.650a	0.083bb	0.878bc	3.515bc
14	Coffee Dregs	60	100	6.660a	0.100bc	1.007bb	2.335ba
15	Coffee Dregs	60	150	6.710a	0.549ba	0.505ba	3.490bb
16	Coffee Dregs	70	50	6.650a	0.099ab	0.544ac	5.850cc
17	Coffee Dregs	70	100	6.600a	0.278ac	0.398ab	2.300ca
18	Coffee Dregs	70	150	6.730a	0.068aa	0.292aa	2.310cb
19	Control			6.560	0.791	2.214	3.490

Note: Different letter notations show a significantly different effect at the 5% level

The pH value is also called the degree of acidity. pH is used to assess the level of acidity or alkalinity of a material. pH is related to the concentration of hydrogen ions as part of the acidity component and the concentration of hydroxyl ions as part of the basic component (Rondinini et al. 2001). The analysis results of oil samples that had been purified using sugarcane bagasse against pH parameters were in the range of 6.43 – 6.86, while used cooking oil purification using coffee dregs results were in the range of 6.60 -6.83 which means that the average sample had a weak acidic pH. The results of the pH parameter analysis of used cooking oil samples are presented in Figure 1.

Based on the analysis results above, it is known that the pH value of the oil purified with bagasse and coffee dregs shows a weak acid category. This is showed by the pH value which leads to an acid value that tends to approach neutral value. These results are in line with a study conducted by [28] that the used cooking oil as a result of the purification which has a pH value in the range of 4.95-6.55 is classified as the weak acid. A similar study conducted a study on a refining used cooking oil using noni fruit to produce used cooking oil with a pH value

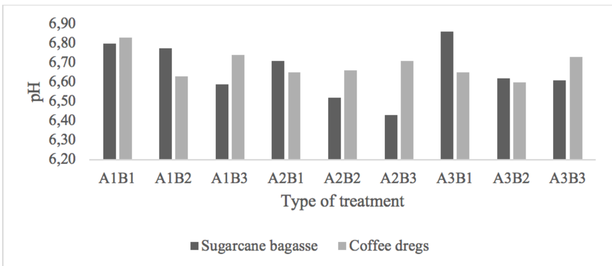

Figure 1. The analysis results of the pH parameters of the used cooking oil purification sample

Determination of moisture content was performed by gravimetric method. This gravimetric process involved weighing 5 grams of the sample in a known-weight porcelain dish, then heating the sample in a drying cabinet or oven at 105°C for 3 hours until the weight remains constant. The moisture content in the oil determined the oil quality. The amount of water contained in the high oil had an impact on the emergence of a hydrolysis reaction, so that the quality of the oil decreases (Sumarna 2014). Analysis of moisture content used the oven method with gravimetric principles. The value of moisture content purified by the type of sugarcane bagasse absorbent had a moisture content value range between 0.666 - 0.7686%, while the absorbent type of coffee dregs had a moisture content value range between 0.0679 - 0.5487%. The parameter analysis results of the moisture content of used cooking oil samples are presented in Figure 2.

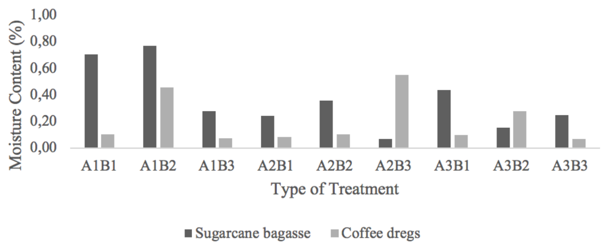

Figure 2. The analysis results of moisture content of the used cooking oil purification sample

Based on Table 1 and Fig. 2 above, it is known that the overall sample treatment had a lower moisture content value compared to the control. This means that there was a change in the moisture content after the purification process. This is influenced by the temperature treatment given, causing the moisture content in the sample to evaporate. Observations of temperature differences also affected the moisture content. The higher the temperature was, the more the water in the material evaporated. Thus, the moisture content in the material decreased (Leviana and Paramita 2017), notwithstanding the fact that it had not been completely proved in observation. In addition, the decrease in moisture content could be caused by the speed of stirring and absorption of the absorbent material, the stirring speed affected the possibility of absorbent colliding with the used cooking oil sample, because the faster the rotation was led to the larger coils or eddies would be (Ferdian et al. 2016), The results of another study stated that soaking using bagasse was able to absorb the moisture content of used cooking oil up to 0.27% (Hajar et al. 2016).

In this study, the lowest moisture content was 0.0666% with the type of bagasse absorbent treatment using a temperature of 60 ^{o}C and a rotation speed of 100 rpm. Meanwhile, SNI 01-3741-2002 concerning Quality Standards for Cooking Oil stipulated the moisture content in cooking oil, which is a maximum of 0.3%. Therefore, the results of the moisture content test in the sample oil fulfilled the SNI requirement.

The analysis results of variance showed that the use of the absorbent type with the treatment of temperature factors and stirring rotation speed resulted in a P value = 0.00 (P <0.005), meaning that the temperature factor and stirring rotation speed had no significant effect on the moisture content parameter produced at the 5% level.

Free fatty acids are fatty acids that are not esterified with glycerol (Trisnaliani et al. 2019). The results showed that the lowest ALB which was produced by the treatment of the absorbent type of coffee dregs with 70 ^{o}C of the temperature and 150 rpm of rotation speed was 0.2924%, while for the highest ALB treatment the absorbent type of bagasse which was produced with a temperature and rotation speed of 50 ^{o}C and 50 rpm was 1.9818%. The analysis results of the free fatty acid parameters of used cooking oil purification samples are presented in Figure 3.

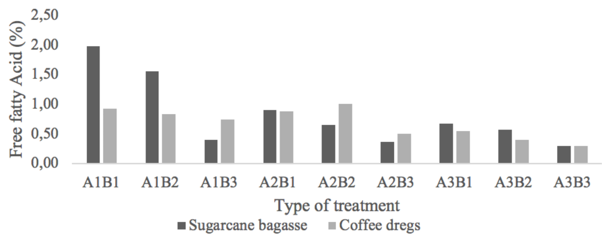

Figure 3. The analysis results of the free fatty acid parameters of the used cooking oil purification sample

Free fatty acids appeared due to the hydrolysis reaction of triglycerides (oil). Free fatty acid oxidation caused unpleasant odor and flavor. Thus, the value of free fatty acids in oil was often used as a damage parameter of used cooking oil (Kusumastuti 2004). Bagasse contained 32.1 percent of cellulose and 25.1 percent of lignin components, respectively. It is known that bagasse was effectively used as an adsorbent because of the role of -OH group bound to the cellulose and lignin (Tomi 2010). The purification principle of used cooking oil using sugarcane bagasse or coffee dregs was when triglyceride compounds reacted to water, ALB was formed, the ALB is written as RCOOH. RCOOH was the formula for a carboxylic acid compound. If the RCOOH was reacted with the -OH group contained in the bagasse, the H atoms of the compound reacted to produce RCOO and H2O compounds (water). Hence, when testing the ALB levels of used cooking oil which was purified with bagasse would be able to reduce the ALB value. This strengthens the previous research regarding to the use of bagasse to reduce ALB levels (Ratno et al. 2013). Therefore, the lower the value of free fatty acids produced by used cooking oil purification sample showed that the purification carried out was getting better. According to the comparison of the value of SNI 06-3532-1994, which indicates that the minimum ALB oil content is 2.5 percent (Hajar et al. 2016), so that the results of refining used cooking oil using coffee dregs and sugarcane bagasse fulfilled the applicable SNI criteria.

The analysis results of variance showed that the use of the absorbent type with the treatment of temperature factors and stirring rotation speed resulted in a P value = 0.00 (P <0.005), meaning that the temperature factor and stirring rotation speed had no significant effect on the free fatty acid parameters at the 5% level.

The amount of acid value in the oil is the total fatty acids, either sodium-bound fatty acids or free fatty acids plus neutral fatty acids (triglycerides or unsaponifiable fat). The principle of determining the amount of acid value was to separate the amount of fatty acids from the sodium soap bond with the addition of strong acid, then extract it with a cake containing a mixture of solid paraffin, free fatty acids, neutral fats and mineral oils which might be exist (Riyanta and Nurniswati 2016). The analysis results of the acid value parameters of used cooking oil purification samples are presented in Figure 4.

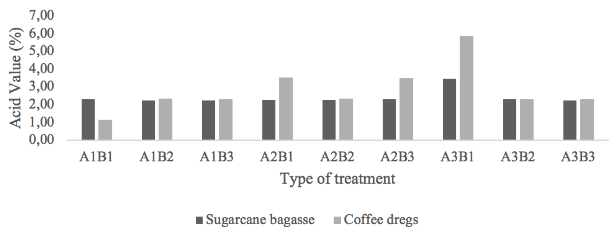

Figure 4. The analysis results of the Acid value parameters of the used cooking oil purification sample

Based on Fig. 4, it shows that the total acid content contained in the purified oil using the type of sugarcane bagasse absorbent was in the range of 2.24 – 3.44, while for the type of coffee dregs absorbent it was in the range of 1.12–5.85. The decrease in the acid value parameter for used cooking oil which was purified using bagasse was 39% with the acid value in the control was 3.49. The acid value was relatively low compared to previous studies which had a decrease in acid value of 49.39%. This was due to the difference in time and temperature used, the time taken was 20-40 minutes with a temperature of 100 ^{o}C, while in this study it was only 15 minutes and 70 ^{o}C. The longer the time that lasts for the absorption process, the more effective it was in reducing the acid value to the maximum time (saturation), besides the temperature used could stimulate the absorption reaction to be more effective (Rahayu et al. 2014).

According to the research results on the acid value parameter, it was not included in the SNI category because the standard of the maximum value required by SNI (3774 2013) is 0.6 mg KOH/g. This condition was possible because the adsorption process required the initial treatment which helped to maximize the purification process in the form of sample neutralization (Oko et al. 2020).

The variance analysis results showed that the use of the absorbent type with the treatment of temperature and stirring rotation speed factors resulted in a P value = 0.00 ($P < 0.005$), meaning that the temperature and stirring rotation speed factors did not significantly affect the acid value parameter at 5% level.

Antiseptic transparent soap formulation from used cooking oil

The second stage of this research was to produce an antiseptic transparent soap formulation from the used cooking oil purification by adding guava leaf extract. The main ingredient for making transparent soap was used cooking oil (UCO) which was purified by the type of coffee dregs absorbent treatment, at a rotation speed of 150 rpm and a temperature of 70 ^{o}C. The antiseptic substance used in transparent soap products was the result of refining used cooking oil using guava leaves. Guava leaf extract has the ability to prevent the growth of Staphylococcus aureus bacteria which can cause disease (Nuryani et al. 2017). The implementation of the research at this stage was the variations treatment in the concentration of guava leaf extract by 1%, 2% and 3%. The results of the antiseptic soap formulation were then analyzed chemically (pH, moisture content), physically (high foam) and microbiologically (antiseptic power). The chemical analysis results of antiseptic transparent soap samples are presented in Table 2.

Table 2. Data analysis results of antiseptic transparent soap formulation

No	Treatment	Parameter			
		pH	Moisture Content	Foam Height	Antiseptic Power
1	Control	11.427a	36.505d	19a	14a
2	1%	13.06b	27.78a	21.5a	12a
3	2%	13.687c	30.67b	19a	8a
4	3%	13.629c	34.095c	20a	2a

Note: Different letter notations show a significant different effect at the 5% level

The pH value in the observation of antiseptic transparent soap samples from used cooking oil purification was in the pH range of 13.06 – 13.687. T his indicates that the sample had an alkaline pH category. The analysis results of the pH parameters of the antiseptic transparent soap sample are presented in Figure 5.

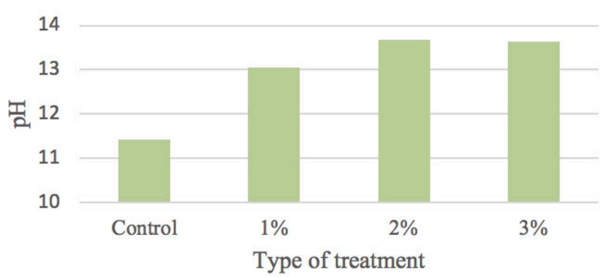

Figure 5. The analysis results of pH parameters of the antiseptic transparent soap sample

The pH value of cosmetic products, particularly soap, has an essential physical feature. pH is one of the parameters for soap quality that customers use in accordance with

Indonesian National Standards. (SNI 3532:2016). The pH value is an essential factor in evaluating the quality of bath soap; a very high or extremely low pH value can boost the absorption capability of the skin, allowing irritated skin to absorb more (Wasitaatmadja 2007). The soap pH produced in this study was classified as alkaline. The alkaline feature of the transparent soap was obtained from the use of NaOH solution which has alkaline properties as the main ingredient for the process of saponification reactions. Standard pH for bath soap ranges from 9-11 (Hernani et al. 2010). Therefore, the samples of antiseptic transparent soap products from used cooking oil fulfilled the predetermined soap quality criteria.

The variance analysis results showed that the addition of guava leaf extract in antiseptic transparent soap made from used cooking oil had a P value of 0.00 ($P < 0.05$), meaning that the addition of guava leaf extract had a significant effect on the pH parameters at 5% level.

The value of moisture content in the observation of antiseptic transparent soap samples of used cooking oil purification was in the range of 27.78 – 36.505%. The value of the moisture content in the sample shows a relatively high moisture content. The parameter analysis results of the moisture content of the antiseptic transparent soap sample are presented in Figure 6.

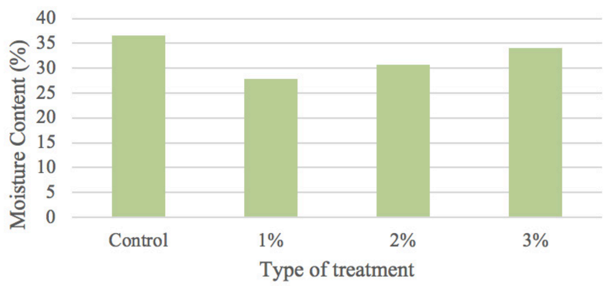

Figure 6. The analysis results of moisture content parameters of the antiseptic transparent soap sample

The moisture content of transparent soap in this study was quite high. It was influenced by the addition of water to several materials which functioned as the materials solvents, such as in dissolving NaOH (30%) and other materials (DEA and Sucrose). This is in line with a previous research which states that the value of the moisture content of transparent soap was influenced by the amount of water used (Afrozi et al. 2021). Based on SNI (3235-2016), the results of this research were still far from the criteria set, which is a maximum of 15%. The variance analysis result showed that the addition of guava leaf extract in antiseptic transparent soap from used cooking oil had a P value of 0.00 ($P < 0.05$), meaning that the addition of guava leaf extract had a significant effect on the moisture content parameter at 5% level.

The foam height test was carried out to see the foam-power of antiseptic transparent soap made from used cooking oil purification which was made according to the high standard of soap foam set by the Indonesian National Standard (SNI) which is 13-220 mm. The high value of foam on the observation of antiseptic transparent soap samples made from used cooking oil purification was in the range of 19 – 21.5 mm. The parameter analysis results of the foam height of antiseptic transparent soap sample are presented in Figure 7.

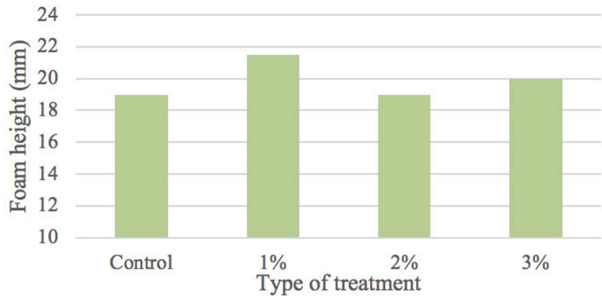

Figure 7. The analysis results of foam height parameters of the antiseptic transparent soap sample

The test results on the foam height of soap formula with a concentration of 1% guava leaf extract had the highest value of 21.5 mm, followed by a concentration of 3% and the lowest concentration of 2% and the control which had the same value of 19 mm. The results of the foam-height test of the soap showed that this value still tended to be low. Foam is a colloidal system in which the dispersed phase is a gas and the dispersing phase is a liquid (Fauziyah et al. 2019).

The presence of surfactant components in soap has a role in the cleaning process. The primary function of soap as a dirt cleanser is unaffected by the amount of foam produced; nevertheless, the more foam produced has an effect on skin sensitivity, which can lead to dry skin. The foam height is determined by the foam's stability, which is achieved by the foaming agent acting to maintain the foam contained in a thin layer that covers the gas molecules scattered in the liquid. If the active substance is mixed with water, it will work in solution (Fauziyah et al. 2019)

Antiseptic-power testing was carried out with a modified replica method (Sari and Dewi 2006). Soap samples consisted of 3 types (1%, 2% and 3%) and one sample without treatment. The next step was in accordance with the steps above. The analysis results of the antiseptic power of the antiseptic transparent soap sample are presented in Figure 8.

The percentage reduction, i.e. how much the soap can lower the amount of bacteria on hands, indicates the antiseptic activity of hand soap. According to Fig. 8, the percentage of inhibition appears to rise (the number of colonies decreases) when the concentration of guava leaf extract increases. The percentage values for the control soap formula, 1%, 2%, and 3% were 14, 12, 8, and 2, respectively. Guava leaf extract has been shown to prevent the growth of Staphylococcus aureus bacteria (Nuryani et al. 2017) and *Escherichia Coli* bacteria (Qonita et al. 2019).

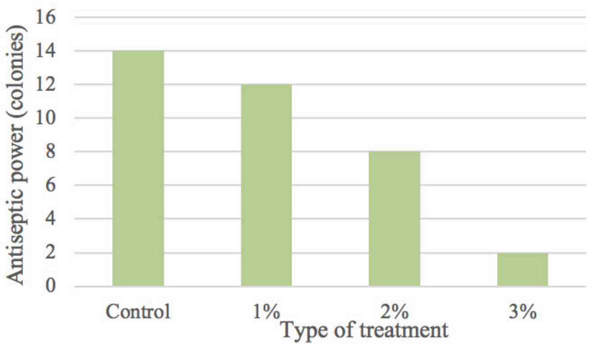

Figure 8. The analysis results of the antiseptic power of the antiseptic transparent soap sample

The ability of guava leaf extract is influenced by the content of tannin compounds. Tannin compounds have the ability to deactivate the adhesion of bacteria, inhibit the work of enzymes and inhibit the transport of proteins contained in cell membranes. The process of destroying bacterial cell membranes and the formation of metal ion complex bonds from tannins has a role in the toxicity of tannins (Fratiwi 2015).

Based on the test results on the antiseptic power of transparent soap, it was found that the most effective transparent soap was transparent soap with the addition of 3 percent guava leaf extract since it had the least number of colonies. The variance analysis results showed that the use of guava leaf extract concentration factor in the antiseptic transparent soap formula which made from used cooking oil did not significantly affect the anticeptic power parameter produced at 5% level. The results of the antiseptic power test are presented in Figure 9.

CONCLUSION

Purification of used cooking oil using the type of sugarcane bagasse absorbent produced oil with a pH value of 6.43-6.86, moisture content 0.67-0-769%, free fatty acids of 0.301-1.982% and acid value of 2.3-3.490%. Meanwhile, for the type of coffee dregs absorbent, it produced oil with a pH value of 6.60-6.83, moisture content of 0.068-0.549%, free fatty acids of 0.292-0.921 and acid value of 1.120-5.850. The results of variance analysis showed that there was a significant effect on the type of absorbent treatment, temperature and stirring speed on the parameters of moisture content, free fatty acid and acid value, while it was not significantly different on the pH. The results of the antiseptic transparent soap formulation obtained a pH value of 11.427-13,687, moisture content of 27.78-36.505, foam height of 19-21.5 mm and antiseptic power of 2-12 colonies. The findings of the variance analysis revealed that the concentration of guava leaf extract had a significant effect on the pH and moisture content parameters, but not on the foam height or antimicrobial power.

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of interest

There are no conflict of interest.

Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

Ethics committee approval is not required.

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Data availability

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Consent for publication

Not applicable.

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