JCNaR
Journal of Chemical Natural Resources
Journal homepage: https://jcnar.usu.ac.id

Utilization of Coconut Shells Activated Charcoal in Making Solid Soap from Used Cooking Oil

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ARTICLE INFO
Article history:
Received 4 October 2022
Revised 29 October 2023
Accepted 31 October 2023
Available online 31 October 2023

E-ISSN: 2656-1492

How to cite:
Amir Hamzah Siregar, Ardina Harahap. Utilization of Coconut Shells Activated Charcoal in Making Solid Soap from Used Cooking Oil. Journal of Chemical Natural Resources. 2023. 5(2):143-151.

https://doi.org/10.32734/jcnar.v5i1.13857

ABSTRACT

Research on the utilization of coconut shell activated charcoal in making solid soap from used cooking oil by adding variations in the concentration of coconut shell activated charcoal by 3%, 5%, 10% and without purification. So, several parameters can be determined to test the quality of used cooking oil, namely PV, free fatty acid (FFA), color, moisture content, and odor based on SNI 3741: 2013. The parameter value of used cooking oil without purification on PV is 15,1607 mekO_2/ kg. FFA, which is 0.8244 mgKOH / g. Water content is 0.1321% b / b. Smell that is not normal. The resulting color is 10.28 red / 87.00 yellow. Value The parameters of the quality of cooking oil produced from the treatment process after the addition of a variation of coconut shell activated charcoal by 10% can reduce the PV of 5.5247 mecO_2/kg. FFA which is 0.2817 mgKOH / g. Water content is 0.0798% b / b. The smell becomes normal. The resulting color is 3.40 red / 35.00 yellow. It can be concluded that the concentration of the addition of coconut shell activated charcoal, which is optimal in the processing process, is by adding coconut shell activated charcoal by 10% in used cooking oil to meet the cooking oil quality standards according to SNI 3741: 2013. Solid soap-free fatty acids were not detected in the study of making solid soap from purified cooking oil. The soap solution was pink when the testing process was titrated with KOH solution 0.1 N. This is presumably because the fatty acids in used cooking oil have reacted all with NaOH so that the free fatty acids cannot be measured.

Keywords: Coconut Shell Activated Charcoal, Free Fatty Acid, Peroxide Value, Used Cooking Oil, Solid Soap

ABSTRAK

Penelitian tentang penggunaan batubara aktif dari kulit kelapa dalam pembuatan sabun padat dari minyak masak yang digunakan dengan menambahkan variasi konsentrasi batuba aktif dengan 3%, 5%, 10% dan tanpa purifikasi. Sehingga dapat ditentukan beberapa parameter untuk menguji kualitas minyak masak yang digunakan, yaitu nomor peroksida, nomor asam, warna, kandungan kelembaban, bau berdasarkan SNI 3741: 2013. Nilai parameter minyak masak yang digunakan tanpa purifikasi pada nomor peroksida adalah 15,1607 mekO_2 / kg. Jumlah asam yang adalah 0.8244 mgKOH / g. Kandungan air adalah 0.1321% b / b. Bau itu tidak normal. Warna yang dihasilkan adalah 10.28 merah / 87.00 kuning. Nilai Parameter kualitas minyak masak yang dihasilkan dari proses perawatan setelah penambahan variasi karbon aktif dari kulit kelapa sebesar 10% dapat mengurangi jumlah peroksida sebesar 5.5247 mecO_2/kg. Jumlah asam yang adalah 0.2817 mgKOH/g. Kandungan air adalah 0.0798% b / b. Bau akan menjadi normal. Warna yang dihasilkan adalah 3.40 merah / 35.00 kuning. Dapat disimpulkan bahwa konsentrasi penambahan batubara aktif dari kulit kelapa yang optimal dalam proses pengolahan adalah dengan menambahkan batuba aktif dengan 10% dalam minyak masak yang digunakan, sehingga memenuhi standar kualitas minyak masak menurut SNI 3741: 2013. Dalam penelitian pembuatan sabun padat dari minyak masak yang diproses, asam lemak padat tanpa sabun tidak terdeteksi, karena ketika proses pengujian dititrasi dengan larutan KOH 0,1 N, larutan sabun berwarna merah muda. Ini mungkin karena asam lemak dalam minyak masak yang digunakan telah bereaksi semua dengan NaOH sehingga asam lemak bebas tidak

dapat diukur.

Keyword: **A**sam Lemak Bebas, Bilangan Perokida, Karbon Aktif Tempurung Kelapa, Minyak Goreng Bekaas, Sabun Padat

1. Introduction

Coconut is one of the agricultural commodities essential in contributing to national export currency proceeds. This commodity is predominantly produced from people's agriculture. One of the bright prospects of coconut torch processing products is activated carbon. The active carbon from cocoa torch has several advantages over other materials. It has a high hardness level to facilitate its handling characteristics, i.e., high absorption, low dust, and high purity. [1].

Fried oil is a necessity of society, whose prices are still relatively high today. As a result, fried oil is often used to fry, mainly done by the fried food vendors. 49% of the total fried oil demand is for household consumption, and the rest is for industrial use, including the hospitality, restaurant, and fast food industries, causing the demand for fried oils to rise. It has caused it to produce used fried oil in considerable amounts [2].

The number of peroxides is the number of environmental peroxide equivalents in 1000 g of fat. Unsaturated fatty acids can bind oxygen to the bonds and form peroxide. This peroxide can be determined by iodometry. Scientifically, fried oils that have been used many times, more or less at high heat, are highly unhealthy because the oils release fatty acids from triglycerides so that free fatty acid contains easily oxidized bonds [3].

Much research has been done on processing exhausted, fried oil into reduced peroxide levels. Wannahari has conducted a study that stated that by adding an active carbon concentration of 7.5% to reduce the number of peroxides in used fried oil, the results of the study obtained maximum adsorption, and the color of the oil changed to brown-yellow [4].

A study conducted by [5] stated that the addition of a concentration of active charcoal of 35% in used fried oil was able to improve the characteristics of the physicochemical properties of oil with a dirt content of 2.3%, FFA of 0.206%, PV of 0.078% and the color of the oil that has changed to yellow. Then, in this study, the researchers will take advantage of the reduction in the number of peroxides performed by the addition of carbon-activated fried with concentration variations of 3%, 5%, and 10% and without purification until it meets the quality of fried oils under SNI 3741-2013 and can make the fried olive used in the manufacture of solid soap.

2. Materials and Methods

2.1. Equipment

Oven, Tanur, Hotplate, 250 mesh pattern, Erlenmeyer Pyrex 250 mL, 500ml Beaker Glass, 250mL Beaker glass, Porcelain cup, pH meter, Whatman Filter Paper No. 42, Analytical Balancing, Corong, Dryer, Magnetic Stirer, Mixer/Spawn Strap, Volume Pipet, Pure 100mL Mushroom, Pipe, Volumepipet.

2.2. Materials

Coconut shells, used cooking oil, phosphate acid, ethanol, phenolphthalein indicator, sodium hydroxide, hydrogen chloride, glacial acetate acid, chloroform, Sodium thiosulphate, cyclohexane, potassium iodide, distilled water, amylum indicator were purchased from Merck.

2.3. Making Activated Charcoal

Method of Sample Collection and Preparation

A sample of the coconut dough taken in some places is then inserted into plastic and cleaned from the remains of coconut meat that are still sticky to the cocoon dough. Then, the cleaned cocoa dough is washed in the sunlight to remove the water content until it is scorched. After drying, 500 g of coconuts are broken into small sizes and then burned in an empty container. Then, the samples were analyzed in one of the private departments at PT. Swasta di KIM II Medan.

Physical Activation of Coconut Shell

In this process, the charred coconut shell is pulverized into powder with a size of 250 mesh. 50 g of coconut shell charcoal was put into the furnace at 400 ^{o}C for 1 hour and then cooled in a desiccator to continue chemical activation.

Chemical Activation of Coconut Shell

In this process, 20 g of physically activated coconut shell charcoal was soaked in 30 mL of 10% (b/v) H_3PO_4 solution for 24 hours. Then, the mixture was filtered using Whatman No. 42 filter paper and washed with distilled water until the pH of the coconut shell charcoal reached 6. Next, it was dried in an oven at 100 ^{o}C for 1 hour.

Activated Charcoal Moisture Content

These water level tests determine how much water is in coconut poultry activated charcoal to meet Indonesian national standards. Weigh the empty weight of the porcelain cup (W0). Then, weigh the sample of the active charcoal of coconut, record the weight of 1 gram (W1), and put it in the porcelain cup. The porcelain cup that contains the sample is heated in the oven at 105^{o}C for 3 hours. After 3 hours, the samples are removed from the oven and cooled in the dryer for 30 minutes. Then, weighed and weighed finally. (W2). The equation can calculate the water level:

$$\text{Water content (\%)} = (W2-W0)/W1 \times 100\%$$

Where:
W0 = Empty porcelain cup weight
W1 = sample weight
W2 = sample weight after heating

Testing the ash content of activated charcoal

This ashes test determines how much ashes is present in coconut poultry activated charcoal to meet Indonesian national standards. Weigh the empty weight of a porcelain cup (W0). The sample of active coal from coconut is weighed and recorded to be 1 gram, then placed in the porcelain Cup (W1). The porcelain cup that has filled the sample is heated in a furnace at 600oC for 6 hours. After 6 hours, the samples are removed from the furnace and cooled in a dryer for 1 hour. Then, weigh and record the weight finally. (W2). The equation can calculate ashes:

$$\text{Ash ratio (\%)} = (W2-W0)/W1 \times 100\ \%$$

Where:
W0 = Weight of empty porcelain cup
W1 = Sample weight
W2 = sample weight after heating

2.4. Used Cooking Oil Peroxide Reduction Process

Used Cooking Oil Refining

In this experiment, coconut shell-activated charcoal purifies used cooking oil and can reduce the PV of used cooking oil. The purification stage uses a mass variation of coconut shell activated charcoal of 3%, 5%, 10%, and without purification. Used cooking oil known to have a PV is weighed as much as 100 g and put into a beaker glass. Then, 3% coconut shell activated charcoal was added. Stirred until mixed using a magnetic stirrer with a speed of 1000 rpm during 60 minutes. After mixing, the sample is filtered using Whatman filter paper number 42, and the filtrate of the filtration results is analyzed for the decrease in peroxidic number. Likewise, experiments were carried out on variations in the mass of activated coconut shell charcoal 5%, 10%, and without purification.

Colour Test

The color examination is carried out using the Lovibond Tintometer Model F tool, consisting of colored glasses in 3 parts, namely red (R), yellow (yellow / Y) and blue (blue / B). The Lovibond Tintometer model F is connected to the electric current source. Put the used and refined cooking oil into the cuvette (5/4 Lovibond Cell) until it is almost full. Inserted into the tintometer in a position adjusted to the distance, then

pressed the power button in the on position. We observed color on the lens or colored glasses consisting of 3 parts, namely red (R), yellow (yellow / Y) and blue (blue / B).

Determination of Peroxide Value of Used Cooking Oils

Weigh carefully 5 g into a 250 ml Erlenmeyer, then add 50 ml of glacial acetic acid solution and chloroform, close the Erlenmeyer and stir until the solution is homogeneous. Then add 0.5 ml of saturated potassium iodide solution using a measuring pipette, shake for 1 minute, add 30 ml of distilled water, then close the Erlenmeyer immediately. Shake and titrate with 0.01 N Sodium Thiosulfate solution until the yellow color almost disappears, then add 0.5 ml of starch indicator and continue the titration. Determination: shake vigorously to release all iodine from the solvent layer until the blue color disappears; make a duplicate determination, make a blank determination, and calculate the PV.

Blank solution:

Add 50 ml of acetic acid and chloroform 3: 2. Cover with plastic and rubber and stir until the solution is homogeneous. Add 0.5 ml of saturated potassium iodide solution using a measuring pipette, then shake for 1 minute, and titrate with 0.01 N sodium thiosulfate solution until the yellow color almost disappears, then add 0.5 ml of starch indicator and continue titrating, shake vigorously to release all iodine from the solvent layer until the blue color disappears, do duplo determination, do blank determination, and calculate the PV = (Vs-Vb)xNx1000/W.

Where:
Vs = Sample Volume
Vb = Blank Volume
N = Normality of Na2S2O3 0.01N
W = Sample Weight

Free Fatty Acid Determination

Cooking and refined cooking oil weigh 20 g in 250 ml Erlenmeyer. 96% alcohol, as much as 50 ml (neutralized with 0.1 N NaOH), then dripped phenolphthalein Indicator as much as three drops. Next, it was titrated with 0.1N KOH until a pink color appeared, which did not change for 15 seconds.

$$FFA = VxNx56.1/W$$

Where:
V = volume of sample
N = Normality of KOH 0.1N
W = Sample weight

Determination of Odor in Used Cooking Oil

Smell the refined cooking oil. The cooking oil is considered abnormal if a rotten/uncharacteristic odor is felt. Several people do this test, to be more specific.

Determination of moisture content in used cooking oil

Water content testing is carried out in the Moisturizer Analyzer instrument. By inserting 1 gram in the Moisture tool, the results of the moisture content of the sample will automatically come out.

2.5. Solid Soap Making Process

Solid Soap Making from Reduced Peroxide Value

At this stage, 50% NaOH is used in making solid soap from used cooking oil with the composition of oil: NaOH (1: 0.5). 50 g of used cooking oil purified, then put into a beaker glass while heated on a hotplate at 70oC while stirring using a stirrer. Then, slowly enter 25 g of NaOH solution until the solution thickens and hardens slightly. The thickened soap solution is put into a soap mold covered with clear plastic to make the mold denser. Let the soap stand for one night so that the soap becomes denser. After the soap becomes solid and hardens, the processed soap from used cooking oil can be tested for pH, water content, saponification number, free fatty acids, and free alkali.

Determination of Moisture Content

Heat the pan and lid in an oven at (130± 1)ºC for about 30 minutes and cool in a desiccator for 20 minutes to 30 minutes, then weigh with an analytical balance (W0); insert 1 gram of solid soap that has been grated into the dish, cover, and weigh (W1). Heat the dish containing the solid soap in an open state by placing the lid of the dish next to the dish in the oven at (130 ± 1) ºC for 30 minutes after the oven temperature is (130 ± 1) ºC; close the dish while still in the oven, move it immediately to a desiccator and cool it for 20 minutes to 30 minutes so that the temperature is the same as room temperature then weigh (W2) and calculate the water content.

$$\% \text{ Water Content} = (W2-W0)/W1 \times 100$$

Where:
W0 = Weight of empty dish
W1 = Weight of sample
W2 = Weight of the pan after heating

Determination of pH

Shredded solid soap that has been finished, weighed as much as 1 gram and put into a 250 ml Erlenmeyer. Then, add 100 ml of distilled water. It was heated until it dissolved. After dissolving, it was cooled to a temperature of 25ºC. Then, measure the pH on the pH meter.

Determination of Free Fatty Acid and Free Alkali Numbers

Shredded solid soap that has been finished, weighed as much as 5 g and put into 250 ml Erlenmeyer. Then 96% alcohol, as much as 150 ml (neutralized with 0.1 N NaOH), dripped with phenolphthalein indicator drops and titrated with 0.1N NaOH until a pink color appears, which will not change for 15 seconds. But when the Fenoftalein Indicator is added, the pink color immediately appears. This is thought to be because the fatty acids in the used cooking oil have all reacted with NaOH, so the acid is not changed. Free fat cannot be measured. So, with that, it must be titrated with 0.1 N HCl until the pink color disappears. Already immediately appeared pink in color. This is because the fatty acids in used cooking oil have reacted with NaOH, so the free fatty acids cannot be measured. Therefore, it must be titrated with 0.1 N HCl until the pink color disappears. This is done to determine the free alkali number.

$$\text{Free Fatty Acid} = VxNx25.6/W \quad \text{Free Alkali} = VxNx4/W$$

Where:
V = Titration volume
N = Normality of NaOH 0.1N or HCl 0.1N
W = Sample weight

Odor Determination

Grate the finished solid soap, then smell the solid soap. If you feel a rancid smell/odor that is not typical, like the smell of used cooking oil, the solid soap is considered abnormal because the remaining odor is still contained in the previously used cooking oil. Several people carry out this test, to be more specific.

3. Results and Discussion

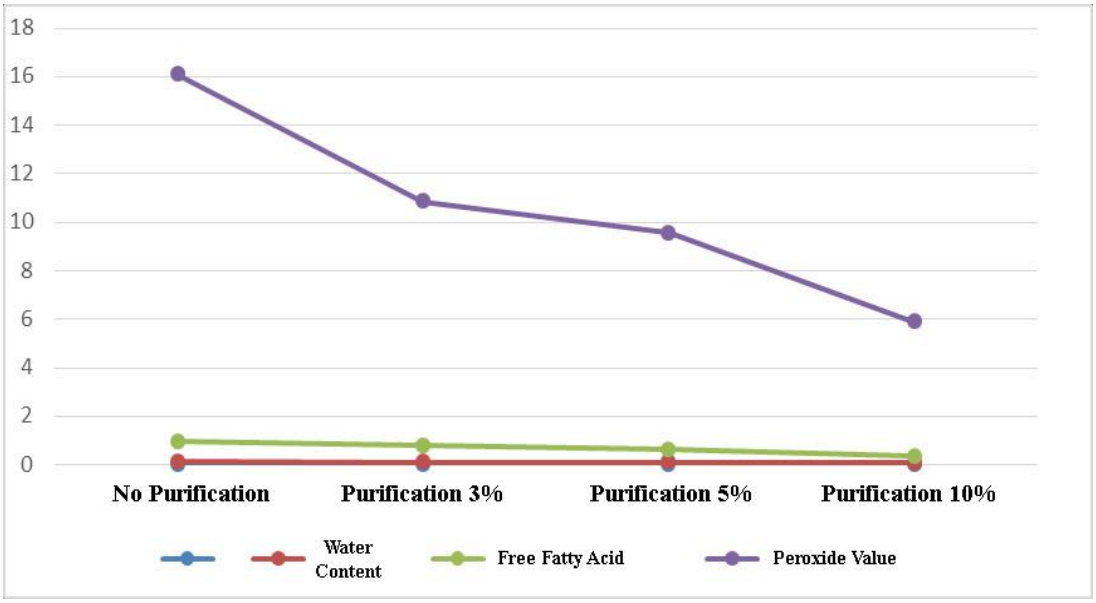
3.1. Research results.

The research carried out used fried oil samples by purifying using coconut activated charcoal with concentration variations of 3%, 5%, and 10% and without purification, then obtained data on the quality of fried oils, which can be seen in the table below:

Table 1: Fresh Fried Oil Quality Data After Purity and Without Purity.

Test Criteria	Standard	Without Refining 3%	5%	10%	Refining Quality Edible Oil
Abnormal	Odor	Not Normal	Normal	Normal	Normal
Color (Lovibond)	10.20/87.00	6.10/62.00	5.50/56	3.40/35	Max. 5.0 Red /50 Yellow
Water Content	0.1321	0.1092	0.0957	0.0798	Max. 0.1
Fatty Acid	0.8244 Free	0.6771	0.5233	0.2817	Max. 0.3
Peroxide Value	15.1607	10.0713	8.9334	5.5247	Max. 10

The data shows a graph of the effect of moisture content, free fatty acids and PV with the addition of activated carbon at a concentration variation of 3%, 5% and 10% in used cooking oil.



This result was obtained from the processing of the data contained in the attachment, whose calculations are as follows:

Calculation of Acid Count

$$\text{Acids count (mgKOH/g)} = VxNx56.1/W$$

Where:

V = volume of titration of KOH solution (ml)
N = Normality of KOh solution (N)
W = Weight of sample (g)

Thus, the average FFA obtained for unrefined used cooking oil is:

FFA (mgKOH/g) = (2.93 x 0.1 x 56.1)/20.1174
= 0.8170

FFA (mgKOH/g) = (2.98 x 0.1 x 56.1)/20.0964
= 0.8318

The same treatment is done after adding coconut shell-activated charcoal with 3%, 5%, and 10% concentration variations.

Determination of Peroxide Value

Peroxide values are expressed as milliequivalents of O_2 per kg fat, which are calculated using the formula:

$$PV\ (mekO_2/kg) = (Vs\text{-}Vb) \times N \times 1000/W$$

Where:

Vb = Titration volume of 0.01N $Na_2S_2O_3$ solution for Blanko (ml).
Vs = Titration volume of 0.01N $Na_2S_2O_3$ solution for Sample (ml).
N = Normality of 0.01 N $Na_2S_2O_3$ standard solution.
W = Sample weight (g).

So, the average PV for used cooking oil without refining is obtained:

PV ($mekO_2/kg$) = ((7.71-0.03) x 0.01 x 1000)/5.1309
= 14.9681

PV ($mekO_2/kg$) = ((7.72-0.03) x 0.1 x 1000)/5.0087
=15,3532

The same treatment was also after adding coconut shells activated charcoal with a concentration variation of 3%, 5%, and 10%.

Solid Soap Analysis Results

After getting the results of reducing the PV in used cooking oil, it can the data from the results of several analyses on solid soap testing written in Table 2 below:

Comparative Data Analysis of Solid Soap Refined and Unrefined Results

Table 2: Test Criteria Without Purification Purification Purification Purification 3% 5% 10%

Comparative Data Analysis of Solid Soap Refined and Unrefined Results				
Smell	Not Normal	Not Normal	Normal	Normal
Water Content	19.26	18.89	18.31	17.55
pH 1%	11.125	11.101	11.062	10.956
Free Alkali	No Detected	No Detected	No Detected	No Detected

3.2. Discussion

Preparation of Coconut Shell Activated Charcoal.

The carbonization process was carried out on coconut shells in a furnace at a temperature of 400C for 1 hour. Samples of coconut shells weighing 500 g were cleaned and dried in the sun. In this process, the yield of coconut shell-activated charcoal is 10%. The average yield of active charcoal is 10% of the initial sample weight. The low yield of activated charcoal is due to too many parts of the coconut shell that have become ash due to the gradual and inconstant heating process, so the part that becomes charcoal is only 10%.

1. Testing the moisture content of activated charcoal

Water content was tested on coconut shell activated charcoal, which was analyzed with a sample weight of 1 gram and heated in the oven at 105ºC for 3 hours. Then, the water content of coconut shell-activated charcoal is 5% and meets the requirements for commercial activated charcoal based on the Indonesian National Standard (SNI), where the maximum water content for activated charcoal powder is 15% [6].

2. Testing the ash content of activated charcoal

The ash content of coconut shell-activated charcoal was analyzed with a sample weight of 1 gram by heating it in a furnace at 600ºC for 6 hours. The ash content of coconut shell-activated charcoal was obtained at 2%. The results show that coconut shell-activated charcoal has met the Indonesian national standard (SNI) in powder form, a maximum of 10% [6].

Used Cooking Oil Quality Test Results

Cooking oil was used to determine by color (Lovibond 5.25 "cell), FFA by titrimetric method, PV, moisture content by gravimetric method, and organoleptic odor with variations in the concentration of activated charcoal addition of 3%, 5%, and 10% and without refining seen in Table 1:

1. Colour Quality Test

From the results of color research that appeared in Lovibond 5.25, "cell obtained color decreased from the color of used cooking oil without refining by 10.20 red/87.00 yellow. As for the addition of variations in the concentration of coconut shell activated charcoal is by 3%, 5%, and 10% of the oil color.

6.10 red/62.00 yellow; 5.50 red/56 yellow and 3.40 red/35 yellow. The color values obtained show that used cooking oil without refining has a very high value due to the use and heating of the oil. The cooking oil is done repeatedly.

2. Water Content Quality Test

For used cooking oil without refining and adding coconut shell activated charcoal with a concentration variation of 3% produces a high water content of 0.1321 and 0.1092. Meanwhile, the addition of activated coconut shell charcoal with a concentration variation of 5% and 10% produces water content that meets the standard quality of cooking oil, namely 0.0957 and 0.0798. The standard quality of cooking oil is a maximum of 0.1%. [6].

3. Odor Quality Test

For used cooking oil without refining and the addition of coconut shell activated charcoal with a concentration variation of 3% produces an odor that is not typical. As for the addition of activated coconut shell charcoal with a concentration variation of 5% and 10, it did not experience changes in odor and produced a distinctive odor. If it smells other than the typical smell of cooking oil, then the results are declared abnormal [6].

4. Free Fatty Acid Test

From the results obtained, the FFA decreased in the value of oil without refining by 0.8244 mgKOH/g, while after the addition of variations in the concentration of coconut shell activated charcoal by 3%, 5%, and 10% amounted to 0.6711, 0.5233; and 0.2817 mgKOH/g.

Used cooking oil with the addition of activated charcoal shell at 10% meets the quality standards of cooking oil, according to Griswold [7]. The stability of cooking oil is influenced by several factors, including the degree of unsaturation of the fatty acids it contains, the spread of double bonds, and auxiliary materials that can accelerate or inhibit the damage process. Auxiliary materials are either naturally occurring or intentionally added.

5. Peroxide Value Test

From the research results obtained, PV decreased the value of oil without refining by 15.1607 mekO_2/kg. In contrast, after refining cooking oil with activated charcoal concentration variations of 3%, 5%, and 10% amounted to 10.0713, 8.9334, and 5.5247mekO_2/kg. The concentration of coconut shell activated charcoal at 5% and 10% meets the standards of cooking oil quality. However, at 3%, PV still increased, indicating poor cooking oil quality. PV is the most important value to determine the degree of oil deterioration. Unsaturated fatty acids can bind oxygen to their double bonds to form peroxides [3]. The quality requirement for PV in cooking oil, according to SNI 3741.2013, is a maximum of 10 mekO_2/kg. PV above 10 mekO_2/kg indicates poor oil quality [6].

Oil will be oxidized when it comes into contact with a certain amount of oxygen. Oil oxidation generally proceeds through a free radical reaction mechanism involving three reaction stages: initiation, propagation, and termination. Initial free radicals, as well as hydroperoxides and peroxides, will be formed at the initiation

stage. The termination stage will stop the reaction that occurs at the propagation stage. At this stage, one free radical will combine with another free radical to form a stable compound. The increase in the price of peroxide indicates the increasing amount [8].

Solid Soap Test Results

In removing free fatty acids, neutralization is carried out using NaOH caustic soda solution [3] so that sodium ions will bind free fatty acids into soap, and this soap can be separated from the oil. Fatty acids can react with soap if a base or salt is in the solution [9].

SNI 3741: 2013 shows that solid soap's free fatty acid is <2.5% [6]. This study did not detect solid soap-free fatty acids because the soap solution was pink during the testing process before titrating with 0.1 N NaOH solution [6]. It is thought that the fatty acids in used cooking oil have all reacted with NaOH, so the free fatty acids cannot be measured. It is reinforced by [10] that the use of caustic soda solution (NaOH) at high concentrations will react with oil to reduce the amount of free fatty acids and increase the amount of soap formed. Too high of free fatty acids will affect the emulsion process of soap with dirt and reduce the binding power of soap to oil, fat, or sweat dirt. These free fatty acids cannot bind to dirt because they are polar, in contrast to oil, fat, or sweat dirt, which is non-polar.

4. Conclusion

Based on the research that has been done, the quality of used cooking oil with the addition of various concentrations of coconut shell activated charcoal, as much as 3%, 5%, and 10%, is very influential in improving the quality of used cooking oil in reducing the PV, FFA, water content, color, and odor. The parameter value of used cooking oil without refining the PV is 15.1607 mekO_2/kg. FFA is 0.8244 mgKOH/g. Water content is 0.1321%b/b. The odor is abnormal. The resulting color is 10.28 red/87.00 yellow. The value of cooking oil quality parameters that meet the standards of SNI 3741-2013 is used cooking oil produced from the processing process after the addition of activated coconut shell charcoal variation of 10%. It can be seen in the decrease in peroxide, which is 5.5247 mekO_2/kg. FFA is 0.2817 mgKOH/g. Water content is 0.0798%b/b. Odor becomes normal. The resulting color is 3.40 red/35.00 yellow. Based on the research that has been done, changes in the physical and chemical properties of solid soap can be seen from the shape and smell of solid soap and changes in the number of free fatty acids of solid soap that are not detected because during the testing process before titrating with 0.1 N KOH solution the soap solution has a pink color. It is thought that the fatty acids in used cooking oil have all reacted with NaOH, so the free fatty acids cannot be measured.

5. Acknowledgments

The authors thank the Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, for providing the facilities.

6. Conflict of Interest

The authors declare no conflicts of interest.

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