Quality Test of Bulk Palm Cooking Oil In Local Market, Banjar, West Java, Indonesia Base on Peroxide Value, Iodin Value and Number of Free Fatty Acid

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Abstract. Vegetable oil used as cooking oil was extracted from fruits of plants. vegetable oil is known as a source energy for human body and an important component for dissolving fat soluble vitamins such as vitamin A, D, E and K. Bulk palm cooking oil sold in many markets does not meet quality standards due to damage that can occur during processing such as heating and during storage. the quality of cooking oil is determined by odor, color, water content, peroxide number, iodine number and free fatty acid content. Chemical analysis for quality test of palm cooking oil include peroxide value, iodine value, and free fatty acid level by the titration method. This study aimed to determined peroxide value, iodine value and free fatty acid level the bulk palm cooking purchased in traditional market, Banjar, West Java. The result of the reseach showed that peroxide value of bulk palm cooking oil, were obtained by AOAC analytical method was 3.33 mekO₂/kg, iodin value 2.38 mg/100g, and free fatty acid level 0.037 mg NaOH/g. Based on the result, the bulk palm cooking oil sold in the Banjar market still under the quality according to SNI standards.

1. Introduction
Oil is one source of energy for humans (9cal / g), a vehicle for fat soluble vitamins such as vitamins A, D, E, and K, increase taste and delicacy of food [1]. Oil is a liquid form of fat. edible oils produced from vegetable or animal ingredients, oils from vegetable ingredients such as corn oil, peanut oil, palm oil, olive oil and coconut oil. whereas animal oil for example fish oil. lately found in a market in Jakarta that the sale of cooking oil on the market that has been mixed with used frying oil with repeated heating at high temperatures. It can cause reduced quality and nutritional content. The harmful effects of repeated heating at high temperatures from cooking oil in addition to damaging the nutritional content can also disrupt human health if consumed because it has affected the oxidation and content of free radicals. So that efforts need to be made to ensure the quality of bulk cooking oil sold in the market.

The parameter used in measuring the quality of cooking oil according to SNI can be determined based on water content, acid number, peroxide number (PV), iodine value (IV) and free fatty acid level (FFA) [2]. The method used for quality test of oil and fat are measured by the titration method. Peroxide number shows the amount of peroxide in meq in every 1000 gram of oil. Peroxide compound are formed because unsaturated fatty acid oxidized [3]. Iodine number shows the amount of unsaturated fatty acid in oil. Unsatuated fatty acid can bind iodine to form saturated compunds. The amount iodine bond...
shows the number of doble bond in oil [4]. Iodine number are expressed as the number of gram of iodine bound by 100 gram of oil or fat [5]. Iodine shows the saturation of fatty acids in oil. Unsaturated fatty acids can binds to iodine and forms a saturated compound. The amount of iodine bond shows the number of bonds double. Unsaturated fats can easily bind with iodine. The more iodine is used means a high degree of unsaturation [6].

A high content of polyunsaturated fatty acid may cause trouble. cooking oil must not smell and preferably neutral flavor. According to SNI 3741: 2013, good cooking oil must match cooking oil quality requirements. Oil damage can occurs during the process for example in the roasting, frying and during storage. This fat damage causes fatty food ingredients has a bad smell and taste, so it can reduce quality and nutritional value of fatty food ingredients.

Altough oil quality can be determined by analytical instrument, such as spectrophotometry uv-vis and gas chromatography, the analytical methode of quality oil can also determined by titration method [7]. the amount of free fatty acids determined by AOCS' method Ca-5a-40 [4]. Fatty acid is produced by the process of hydrolysis and oxidation which binds to neutral fat, the results of hydrolysis of oil are glycerol and free fatty acids. This reaction will accelerated by the presence of heat, water, acidity and catalyst (enzyme). [8]

2. Material and Methods

2.1. Material

The sample of bulk palm cooking oil purchased in the traditional market, Banjar, West Java, Indonesia, chloroform, ethanol, iodine bromide, potassium iodide (KI) 15%, distilled water, Na₂S₂O₃ 0,1 N, starch, phenolphthalein, glassware in the laboratory, analytical weight and a set of titration tools.

2.2. Sample Preparation

The research was done at the analytical chemistry Laboratory STIKes Muhammadiyah Ciamis. In this study, it was used iodometric titration method for testing peroxide and iodine numbers, and Alkalimetry titration method for free fatty acid levels. The sample preparation stages include:

2.2.1. Solvent of palm cooking oil:

The solvent consists of glacial acetic acid and chloroform with comparison 3; 2. The way to make it is by entering 600 ml of glacial acetate into a dark bottle and then added with 400 ml of chloroform, then cover tightly.

2.2.2. Na₂S₂O₃ solution 0,1 N:

Na₂S₂O₃ 0,1 N made by weighing 2,48 g sodium thiosulfate crystal then put into a 1000 ml volumetric flask and added distilled water until the sign line.

2.2.3. Saturated potassium iodide solution:

Saturated KI solution is made by adding Potassium Crystals Iodide into distilled water until the crystal becomes not dissolve anymore. In the KI crystal research was used as much as 8 g which is dissolved in 5 ml of distilled water.

2.2.4. 1% of Starch solution

The starch solution 1% as indicator is made by adding 1 gram amprotab powder into 100 ml of distilled water, then heated over the hotplate until boiling while continuing to stir. Then cooled before using it. Amylum solution is made immediately before titration to prevent damage.

2.2.5. 15% of Potassium solution

15% KI solution is made by dissolving KI crystals as much as 7.5 grams in 50 ml Aqua Destilata, then stir until dissolved perfect and homogeneous.

2.2.6. Iodine solution

Iodine solution was made by weighing 12.69 grams of iodine and 18 grams of KI, then put in a 250 ml glass container. add distilled water until all the powder dissolves perfect. Then the solution is transferred
into a 1000 ml volumetric flask add distilled water to the sign line. Make sure the measuring flask is closed properly, to avoid evaporating Iodine.

2.2.7. NaOH solution 0,1 N
The NaOH titrant solution is made by weighing 4 grams of NaOH powder, then in glass 250 cup dissolve NaOH powder with distilled water until the powder dissolves completely. glass beaker is covered with aluminium foil and wait for the solution is cool. Then transferred it to a 1000 ml volumetric flask and fill it with distilled water until the sign line.

3.  Method

3.1. Determination of peroxide value
Determination of peroxide number by iodometric titration method is to weigh 5 grams of oil and then put it in a 250 ml erlenmeyer. Add 12 ml of chloroform and 18 ml of glacial acetic acid. The solution was shaken until the material was dissolved then 0.5 ml of saturated solution KI was added and left to stand for 1 minute while continuing to shake. 30 ml of aqua destilata and 0.5 ml of 1% starch are added and immediately titrate with Na2S2O3 0.1 N until the solution changes from blue to clear.

Peroxide value are calculated:

\[
\text{Peroxide value (PV)} = \frac{\text{ml Na}_2\text{S}_2\text{O}_3 \times 0,1 \times 1.000}{\text{sample weight (g)}}
\]

Where 0,1 is the concentration of Na2S2O3

3.2. Determination of iodin value
Blank solution is made from 25 iodine bromide and 10 ml potassium iodide 15% and added 100 ml aqua destilata and boiled in water bath the titrated by Na2S2O3 0,1 N. 0,5 g of palm oil put in the erlenmeyer, added 10 ml chloroform and 25 ml of iodin bromide storage in dark place for 30 minutes. Added 10 ml potassium odide solution 15% and 50 ml boiling aquades and titrated bu Na2S2O3 0,1 N until the color is pale yellow. Added of 2 ml starch solutin until the blue color is lost. For iodine value determination calculated as:

\[
\text{Iodine value (IV)} = \frac{\left(\text{ml Na}_2\text{S}_2\text{O}_3 \text{blank} - \text{ml Na}_2\text{S}_2\text{O}_3 \text{sample}\right) \times 0,1 \times 12,69}{\text{weight of sample (g)}}
\]

Where 0,1 is the concentration of Na2S2O3 and 12,69 is a constant related to the equivalent weight of iodine (4)

3.3. Free fatty acid level.
Determination of the amount of free fatty acids by alkalimetry method. The sample is stirred, then weighed 5 grams of sample and put in an erlenmeyer glass which has known empty weight. Mixed 50 ml of alcohol and then heated with a temperature of 50 - 75°C. Added 5 drops of phenolphthalein indicator and heated to dissolve titrated with 0.1 N NaOH until a pink solution is formed. [9]

\[
\% \text{ Free Fatty Acid Level as palmitic acid} = \frac{\text{ml of NaOH x N NaOH x Z82}}{\text{weight of sample}} \times 100 \%
\]

4. Result and Discussion
In the peroxide value test with iodometry titration was carried out using Na$_2$S$_2$O$_3$ 0.1 N as titrant, glacial acetic acid solution and chloroform oil solvent starch, saturated KI as reactant with oxygen, and 1% amyllum as indicator. At the time of titration the peroxide test must be considered when the color of the sample change from yellow to pale yellow, titration must be done while strong shaking because the reaction that occur are slow, so it must be helped by strong shaking, and guard do not let the yellow color disappear, because if the yellow color disappears, addition the starch indicator will not changes in color to blue.

| Table 1. The result of Peroxide Value |
|--------------------------------------|
| Volume of Na$_2$S$_2$O$_3$ (ml) | Peroxide Value (mek O$_2$/kg) |
| 1 | 0,1 | 2 |
| 2 | 0,2 | 4 |
| 3 | 0,2 | 4 |
| Mean | 0,17 | 3,33 |

From the table, the bulk cooking oil sample data is obtained tested to have a peroxide value of 3.33 meq O$_2$/kg. According to SNI 3741: 2013 standard that good quality cooking oil has a number peroxide maximum 10 mek O$_2$/kg.

In the iodine value test carried out using the method iodometric titration, using Na$_2$S$_2$O$_3$ 0.1 N as a titrant, chloroform and iodine as oil solvents, KI 15% as reagents, and starch as indicators. When doing Iodometry titration, distilled water was boiled and then waited until it was cold. It aims to free O$_2$ so that the double bond in the oil is not interrupted by O$_2$ which can result in errors calculation of iodine value in cooking oil.

| Table 2. The result of Iodine Value |
|------------------------------------|
| Volume of Na$_2$S$_2$O$_3$ (ml) | Peroxide Value (mg/100mg) |
| 1 | 49,4 | 2,13 |
| 2 | 41,5 | 2,46 |
| 3 | 40,2 | 2,15 |
| Mean | 43,7 | 2,38 |

From this table iodine number is 2.38. According SNI that cooking oil has good quality has iodine value between 7.7 - 10.5 mg / 100g. So it can be concluded that the quality of bulk cooking oil which is sold in the traditional market of Banjar City based on numbers iodine is not according to standard, because the iodine number is far away below normal values. This means in bulk cooking oil samples. which is sold in the traditional market, Banjar, is saturated oil, because it only has a few double bonds so it is in titration can only catch a little iodine.

In the free fatty acid level test carried out with using the alkalimetric titration method using a titrant. NaOH with a sample temperature of 50-75°C, with alcohol as oil solvents, and fenofaldien indicators. When titrating the free fatty acid test, NaOH titrant as much as possible made fresh because NaOH is easy to bind carbon dioxide.

| Table 3. The result of Free Fatty Acid level |
|---------------------------------------------|
| Volume of NaOH (ml) | Free fatty acid level (mg NaOH/g) |
| 1 | 0,6 | 0,03 |
| 2 | 0,8 | 0,04 |
| 3 | 0,8 | 0,04 |
| Mean | 0,73 | 0,037 |
From the table, the amount of bulk cooking oil free fatty acid has been obtained tested 0.037 mg NaOH / g. According to SNI 3741: 2013 standards regarding quality requirements for cooking oil that good cooking oil has free fatty acid level 0.6 mg NaOH / g. So it can be concluded that the quality of bulk cooking oil which is sold in the traditional market Banjar based on free fatty acid level according to SNI standards, because the levels under the maximum amount of SNI.

5. Conclusion

Based on the results of thesearch on the quality test of cooking oil sold in the Banjar market, west java, it has a peroxide value of 3.33 mek O₂ / kg and free fatty acid level according to 0.037 mg NAOH / g, so that according to SNI standards. whereas for iodine numbers obtained at 2.38 mg/100 mg and not in accordance with the value of the SNI standard.

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Acknowledgement

The authors thanks to STIKes Muhammadiyac Ciamis for financial assistance during the research and all laboratory facilities. Thanks too colleagues at DIII pharmacy study programs for all their suggestions in completing this journal.