Production and characterization of cooking oil from crude palm oil

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Abstract. Research has been carried out on the production and characterization of cooking oil with the Indonesian National Standard CPO (Crude Palm Oil). In principle, the raw material in the form of crude palm oil is adsorbed by natural bleaching which causes a color change in crude palm oil. This study aims to determine how much natural bleaching is used to reduce β-carotene from CPO (Crude Palm Oil) to comply with Indonesian National Standard for cooking oil, and how the characteristics of cooking oil adsorption using natural bleaching. The best mass of natural bleaching obtained according to Indonesian National Standard is 1.5 grams with β-carotene content of 30.664 ppm, water content of 0.59%, free fatty acid content of 0.53% and peroxide number of 0.8 mgO₂ / 100 grams. The characteristics of the resulting cooking oil are clear yellow with a distinctive aroma.

1. Introduction

Crude palm oil in general has several uses in food sectors (such as cooking oil, margarine and candy products), an alternative fuel source (such as biodiesel), and commodities (such as cosmetic products, soaps, candles, textiles, and plastics). Palm oil is widely known to have a high oil content and a very large potential compared to other vegetable oils. Indonesia is the world's largest producer of palm oil, with a production capacity of 33 million metric tons, followed by Malaysia with 20.5 million metric tons, while Thailand produces 2.4 million metric tons [1] based on 2015 data. Palm oil can be used as a raw material in the food and non-food processing industries. Before being consumed, palm oil undergoes a processing process in the form of degumming, deacidification, bleaching, deodorization and fractionation [2].

In the process of refining free fatty acids, it can be removed by a deodorization process in the form of steam at high temperatures and pressure exerted in a vacuum. However, the oil is still processed first through a degumming process to remove sap and a bleaching process to remove the carotenes content in the crude oil. The result is that it can cause discoloration and loss of other qualities when the oil is heated [3]. To maintain product quality, changing the color of the oil is very important to attract consumers. The carotene content of palm oil is caused by α- and β-carotene, so that the bleaching process will disappear. In addition, the content of other pigments (eg chlorophyll), metals (iron and copper), soap and oxidation products will be lost during the bleaching process [4].

The adsorption process is a complex chemical process that is often used in the refining process of vegetable oils, where impurities in the oil are removed by the adsorbent after going through an alkaline
process or before physical purification. In this bleaching process, compounds such as phospholipids, dyes, soaps, contaminants and lipid peroxidation products are removed, so that the desired characteristics in vegetable oils are in accordance with industrial requirements [5]. In principle, part of the pigment color will be lost during the bleaching process, where the adsorption process will take place a physical binding process through appropriate bleaching. Then the remaining color components are thermally degraded during deodorization using high temperature [6]. In addition, this study will characterize cooking oil produced from the adsorption process using natural bleaching.

2. Materials and methods

The materials used are crude palm oil comes from Pasangkayu, Pasangkayu Regency, West Sulawesi), natural bleaching (Beka village), Hydrochloric Acid (HCl), sodium hydroxide (NaOH), phosphoric acid (H3PO4), potassium hydroxide (KOH) 0,1 N, phenolphthaline, n hexane, 96% ethanol, indicators of phenolptalein (pp), glacial acetic acid 40%, KI 6 M, sodium thiosulfate (Na2S2O3), chloroform, filter paper and distilled water.

CPO samples are separated using a centrifuge at a speed of 4000 rpm for 30 minutes. The CPO sample is separated into crude palm olein and crude palm stearin (CPOo and CPS). Furthermore, the olein sample was degumming process to remove the gum using phosphoric acid 85% for 30 minutes at 60°C. Degumming oil is then carried out by the bleaching process using an activated bleaching earth. In the bleaching process, a mass variation of 0.5 grams to 2.5 grams is used. The bleached oil is then filtered to remove any impurities that are still in the oil. The next step is to carry out the characterization process of the oil produced by referring to Indonesian National Standard for cooking oil.

![Figure 1. Processing step for CPO preparation for production cooking oil](image-url)
2.1 Characteristic of cooking oil
In this study, the resulting cooking oil characterization will be carried out in the form of determining carotenoid, moisture content, free fatty acids, and peroxide number. The characteristics of the cooking oil are based on codex [7]. In the determination of beta carotenoid measurements were carried out at a wavelength of 446 nm using a UV-Vis spectrometer. For the determination of water content using an oven, while the free fatty acid and peroxide numbers used the titration method.

3. Results and discussion
In the preliminary research, it was found that the crude palm oil (CPO) carotenoid content was 213.61 ppm, while the oil that had undergone the bleaching process with natural bleaching variations (0.5 g; 1 gr; 1.5 g; 2 g; and 2.5 g) namely 65.49 ppm, 40.21 ppm, 30.64 ppm, and 17.87 ppm and 9.76 ppm. Based on the results of measuring the reduction in beta carotene (figure 2), it can be seen that the ratio of natural bleaching earth to crude palm oil greatly affects the bleaching process. The use of natural bleaching will have an effect on reducing carotenoid levels. In this study, the use of natural bleaching 1.5 grams is in accordance with the standard, where the carotenoid content of 30.64 ppm is in accordance with consumer acceptance. The recommendation for a special standard for palm cooking oil enriched with spro-vitamin A is yellow to orange in color, with a minimum carotenoid content of 30 ppm and a distinctive smell of carotenide. Based on the Indonesian National Standard 01-3741-200216 provisions, the oil color is white, pale yellow to yellow.

Testing the moisture content affects the quality of the oil. The lower the water content, the better the quality of the oil. The water in the oil can trigger a hydrolysis reaction which causes a decrease in the quality of the oil due to an increase in free fatty acid levels. This is in accordance with the results of Nurul research which states that the high water content in oil will affect the free fatty acid content [8]. The container is heated and then put in a desiccator so that the container is free of water. Also done is heating the container filled with oil in order to make water oil. The best water content in cooking oil is 0.19%. For testing the water content is in accordance with the proposed quality standard of carotenoid enriched palm cooking oil (revised Indonesian National Standard 01-3741-2002), namely the maximum water content in cooking oil is 0.1-0.3%. The analysis showed that the free fatty acid content in the oil produced was 0.53%. Free Fatty Acid content of less than 0.5% shows good results, the higher the value of free fatty acids in palm oil, the change in quality and oil damage will occur. This is consistent with the results of research by Densi [9] which states that the amount of free fatty acids in oil shows a decrease in oil quality. In the oil produced, the peroxide number is 0.8 mg O₂ / 100 grams. The results obtained are in accordance with Indonesian National Standard 01-3741-2002 standards, namely the maximum peroxide number in oil is 1.00 mg O₂ / 100 grams.

![Figure 2 β-carotene content of cooking oil](image-url)
4. Conclusion
Based on the research results it can be concluded that bleaching earth mass used as an adsorbent to obtain cooking oil according to SNI standards is 1.5 grams with β-carotene content of 30.64 ppm, water content of 0.59%, free fatty acid content of 0.53%, and peroxide number 0.8 mgO₂/100 gram. Characteristics of cooking oil produced using adsorbent from bleaching earth, namely clear yellow color with a distinctive smell of CPO.

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