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Iodine value analysis on RBD palm olein and RBD palm stearin

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ABSTRACT

Studies and analyses were made to determine the degree of uncertainty in the iodine value estimation of refined, bleached, and deodorized (RBD) palm oil and after fractination (RBD palm olein and RBD palm stearin). At refining process and produce Refined Bleached Deodorized Palm Oil (RBDPO), enter the fractionation process will produce RBD palm olein (RBDPL) and RBD palm stearin (RBDPS). A commonly used metric to assess the quality of vegetable oils is the iodine value (IV). The main objective is to observe IV of RBDPL and RBDPS after fractination process. The approved AOCS Cd 1–25 technique was used to compute this parameter. The IV of the RBDPO samples shows that RBDPL and RBD PS met the requirement specified by PORAM with a iodine value of RBDPO is 52.33°C–53.06°C for RBDPO (standard 50-55), RBDPL is 58.13 – 58.40 (standard min 56) and RBDPS is 34.18 – 35.81 (standard 48 max).

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1. Introduction

People consume food to promote health and growth and development. However, food's ability to maintain and nourish life is diminished when its quality is impaired (MacArthur et al., 2021). The most prevalent vegetable oil produced worldwide is palm oil, which comes from the mesocarp of the oil palm fruit (Edo et al., 2022). The oil palm (*Elaeis guineensis*), is the most significant oil crop in the world, accounting for almost 40% of all sold vegetable oil. Over three billion people, primarily in Asia, rely on palm oils as essential nutritional components. There are also numerous significant non-food applications for palm oils, such as in cleaning and sanitizing chemicals (Murphy et al., 2021).

Over the past ten years, palm oil (*Elaeis guineensis*) has surpassed soybean oil to become the most produced vegetable oil globally, making up 57% of vegetable oil exports to markets (de ALMEIDA et al., 2019). The highest energy density is found in lipids, which are the second main dietary energy source for humans. In addition to supplying energy and necessary fatty acids, lipids play crucial roles in the construction of Signaling systems and cellular

structure. Lipids are also needed for the absorption and transportation of fat-soluble bioactive substances, including vitamins (Altberg et al., 2020).

Crude palm oil (CPO) refining is a crucial step in the palm oil industry. When CPO is refined, undesirable minor components including gums, free fatty acids (FFA), heavy metals, color pigments, etc. are removed before it is employed in subsequent processes, whether they are edible or not. A commonly used metric to assess the quality of vegetable oils is the iodine value (IV) (Yung et al., 2020). Processing of Crude Palm Oil (CPO) to become palm oil products is the raw materials go through a refining process and produce Refined Bleached Deodorized Palm Oil (RBDPO) and Palm Fatty Acid Distillate (PFAD). Then, enter the fractionation stage which will eventually produce Refined Bleached Deodorized Palm Olein (RBDPL) and Refined Bleached Deodorized Palm Stearin (RBDPS) (Sitanggang & Sukanta, 2023).

The fats and oils industries have long used the well-established method of fractionation. Under carefully regulated cooling conditions, low and high melting triacylglycerol are separated into olein and stearin fractions, each of which has unique chemical and physical characteristics (Tong et al., 2021). The valued oil extracted from oil palm mesocarp is semi-solid by nature at room temperature and, following a number of fractionation steps, has unique physical and chemical characteristics. Because of its distinct fatty acid and triacylglycerol profile features, it was also suitable for a range of dietary applications. Two distinct fractions are produced after the initial fractionation of the palm oil: liquid palm olein and solid palm stearin. Widely utilized for both culinary and non-food purposes, palm stearin is produced by crystallizing at regulated temperatures (Ahmad Bustamam et al., 2022).

Palm stearin is a valuable natural hard stock for creating trans-free fats and is important in the process of film creation and coating replacement (Subroto & Nurannisa, 2020). Products like fats and oils play a significant part in making food digestible (Siswanti et al., 2021). Any feed ingredient's energy content per unit weight is significantly influenced by oils and fats. Although broiler diets may contain a lot of fat and oil resources, commercial producers employ these energy sources sparingly because of a lack of expertise (Khaskheli & Chou, 2021).

The quality of Malaysian palm stearin was monitored through a twelve-month survey in 2018 such as moisture, impurities, free fatty acids, slip melting point, peroxide value and iodine value were determined. Results obtained from this survey indicated that the quality of Malaysian palm stearin complied with the requirements (Ahmad Bustamam et al., 2022). In another research in Malaysia, the production of Palm-Based Standard Reference Materials (palm oil, palm olein and palm stearin) for iodine value is achievable (Ahmad Tarmizi & Ismail, 2008).

The Federation of Oils, Seeds, and Feeds Association's (FOSFA) free-on-board contract for bulk oils served as the basis for the quality standards for refined palm oil products, which were set by the Palm Oil Refiners Association of Malaysia (PORAM). These standard requirements are often known as PORAM requirements, and they are recognized for bulk international trade in refined palm oil products, one of the important requirement is IV. The unsaturation level of oils, which is influenced by fatty acid chains, is frequently evaluated using IV. Double bonds that interact with iodine compounds serve as a representation of this unsaturation. As a result, the iodine number and the quantity of double bonds in the oil are commensurate. Concerning the oil's chemical properties, it may also be used as a sign of the kind and purity of the oil. For refined, bleached, and deodorized palm olein (RBDPOL), the IV

minimum requirement is 56 (Noor et al., 2020). Soft and hard stearin categories are produced by varying the IV of RBD palm stearin (RBDPS) up to 48 gI2/100g oil. Hard stearin typically has a lower IV (17 to 21gI2/100g oil), while soft stearin has a higher IV (40 to 42 gI2/100g oil) (Podchong et al., 2018). With a higher melting point of 48°C to 50°C, palm stearin has a TAG profile and more saturated fatty acids (Gunstone, 2011)

2. Method

Samples oil were obtained from a local supplier in North Sumatera, there are RBD Palm oil (before fractination), after fractination process are RBDPL and RBDPS (each 5 samples). Samples were heated to 60°C in an oven and well agitated to make sure complete melting and homogenization (Ahmad Bustamam et al., 2022). Standard quality of oil set out by PORAM (The Palm Oil Refiners Association of Malaysia), such as moisture and impurities (M&I), free fatty acids (FFA), slip melting point (SMP), iodine value (IV), and color, as stated in the PORAM specification.

The approved AOCS Cd 1–25 technique was used to compute this parameter. Weighing 0.2 g of oil, 15 ml of CCl4 solution and 25 ml of Wijs reagent were added to a flask. After giving the firmly sealed bottle a gentle shake and letting it sit in a dark area for an hour, 20 milliliters of KI aqueous solution (10 g/100 milliliters), 15 milliliters of distilled water, and the addition of five drops of 1% starch solution paste. The volume V1 of sodium thiosulfate needed to turn the solution (make the blue color dissapear) from the flask was recorded after 0.1 N sodium thiosulfate solution was used to titrate the solution in the flask. The blank test was also employed for this titration, and the volume V0 of sodium thiosulfate that was utilized was recorded. The iodine value (IV) expressed in Iodine was calculated according to the formula (Houketchang Ndomou et al., 2023) :

$$\mathrm{IV} = \frac{(\mathrm{V0} - \mathrm{V1})\mathrm{x}\ 12.69\ \mathrm{x}\ \mathrm{T}}{\mathrm{M}}$$

Where V0 (ml) is the volume of the thiosulphate solution for the blank; V1 (ml) is the volume of the thiosulfate solution for the sample; M (g) is the test portion's mass; T is titer of the sodium thiosulfate solution employed (Houketchang Ndomou et al., 2023).

3. Results and Discussion

According to several accepted techniques, including the Wijs, the IV quantifies the extent of Unsaturated fats and oils (Imoisi et al., 2020). Table 1 shows the iodine values of RBDPO (before fractination) and after fractination (RBDPL & RBDPS). IV RBDPO (before fractination) are 52.33, 52.60, 52.52, 53.06 and 52. 38 ($\sum$ = 52.58), after fractination IV olein are 58.28, 58.14, 58.13, 58.30 and 58.40 ($\sum = 58.25$), IV stearin are 35.35, 35.62, 35.81, 35.54 and 34.18 ($\sum$ = 35.30).

Table 1.

Iodine value (IV) of RBDPL and RBDPS in Fractination process

Before Fractinaton	After Fractination	
RBDPO	RBDPL	RBDPS
52.33	58.28	35.35
52.60	58.14	35.62
52.52	58.13	35.81

53.06	58.30	35.54
52.38	58.40	34.18

Following to several accepted techniques, including the Wijs, the iodine value quantifies the extent of unsaturation of oils and fats (Imoisi et al., 2020). The IV quantifies the degree of unsaturated fats and oils; higher IVs indicate more unsaturated bonds. RBDPO testing result show that all sample is requiring PORAM standard. It is acceptable to assume that the majority of samples have high IV quality based on the data shown in Table 1. According to PORAM guidelines, the minimum IV for RBD palm olein is 56, while the acceptable IV range for RBDPO is 50–55 (Roslan et al., 2023). Failure to fulfill specifications in the manufacturing of RBDPO would result in zero output at that time and recycling during the refining of palm oil. Therefore, it is highly helpful to be able to estimate the output quality characteristics so that the process may be adjusted appropriately in advance, which will reduce the time and cost of production (Mohd Noor et al., 2017).

4. Conclusion

Based on the data in Tables 1, the IV of the tested RBDPO, RBDPL and RBDPS met the requirement specified by PORAM with a iodine value of RBDPO is 52.33℃–53.06℃ for RBDPO (standard 50-55), RBDPL is 58.13 – 58.40 (standard min 56) and RBDPS is 34.18 – 35.81 (standard 48 max). IV is one of the standard quality of oil by PORAM (The Palm Oil Refiners Association of Malaysia). The other standard parameter in PORAM specification are moisture and impurities (M&I), free fatty acids (FFA), slip melting point (SMP) and color.

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