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Research Article

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Determination and comparison of peroxide value of cold press peanut oil and refiend sunflower oil

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Abstract

The peroxides are the main initial products of oxidation, and the peroxide value is usually expressed in terms of milliequivalents of oxygen per kilogram of fat. Peroxide value determination gives a measure of the extent to which an oil sample has undergone primary oxidation. In this study, we addressed the effectiveness of antioxidants on the value of peroxide. Two samples of oil were prepared. The first sample contained cold press peanut oil without any addition of antioxidants. The second sample contained refined sunflower oil purchased from markets. The study focused on the value of peroxide in two samples for about nine months, every fifteen days once the test was applied. Finally, the results from the experimental tests showed that the peroxide value of the first sample approximately reached the range 4–16.4 milliequivalents per kg of sample. Furthermore, the peroxide value of the second sample reached the range of 5.5–49.5 milliequilvalents per kg of sample.

Keywords: Cold press peanut oil, Refined sunflower oil, Peroxide value and antioxidants.

1. Introduction

The average bottle of cooking oil contains vegetable oil, with no additives, preservatives, or special flavorings. The oil comes from various parts of plants, in most cases from what are commonly called seeds (including sunflower, palm kernel, safflower, cotton, sesame, and grape seed oils) or nuts (including peanut, soybean, almond, and walnut oils). A few special cases involve merely squeezing the oil from the flesh of the fruit of the plant. For example, coconut oil comes from the coconut's white meat, palm oil from the pulp of the palm fruit, and olive oil from the flesh of fresh olives.

Atypically, corn oil is derived from the germ (embryo) of the kernel [1].

The oil may oxidised with existence of some trace elements and also support the generation of aldehyde, ketone, peroxide, acid, epoxide and other compounds [2]. Hydroperoxide is one of the major oxidation products of vegetable oil [3].

The main aim of this study was to determine and compare the effects of the total antioxidant capacity, i.e., peroxide value, of cold press peanut oil and refined sunflower oils sold in markets [4].

Two samples were prepared.

To assess the value of peroxide after 45 to 270 days of antioxidants in peanut oil.

To investigate the effect of antioxidants on the peroxide value of refined sunflower oil over 45 to 270 days.

The present study focused on the value of peroxide in two samples for about nine months, every fifteen days once the test was applied.

2. Materials and Methods

Collection of samples

The first material was purchased from cold-pressed oil (traditionally referred to as "Chekku"). Peanut seeds are made by first cleaning them and then the seeds are crushed in a rotary chekku for oil extraction. The extracted oil is filtered. Thus, the purchased product is designated as cold press peanut oil. (Sample 1)

The second material was purchased from markets; it is named refined sunflower oil. (Sample 2)

Chemicals and Reagents

1. Lipid (cooking oil can be used)
2. Acetic acid
3. Chloroform
4. Potassium iodide
5. Sodium thiosulfate
6. Starch

Peroxide Value Test (PV)

Peroxide value (PV) is a measure of the peroxides contained in the oil. PV is determined by measuring the iodine released from potassium iodide. The American Oil Chemists' Society's (AOCS) Official Method Cd 8-53 is often used in determining the peroxide value of fats and oils [5-6]. Firstly, 2.5g of each sample was weighted into a 250-ml Erlenmeyer flask, and a 15-ml mixture of acetic acid and chloroform solution was added together in a proportion of 3:2. The solution was shaken before 0.5 ml of saturated KI was filled with it. KI solution was made by adding KI solute drop by drop to distilled water until it became saturated. Next, 15 ml of distilled water and 0.5 ml of starch indicator were mixed with the solution. A starch indicator was prepared by pouring 100 ml of hot distilled water into 2 g of starch. A saturated KI mixture is added to the sample, and the measure of iodine liberated from KI by the oxidative action of peroxides present in the oil is determined by titration with standard 0.1 N sodium thiosulfate using the starch solution as an indicator [7]. Titration was also performed for blanks. The solution was titrated with 0.1 N sodium thiosulfate until the solution turned from oily yellow to colorless. All the samples were repeated in three replicates. Record the volume of sodium thiosulphate. The peroxide value was computed using the equation below:

$$\%PV = \frac{S \times N \times 1000}{\text{Weight of the lipid}}$$

Where , S= mL of sodium thiosulfate and
N= normality of the sodium thiosulfate.

3. Results and Discussion

A test on peroxide value (PV) was handed out to investigate the level of peroxide that occurred due to the lipid oxidation of used cooking oils. The American Oil Chemists' Society's (AOCS) Official Method Cd 8-53 is a common mode that has been used as an indicator of the initial stage of oxidative change. Figure 3.1 shows the peroxide value of cold press peanut oil when compared with the 45th day to 270 days. Table 3.1 tabulated the data on the amount of milliequivalents of peroxide per gram of oil.

Table 3.1 Peroxide value of cold press peanut oil cooking oil

PEROXIDE VALUE OF COOKING OIL	
DAY INTERVEL	PV OF COLD PRESSPEANUT OIL
45TH DAY	4
60TH DAY	4.1
75TH DAY	4.5
90TH DAY	5.4
105TH DAY	6.5
120TH DAY	7.7
135TH DAY	8.4
150TH DAY	9.5
165TH DAY	10.3
180TH DAY	11.4
After 270 days	16.4

Table 3.1 showed that the peroxide value increased by a large amount of milliequivelents during the experimental tests, and the peroxide value of this sample approximately reached out of the range of the fresh oils. The absence of antioxidants in fats and oils will cause several problems for their flavor and color, which will reduce their acceptable use. So, antioxidants are necessary to add to fats and oils to keep them natural and acceptable to use.

Table 3.2 Peroxide value of refined sunflower oil

PEROXIDE VALUE OF COOKING OIL	
	PV OF REFIND SUNFLOWER OIL
45TH DAY	2
60TH DAY	5.4
75TH DAY	6.1
90TH DAY	6.9
105TH DAY	9.5
120TH DAY	11.4
135TH DAY	12.8
150TH DAY	13.8
165TH DAY	16.3
180TH DAY	16.5
270 DAYS	18.6

Table 3.2 shows the result of the second sample that was tested with an imported antioxidant. The effect of antioxidants on the stability of oil was assessed by measuring the increase in peroxide value. The low stability of the oil samples containing antioxidants gave a lower rate of increase in peroxide value compared to the cold press peanut oil, which does not contain any antioxidants.

The rate of increase in peroxide value of the oil containing this antioxidant was also significantly lower. If we compare the two kinds of oil, the one prepared in the cold press peanut oil and the other refined sunflower oil, we find a minor difference in the rate of increasing peroxide value, and the refined sunflower antioxidant is more active than the cold press peanut oil [8]. The maximum level for the peroxide value of edible fats and oils was established by the milliequivalents per kilogram of fats or oils. The rapid screening of the peroxide value of cooking oils should be applied to control the quality of cooking oils. Cooking oil, used for frying several times or kept in an unsuitable environment such as in contact with air, heat, and light, causes deterioration, loss of nutritive value, and the production of toxic substances [9].

Tables 3.1 and 3.2 showed a value of peroxide, which started from sample 1 cold press peanut oil (5.5 to 49.5) and refined sunflower oil (2 to 18.6), respectively. The measured value of peroxide in oil kept increasing after 270. The maximum level suggested by the FAO of the United Nations (2013) is up to 10 milliequivalents of active oxygen per kg of refined oil. The increase in peroxide value also suggested that the peroxide formed during the storage condition. Furthermore, the lipid hydroperoxide radical is formed when the heated oil is kept at room temperature and reused again in frying. They are parameters of standards for oil quality determination, such as the content of moisture, the content of free fatty acids, trace heavy metals, and the peroxide value [10].

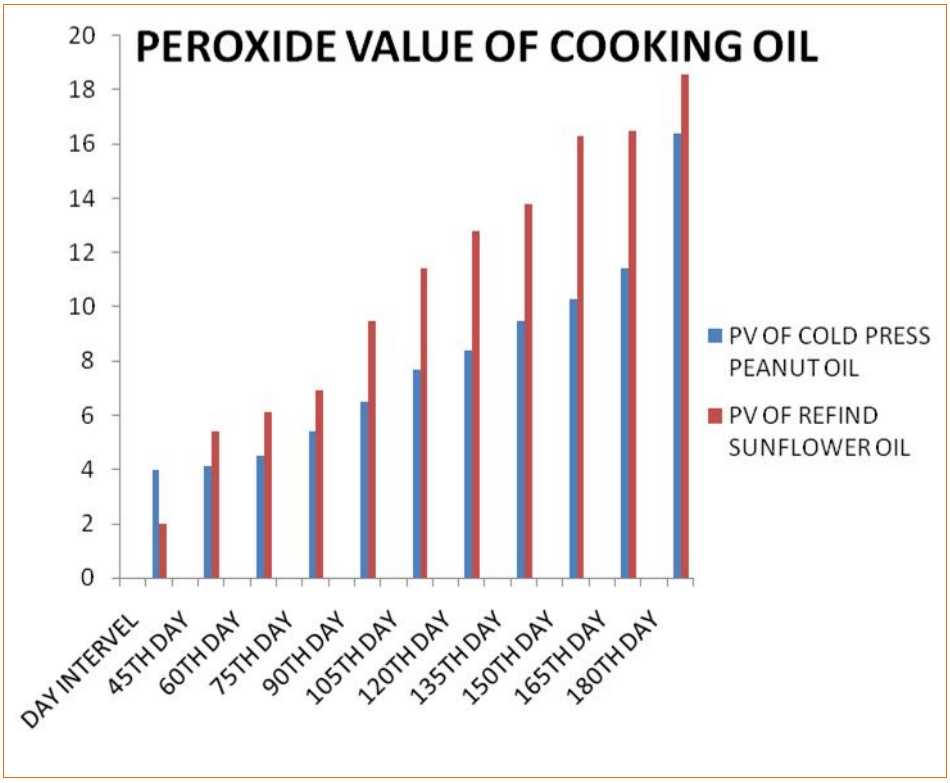

Figure 3.1 Peroxide Value of Cooking oil

4. Summary and Conclusion

Oil and fats are needed in our body as energy sources, as structural components, and to make powerful biological regulators [11]. They also play a vital role in metabolic reactions in the human organism. Basically, vegetable oils are beneficial and well accepted due to their cholesterol-lowering effect. However, compared with animal fats, which are mostly saturated and don't usually react with other chemicals like oxygen, unsaturated vegetable oils are more reactive [12].

Peroxide value (PV), along with free fatty acids, is one of the most frequently determined quality parameters during oil production, storage, and marketing. PV, often expressed as milliequivalents of hydroperoxide (ROOH) per kilogram of oil, is a measure of the hydroperoxides present in the oil as a product of primary oil oxidation. The first stage of the standard method includes the reaction of KI oxidation (at KI excess) by hydroperoxides in oils. The next stage is the volumetric titration, in which I_3 isliberated by $Na_2S_2O_3$ with the presence of a starch indicator. The iodine released is complexed with soluble starch, which acts as an indicator, and the iodine is quantitated by titration with sodium thiosulfate. Based on the stoichiometry of the two reactions, the hydroperoxide concentration can be calculated. Cold press oil is better than refined oil because refined oil cannot be used for a long time. It often produces a product with a longer shelf life, a lower smoke point, and fewer particles.

The present study suggested that when choosing oil, the refined sunflower oil should not be used for a long time. The peroxide value is high. Cold press peanut oil (Chekku) has a longer shelf life when compared with refined sunflower. There is nothing to spoil in it, as there is no organic life in it.

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