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Research Paper

The Effect Of Antioxidants On Peroxide Value In Edible Oil

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ABSTRACT

The peroxides are the main initial products of Autoxidation, and the peroxide value is usually expressed in terms of milliequivalents of oxygen per kilogram of fats. Peroxide value determination gives a measure of the extent to which an oil sample has undergone primary oxidation. In this study we used to address the effectiveness of antioxidants on the value of peroxide. Three samples of refined sunflower oil were prepared. The first sample was contain sunflower oil without any addition of antioxidants. The second sample was contain sunflower oil with adding imported antioxidant. The third sample was contain sunflower oil with adding prepared antioxidant in the laboratory of the Savola Edible Oil industry. The study focused on the value of peroxide of three samples for about two months, every seven days once the test was applied. Finally, the results from the experimental tests showed that the peroxide value of first sample approximately reached the range that can cause a rancidity (30 - 40ppm) , because of the absent of anti oxidents. While the peroxide values of second and third samples were less (10ppm) , this value is the range of fresh oils.

KEY WORDS: *sunflower oil, Edible oils, peroxide value and antioxidants.*

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I. INTRODUCTION

The fats and oils make up one of the three constitute of organic matter , the other two being carbohydrates and proteins, that are the main building materials of living organisms, although in some, the proportion of fat may be very small. Fats and oils have the same chemical structure. [1]. Fats, which are liquid at room temperature, are called oils. Fats and oils are insoluble in water. Fats and oils carry flavor, odor , and fat soluble vitamins. Most fats and oils consist of triglycerides which differ in their fatty acid composition to certain extant. Other constituents which make up less than 3% of fats and oils are the unsaponifiable fraction. And a number of acyl lipids [2].

Lipids are one of the important group of organic compound of a great physiological role and present in all food products [3].. They are also a good sources of energy. Lipids are composed of many classes of compounds. Most of them are a polar, and others have very polar character [4].. In living organism, lipids play

a unique role in the structure of biomembranes and transporting biologically active compounds. In general lipids are classified to simple, compound, and derived lipids. The most important of simple lipids are fats and oils[5].

The sunflower which can be grown in limited areas due to soil properties and climatic requirements, is the fourth common oil seed in the World, after soybean, palm and canola [6].

Edible oils are mostly refined before their consumption so that the resulting taste is sensorially neutral. Even very small traces of volatile products are easily perceived by the consumer[7].

Edible oils become rancid on storage, the type of rancid off-flavour depending on their fatty acid composition (for example, it may become painty and fishy in oils containing linolenic acid, such as rapeseed oil) and the presence of minor components (for example, in flavour-reverted soybean oil). Edible oil producers try to prolong the shelf life of edible oils by different techniques, including the addition of antioxidants[8].The presence of natural antioxidants should always be taken into account, when appropriate levels of added antioxidants are considered. [9].

All edible oils contain tocopherols in different total amounts and different ratios of α-, β-, γ- and d-tocopherols. Tocopherols are partially removed during the deodorisation process, which is the last step in refining edible oil. They are often restored by adding nature-identical preparations or natural tocopherol concentrates. Instead of tocopherol concentrates, some speciality oils rich in tocopherols may be added or mixed with edible oils, for example, oil from grapefruit seeds,2 which are wastes of grapefruit juice production[10].

In this study,we discussed about the effectiveness of antioxidants on the value of peroxide.Three samples of refined sunflower oil were prepared. The first sample was contain sunflower oil without any addition of antioxidants. The second sample was contain sunflower oil with adding imported antioxidant. The third sample was contain sunflower oil with adding prepared antioxidant in the laboratory of the Savola Edible Oil industry. The study focused on the value of peroxide of three samples for about two months, every seven days once the test was applied.

II. MATERIAL AND METHOD

1. Material

A. The first materialwere imported antioxidant as liquid , and containing for the flowing compounds:65% of polyethylene glycol, 25% of Tertiary butyl hydroquinone (TBHQ) and 10% of citric acid.

B: The second material were prepared antioxidant in the laboratory of the Savola Edible Oil industry (Sudan), And it is also the same composition of the first one.*65% of polyethylene glycol*, *25% of* Tertiary butyl hydroquinone (TBHQ) and 10% of citric acid.

C. Three samples of refined sunflower oil:

Sample (A) has been tested without adding antioxidant, while sample (B) has been tested with adding imported antioxidant.In the last, sample (C) has been tested with adding antioxidant prepared in the laboratory of the Savola Edible Oil industry (Sudan). This test of evaluation antioxidant as peroxide value has proceeded approximately about two months, in every seven days once was applied the test.

Apparatus:

Pipe , Erlenmeyer flasks with glass stopper 250ml, Low actinic red or amber container about 50ml to 100ml, Burette with 50ml or 100ml, Timer.

Reagents:

Acetic acid – chloroform solution (3:2 v/v), potassium iodide solution , saturated prepared fresh each day analysis, Sodium thiosulfate solution (0.1N), Starch indicator solution.

2. Method

The method for determination of peroxide concentration is based on the reaction of the hydroperoxide group with KI or Fe^{2+}.The result of the iodometric titration is expressed as the peroxide value. This method determines all substance in terms of milliequivelents of peroxide per 1000g of sample.

Procedure:

- Weight 5g of sample into 250ml Erlenmeyer flask, add 30ml of the 3:2 acetic acid-chloroform solution, and add 0.5ml of saturated potassium iodide solution.
- Allow the solution to stand with associational shacking for exactly 1min, and then immediately add 30ml of distilled water and drops of starch solution.
- Titrate with (0.1N) sodium thiosulfate(Na2S2O3) continue the titration until end point.

Calculation:

$$\boldsymbol{PV}_{(\boldsymbol{Eq})} = \frac{\boldsymbol{N \times V \times M_{wt} \times 1000}}{\boldsymbol{W_t}}$$

Where:

N = normality of Na_2SO_3

V = volume of Na_2SO_3 consumed in the titration
M.Wt = molecular weight of Na_2SO_3
Wt = weight of sample

III. RESULTS AND DISCUSSION:

Although the aim of this research is the effect of antioxidants on peroxide value in edible oil, in this stıdy,we have been analysed the results of three samples. The results of each sample has been showed in the table 1 , 2 and 3 as the following:

Table(1): Result of first sample:

No of tests	Date of tests	Peroxide value /milliequivalents per Kg of sample
1	02/08/2012	1.20
2	09/08/2012	1.54
3	16/08/2012	2.01
4	23/08/2012	4.72
5	30/08/2012	6.73
6	06/09/2012	11.32
7	13/09/2012	15.82
8	20/09/2012	19.11
9	27/09/2012	28.04

Table (1)showed that the peroxide value increased a large amount of milliequivelents during the experimental tests, and the peroxide value of this sample approximately reach out of the range of the fresh oils.The reason of absent antioxidants in fats and oils will cause several problems for their flavor and their color and that will reduce their acceptable of using. so that, antioxidants are necessary to add in fats and oils to keep their natural and their acceptable of using.

Table(2): Result of second sample:

No of tests	Date of tests	Peroxide value/milliequivalents per Kg of sample
1	02/08/2012	1.20
2	09/08/2012	1.42
3	16/08/2012	1.76
4	23/08/2012	2.07
5	30/08/2012	2.54
6	06/09/2012	3.21
7	13/09/2012	3.73
8	20/09/2012	4.11
9	27/09/2012	4.46

Table (2) shows the result of second sample that was tested with adding imported antioxidant. The effect of antioxidants on the stability of oil was assessed by measurement of increase in peroxide value. the low stability of the oil samples containing antioxidants gave a lower rate of increase of peroxide value compared to the samples that do not contain any antioxidants.

Table (3): Result of third sample:

No of tests	Date of tests	Peroxide value/milliequivalents perkg of sample
1	02/08/2012	1.20
2	09/08/2012	1.41
3	16/08/2012	1.73
4	23/08/2012	2.14
5	30/08/2012	2.83
6	06/09/2012	3.27
7	13/09/2012	3.75

8	20/09/2012	4.20
9	27/09/2012	4.41

Table (3)the sample was tested by using laboratory preparing antioxidant. The rate of increase in peroxide value of the oil containing this antioxidant also was found significantly lower. If we compare the two kind used antioxidants; the one prepared in the laboratory of Savola Edible Oil Industry and the imported antioxidant, we found a minor deference for the rate of increasing peroxide value, and approximately the imported antioxidant is more active than prepared in the laboratory.The maximum level for peroxide value of edible fats and oils was established by the milliequivalents per kilogram of fats or oils. The rapid screening on peroxide value of cooking oil should be applied to control the quality of cooking oils.Cooking oil, used for frying several times or kept in unsuitable environment such as in contact with air, heat and light, causes deterioration, loss of nutritive value and production of toxic substances.

Vegetable oils, which contain high unsaturation of fatty acid, tend to develop rancidity easily. There are end products of cooking oil degradation and responsible for rancidity, color change, off-odors and flavors, Those products are Aldehydes, ketones, alcohols, acids, peroxides and polymers.Consuming deteriorated cooking oils causes:Loss of nutritive value due to essential fatty acids.(linoleic acid) and vitamins (A,D and E) destruction and Health effects from toxic substances and some polymers (carcinogens) formation.

IV. CONCLUSION

The peroxides are the main initial products of Autoxidation, and the peroxide value is usually expressed in terms of milliequivalents of oxygen per kilogram of fats. Peroxide value determination gives a measure of the extent to which an oil sample has undergone primary oxidation, The double bonds found in fats and oils play a role in Autoxidation. Oils with a high degree of unsaturation are most susceptible to Autoxidation. The best test for Autoxidation (oxidative rancidity) is determination of the peroxide value. Peroxides are intermediates in the Autoxidation reaction.

Correlation of rancid taste and peroxide value depends on the type of oil and is best tested with taste panels. The odours and flavours associated with typical oxidative rancidity are mostly due to carbonyl-type compounds. The carbonyl-type compounds develop in low concentrations early in the oxidative process.

Peroxide values of fresh oils are less than 10 milliequivalents per kilogram of fat or oil , when the peroxide value is between 30 and 40 milliequivalents per kilogram of fat or oil, a rancid taste is noticeable. Peroxide values are not static and care must be taken in handling and testing samples. It is difficult to provide a specific guideline relating peroxide value to rancidity. High peroxide values are a definite indication of a rancid fat, but moderate values may be the result of depletion of peroxides after reaching high concentrations.

According to above conception and the results from the experimental tests we can extract the following ideas:

- The peroxide value of firs sample approximately reach about 30 milliequivalents per kilogram of sample. so we can to consider as rancidity.
- But the peroxide values of second and third samples are less than 10 milliequivalents per kilogram of sample. so we can to define them as fresh oil.

CONFLICT OF INTEREST STATEMENT

All authors of the manuscript declare that they do not have financial/commercial conflicts of interest.

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