

Effect of Adding Vitamin to Cooking Oil on Peroxide Value

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Abstract: The aim of this research is to reduce the number of peroxides in two frying oil samples by using one of the natural antioxidants which is vitamin E, one of the chemical specifications that assess the oil is the peroxide number, which is the amount of free radicals formed in the oil and the number of peroxides increases during exposure to heat, moisture, oxygen, bad storage conditions, light or other conditions. These peroxides have a harmful effect on the consumer health (Carcinogenic substances). The vitamin E had a clear impact on the peroxide value, as when conducting the experiment and using oil to fry potato slices, the number of peroxide was high before adding vitamin E which score approximately (Peroxide number is 5.6 for 15 minutes, 9.8 for 30 minutes, and 11.6 for 45 minutes). After using vitamin E in amount of 10 microgram per 100 ml of oil, the effect was clear of vitamin E on the number of peroxide as it decreased significantly. Which scored (5 for 15 minutes, 8.1 for 30 minutes, 8.9 for 45 minutes), When vitamin E added by 20 microgram the result was (4.8 for 15 minutes, 5.5 for 30 minutes, 6.5 for 45 minutes). 50 micrograms per 100 oil shown to have no significant effect on the peroxide value. it was found that the best concentration is 20 microgram for a sample of 100 ml of oil .

Keywords: frying oil, peroxide value, vitamin E.

INTRODUCTION

all of contradiction about the appropriate amount of fat within daily food consumption. Including fat in the diet is a must, especially since fat (in the form of oil) is an essential ingredient in many different types of cooking. The Food and Drug Administration recommends that calories consumed daily include approximately 30% fat or slightly less. Some nutritionists recommend that fat should not exceed 10% of the daily calorie intake. In fact, the diet containing approximately two-thirds of the recommended amount of calories may be a reason for staying healthy and surviving in very cold atmospheres. (1_2)

The properties of the oil change when it is heated. Healthy oils kept at room temperature may be harmful when heated above a certain temperature. When choosing cooking oil, it is necessary that the specific heating degree of the oil be proportional to the cooking method. It is worth noting that palm oil has the ability to withstand high temperatures resulting from deep frying and is resistant to oxidation compared to vegetable oils rich in unsaturated fatty acid, because it contains more saturated fats than canola oil, corn oil, flaxseed oil, soybean oil, safflower oil, and sunflower oil. Since 1900, the global commercial food industry has increasingly included palm oil in food because it maintains its properties both in deep frying and baking at high temperatures, and because of its high level of natural antioxidants. (3) Adding vitamin E to cooking oil can have several potential effects:

1. **Antioxidant Properties:** Vitamin E is a potent antioxidant, which means it helps protect cells from damage caused by free radicals. When added to cooking oil, it can help prevent oxidation of the oil, which can lead to rancidity and the formation of harmful compounds. This can extend the shelf life of the oil and maintain its quality.
2. **Health Benefits:** Consuming vitamin E through cooking oil may provide health benefits. Vitamin E is important for immune function, skin health, and cell function. It may also have anti-inflammatory properties and contribute to heart health.
3. **Stability:** Adding vitamin E to cooking oil can improve its stability at high temperatures. Cooking oils are often exposed to heat during cooking, which can lead to oxidation and the formation of harmful compounds. Vitamin E can help stabilize the oil and prevent it from breaking down under heat.
4. **Flavor Preservation:** By preventing oxidation, adding vitamin E to cooking oil can help preserve the natural flavors of the oil. Oxidized oils can develop off-flavors and aromas, which can affect the taste of food cooked with them.
5. **Nutrient Retention:** Adding vitamin E to cooking oil may help retain the nutritional value of the oil. Some nutrients in oils, such as omega-3 fatty acids, are sensitive to oxidation and can degrade over time. By stabilizing the oil, vitamin E can help preserve these nutrients.

It's worth noting that the effect of adding vitamin E to cooking oil may vary depending on several factors such as the type of oil, the amount of vitamin E added, and the cooking conditions.

Due to these changes that occur in foods during frying, the demand for more stable oils when frying increased, and it was found that Vitamin E has a positive effect to reduce these changes. Vitamin E have a unique colour which is pale yellow oil, acid and heat resistant, in soluble in water

6. Extremely slow in oxidation, which gives it an important role as an antioxidant agent. Vitamin E is a soluble in fat but not water that consists of eight formulas alpha, beta, gamma, delta tocopherol the aim of this study is :_

to evaluate the effect of adding different concentration of vitamin E to frying oil on the peroxide value.

	CAS No.	Hazards
Acetic acid (glacial)	64-19-7	Corrosive
Chloroform	67-66-3	Harmful
Hydrochloric acid (HCl)	7647-01-0	Corrosive
Potassium chromate (K ₂ Cr ₂ O ₇)	7789-00-6	Toxic, dangerous for
Potassium iodide (KI)	7681-11-0	
Sodium thiosulfate	7772-98-7	
Soluble starch	9005-25-8	

The experiment was conducted in the food analysis lab. in Al-Qasim Green university / food science collage / food science & technology department and The chemicals was procured from the chemical shop in Hilla city and from the chemistry lab of food science & technology departments. The animal oil tissue was purchased from the local meat shop in Al-qasim town The chemicals which were used in the experiment as follow:

- Beaker, 250 ml (to melt fat)
- Buchner funnel (to fit side-arm flask)
- Buret, 25 ml or 50 ml
- 4 Erlenmeyer flasks, 250 ml, glass stoppered
- Fat and/or oil samples
- Filter paper (to fit Buchner funnel, to filter melted fat and oil)
- 2 Graduated cylinders, 50 ml
- Mechanical pipettor, 1000 I, with plastic tips (or 1 ml volumetric pipette)
- Side-arm flask Equipment
- Analytical balance
- Hot plate

Materials and Methods

The methodology for this study was designed to evaluate the effect of adding vitamin E to frying oil on its peroxide value, an essential indicator of oxidative stability. The experiment was conducted in a controlled laboratory setting, ensuring precise measurement and repeatability. Two frying oil samples were selected, and their peroxide values were assessed before and after the addition of different concentrations of vitamin E. The samples were subjected to a standardized frying process, where potato slices were fried for different time intervals. The peroxide value was determined using a titration method involving potassium iodide and sodium thiosulfate, following established food analysis protocols. To ensure accuracy, each test was conducted in triplicate, and a blank sample was prepared for comparison. The peroxide values were recorded at 15, 30, and 45 minutes of frying to assess the impact of heat exposure. The effect of three different concentrations of vitamin E (10, 20, and 50 micrograms per 100 ml of oil) was analyzed to determine the optimal amount that effectively reduces peroxide formation. Statistical analysis was performed to evaluate significant differences between treatments. The controlled addition of vitamin E and the systematic approach to peroxide measurement provided reliable data, supporting the hypothesis that vitamin E acts as an effective antioxidant in frying oils. The methodology ensured that external factors such as temperature fluctuations and exposure to light were minimized, allowing a precise

assessment of how vitamin E influences the oxidative stability of frying oils under practical cooking conditions.

Discussion

EXTRACTION OF ANIMAL OIL BY THERMAL EXTRACTION:

This method is usually used to extract fats from animal tissue. The percentage of fat in fatty animal tissues free of meat and bone is about 70-90%, and the rest is water and connective tissue that contains a high percentage of protein and fat. The thermal extraction process is widely applied to produce animal fats. (6)

Such as fallow, bone fat and consists of cutting or chopping adipose tissue into small pieces that are boiled in open pots or cooked in steam digesters. The fat, which is gradually released from the cells, floats to the surface, where it is collected by skimming. The membrane material (graeve) is separated from the aqueous (viscous) phase. (7)

PEROXIDE VALUE

Determine the peroxide value of fats and oils, as an indicator of oxidative rancidity. Peroxide value is defined as the milliequivalents of peroxide per kilogram of fat, as determined in a titration procedure to measure the amount of peroxide or hydroperoxide groups. To a known amount of fat or oil, excess potassium iodide is added, which reacts with the peroxides in the sample. The iodine liberated is titrated with standardized sodium thiosulfate using a starch indicator. The calculated amount of potassium iodide required to react with the peroxide present is used to determine the peroxide value. (8)

	CAS No.	Hazards
Acetic acid (glacial)	64-19-7	Corrosive
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Potassium chromate (K ₂ Cr ₂ O ₇)	7789-00-6	Toxic, dangerous for
Potassium iodide (KI)	7681-11-0	
Sodium thiosulfate	7772-98-7	
Soluble starch	9005-25-8	

➤ Potassium iodide solution, saturated

Dissolve excess KI in freshly boiled (dd) water. Excess solid must remain. Store in the dark. Test before use by adding 0.5 ml acetic acid-chloroform solution, then add 2 drops 1% starch indicator solution. If solution turns blue requiring 1 drop 0.1 N thiosulfate solution to discharge color, prepare a fresh potassium iodide solution.

➤ Sodium thiosulfate, 0.2 N, standard solution (AOAC Method 942.27)

Dissolve ca. 50 g sodium thiosulfate in 1 L. dd water Boil gently for 5 min. Transfer while hot to a storage bottle (make sure bottle has been well cleaned, and is heat resistant). Store solution in a dark, cool place Use the following procedure to standardize the sodium thiosulfate solution Accurately weigh 0.20-0.23 g potassium chromate (KCr) (previously dried for 2 h at 100°C) into a glass-stoppered flask. Dissolve 2 g potassium iodide (KI) in 80 ml chlorine-free water. Add this water to the potassium chromate. To this solu tion, add, with swirling, 20 ml ca. 1 M HCl, and immediately place in the dark for 10 min. Titrate a known volume of this solution with the sodium thiosulfate solution, adding starch solution after most of the iodine has been consumed • Starch indicator solution, 1% (prepare fresh daily)**Mix ca. 1 g soluble starch with enough cold dd water to make a thin paste. Add 100 ml boiling dd water. Boil ca. 1 min while stirring.

Hazards, Precautions, and Waste Disposal

Potassium chromate is toxic and must be handled with caution. Use hydrochloric acid in a fume hood. Otherwise, adhere to normal laboratory safety procedures. Wear gloves and safety glasses at all times. Chloroform and potassium chromate must be handled as hazardous wastes. Other wastes likely may be put down the drain using a water rinse, but follow good laboratory practices outlined by environmental health and safety protocols at your institution

PROCEDURE

1. Melt any samples that are solid at room temperature by heating to a maximum of 15°C above the melting point. Filter melted fat sample and oil sample through filter paper to remove impurities.
2. Accurately weigh ca. 5 g fat or oil (to the nearest 0.001 g) into each of two 250-ml glassstoppered Erlenmeyer flasks.
3. Add 30 ml acetic acid-chloroform solution and swirl to dissolve.
4. Add 0.5 ml saturated KI solution. Let stand with occasional shaking for 1 min. Add 30 ml dd water.
5. Slowly titrate samples with 0.1 N sodium thiosulfate solution, with vigorous shaking until yellow color is almost gone.
6. Add ca. 0.5 ml 1% starch solution, and continue titration, shaking vigorously to release all iodine from chloroform layer, until blue color just disappears. Record the volume of titrant used. (If <0.5 ml of the sodium thiosulfate solution is used, repeat determination.)
7. Prepare (omitting only the oil) and titrate a blank sample. Record the volume of titrant used.

Oil/fat sample type tested:

Blank Titration (ml)

= Sample 1

= Sample 2 =X

: Calculate the peroxide value of each sample as follows

$$S_B(\times N)$$

$$\text{Peroxide value} = \frac{\quad}{W} \times 1000$$

: where

Peroxide value = mEq peroxide per kg of sample

TREATMENT	Mg. vitamin E per 100 ml of oil	Time	Peroxide value
T0	0 mg	15	5.6
		30	9.5
		45	11.6
T1	10 mg	15	5
		30	8.1
		45	8.9
T2	20 mg	15	4.5
		30	5.5
		45	6.5
T3	50 mg	15	4.8
		30	5.5
		45	6.5

S = volume of titrant (ml) for sample

B=volume of titrant (ml) for blank

N= normality of Na₂S₂O₈ solution (mEq/ml) conversion of units (g/kg) = 1000

W = sample mass (g)

RESULTS

The results of the study were tabulated and analyzed statistically using completely random design. The significant and non-significant differences observed have been analyzed critically within and between the treatments and control.

Table 4:1 peroxide value in sample and control at different time of frying oils treated with Vitamin E

The Vit.E was added to four oil samples the addition were as follow:

T0= no vitamin E was add

T1=10 microgram of vitamin E per 100 oil

T2=20 microgram of vitamin E per 100 oil

T3= 50 microgram of vitamin E per 100 oil

It was observed that the lowest peroxide value was at T3 and T2 which scored 4.5,5.5 and 6.5 at frying time (15.30 and 45) minute. followed by T1 which scored 5,8.1 and 8.9 at frying time (15.30 and 45) minute and the highest peroxide value was for control sample which scored 5.6, 9.5 and 11.6 at frying time (15.30 and 45) minute. The stactical analysis showed no significant difference at level 0.05 between T3 and T2 but a significant difference at level 0.05 compared with T0 and T1. All the treatments were significant compared to T0.

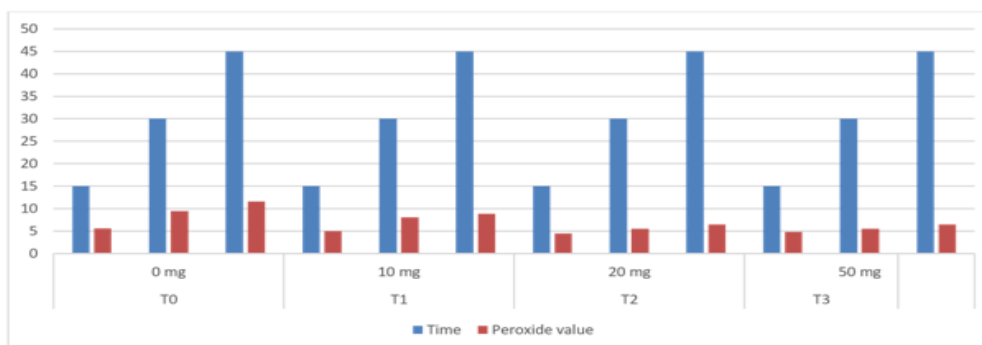


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CONCLUSION

We conclude from this that the heat leads to an increase in the peroxide number with repeated use and an increase in time and that the use of vitamin E in the amount of 20 microgram per 100 ml of oil has resulted in a significant decrease in the value of peroxide and that the increase in the vitamin is not of little effect depending on the amount of oil used and its increase when using A greater amount of oil, this means that there are limits to reducing the number of peroxide in the oil by the of vitamin E.

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