

STUDY OF EDIBLE OILS ADULTERATION BY ULTRASONIC ATTENUATION*

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Received September 12, 2006

This paper propose a new method for investigation the properties of the edible oils. The attenuation of the ultrasonic waves in the vegetable oils is studied in order to make the difference between a fresh oil and an aged or adulterated oil.

INTRODUCTION

Studies of some physical properties of foodstuffs is very important and represent a subject of intensive research effort carried out both in industry and academic institutions. Once known and their behavior understood, such properties can be used to benefit industrial manufactures by improving specific applications, as well as to control the stability and the shelf-life of the product. Because their composition and intrinsic in homogeneity foods are generally difficult to analyze thermally. Some foodstuffs as edible oils have a composition based on the well-known chemical compounds and can be investigated with physical methods. In the last years some methods like photoluminescence, classical and photopyroelectric (PPE) spectroscopy, gaschromatography, optothermal window was used to study the edible oils. It was of interest to find out by experiment wich among the methods is most suitable one to detect early stage of oxidation and to determine the extent of adulteration in oils.

THEORY

The edible oils have in their composition fatty acids and triglycerides. Fatty acids are straight chain aliphatic compounds terminated with a **-CCOH** group

* Paper presented at the 7th International Balkan Workshop on Applied Physics, 5–7 July 2006, Constanța, Romania.

Rom. Journ. Phys., Vol. 52, Nos. 5–7, P. 641–644, Bucharest, 2007

and triglycerides are esters of the propane 1,2,3-triol with three fatty acid residues [1]. The most important compounds of edible oils as sunflower oil or olive oil are the saturated fatty acids C12:0 (lauric), C16:0 (palmitic), C18:0 (stearic) and the unsaturated fatty acids C18:1 (oleic), C18:2 (linoleic), C18:3 (linolenic) [1, 2].

The two conjugated double bonds in linoleic acid are more susceptible to oxidation than a single double bond in oleic acid [3]. The oils with a rich content of oleic acid is expected to have longer lifetime than oil with a large content of linoleic acid. Oxidation slightly reduced content of oleic acid in the olive oil and an increase of saturated constituents (palmitic and stearic acid). In the sunflower oil, oxidation induced more pronounced compositional changes: contents of linoleic and linolenic acids dropped while at the same time concentration of oleic acid increased [4].

It is well known that auto-oxidation developed during the storage and heating, is considered as a major cause for degradation of edible oil [3].

To assess oxidative state of oils can be used the spectroscopic measurements (IR, classical transmission or/and PPE) or the gaschromatography (GC) analysis [4].

Degradation kinetics of chlorophyll [5, 6] and changes in composition of fatty acids profiles [7] may be selected as parameters to monitor in oils. The attenuation of ultrasonic waves

EXPERIMENTAL RESULTS

The sunflower oil to be investigated may be oxidized in several ways [4]:

- a) spontaneous ageing achieved by depositing fresh oil into a dish, covering it by glass and keeping it for 6 month under laboratory conditions;
- b) by exposing the fresh oil to microwave radiation;
- c) by exposing fixed quantities of test oils to UV radiation;

In our experiments the classical method (accelerated ageing) was used. That implies pouring 20 ml of fresh test oil into a glass container that on its turn is immersed in a thermostated bath (110–115°C) and flushed (300 ml/min with pressurized air) for 2, 4, 6, 8, 10 hours.

The study of the ultrasound attenuation in the fresh and aged oils or mixtures of oil with carbon tetrachloride was performed with a classical ultrasonic defectoscope. The investigations for the sunflower oil was performed as function of duration of treatment and as oil concentration.

The dependence of ultrasonic attenuation of oil concentration and ageing time is given in Fig. 1 and Fig. 2.

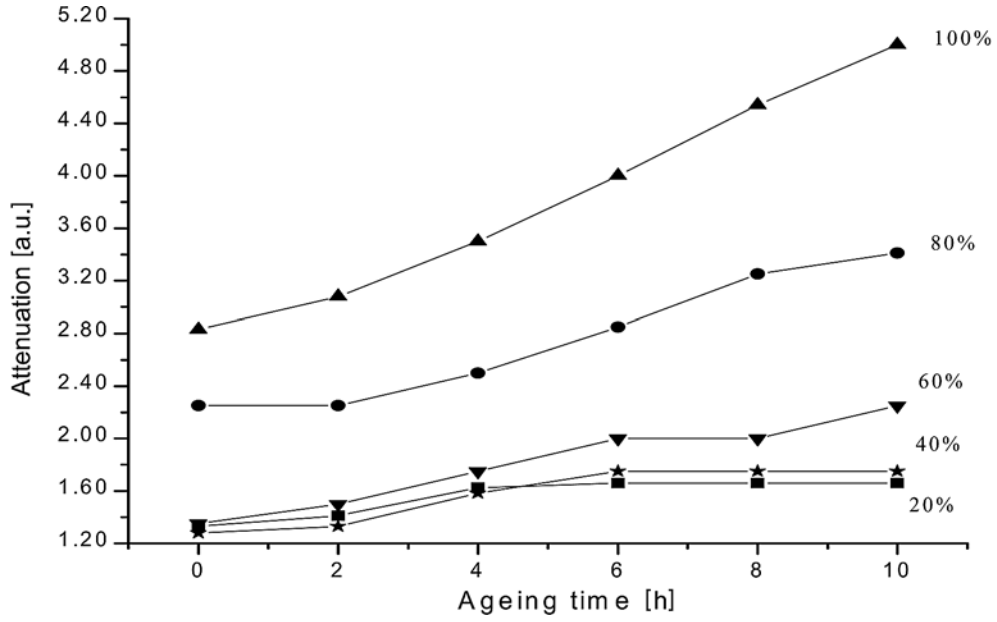


Fig. 1 – Attenuation of the ultrasonic signal *versus* ageing time for sunflower oil.

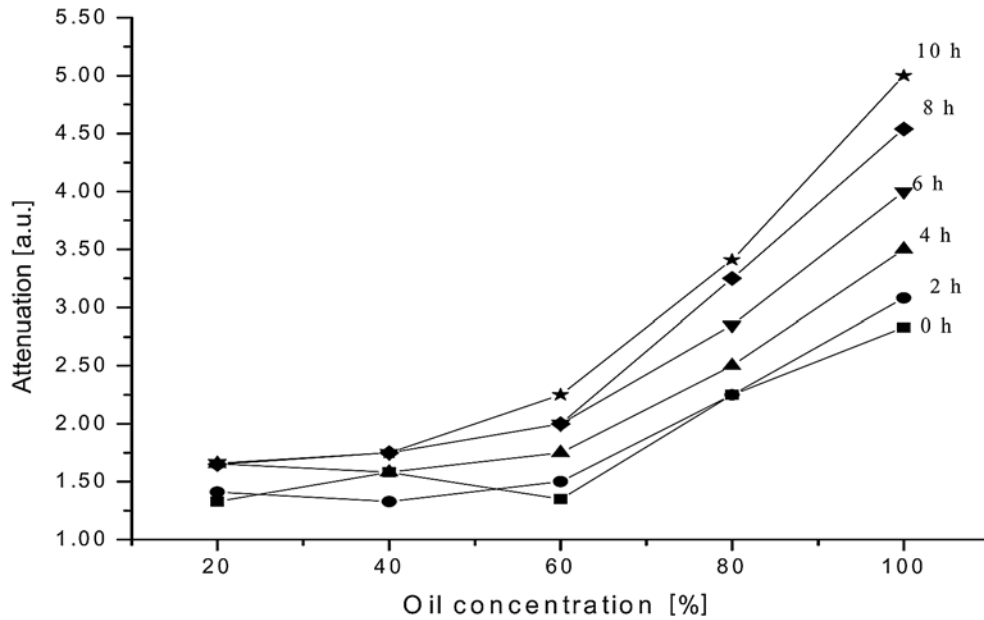


Fig. 2 – Attenuation of the ultrasonic signal *versus* concentration for sunflower oil.

CONCLUSIONS

The values of attenuation are related with concentration of oil in mixture with carbon tetrachloride and with time of accelerated ageing by classical method. It was found that the attenuation of the ultrasonic signal was affected by increased of oil concentration for all samples with different ageing time. The increase of attenuation may be attributed to the changes in composition of fatty acids. The mixtures with 20% and 40% oil have constant attenuation for values of ageing time greater than 4 hours. This fact indicates that ageing or adulteration of oils produce no changes in the value of ultrasonic attenuation with the increase of ageing time.

The experimental results obtained in this work will be preliminary dates for a new method to investigate edible oils.

The results obtained by attenuation of ultrasonic waves are confirmed by other methods like photoluminescence and gaschromatography.

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