Temperature Effect on the Structure and Photophysical Properties of the Olive Oil

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Abstract

Vegetable oils are an essential source of energy for the human body. Therefore, it is considered one of the essential components of food. The process of frying is one of the most food operations in Iraqi kitchens. The repeated heating of edible oils causes a change in the physical properties of these oils. This study attempts to pay attention to these changes in physical properties, such as color, concentration, and smile. Adopted the spectroscopic method to study the changes resulting from the heating of edible oils and adopted olive oil because it has the specifications of the important between edible oils used in frying. It was found that heating these oils to a temperature higher than 100 degrees Celsius cause significant changes in the spectral structures which are the reflection of the chemical composition, i.e. the heating may be changed the structures of oils and perhaps toxic.

Key Words: Olive Oil, Photophysical Properties, Temperature Effect.

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Introduction

Vegetable oils have known for thousands of years. They extracted from seeds and oleaginous fruits in various primitive ways. They used in food, soap, and lighting, and pharmaceuticals used[1]. Vegetable oils and fatty substances are essential ingredients in the synthesis of all living organisms, plants, and animals, and playing a significant role in the life of humans and animals, food-rich energy, which produce more than double the production of similar quantities of proteins or carbohydrates[2]. One of the fat about 9 kilocalories, while producing a gram of protein about 4 kilocalories and one gram of carbohydrates about 3.7 kilocalories[3]. The oil and vegetable oils provide about one-third of the daily energy needs of the people, and these oils contain many other substances necessary for human safety and health. Olive oil has known for thousands of years. Bilad al-Sham is the original home of the olive tree[4].

Today there are more than 100 plant raw materials used to produce vegetable oils. The oil content ranges between 10 and 70%, of which are of great economic importance at present, and the percentage of oil produced is 98% of the total world production of vegetable oils, seeds: soybean, sunflower, rapeseed nuts palm, cotton corn peanuts, sesame seeds, castor linen hemp, safflower, and black horse spear, ii: fruits: coconut oil palm, coconut olive, and coconut laurel. Many fruits contain oil-rich pulp and seeds with different proportions. Oil is sometimes extracted from whole fruit or from pulp alone, followed by extracting the type and nature of the fruit[5].

Constant oils are usually a large percentage that can extracted from plant seeds and are 30-40% and are often used in nutrition, containing vitamins, minerals salts, and carbohydrate materials, mainly olive oil, sesame oil, flaxseed oil, palm oil, coconut oil, and almond oil, Soybeans, and other fixed oils[6].

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Pilot oils are usually minimal, not exceeding 2-3%. They are light in volatile form and usually used in perfumes and treatments[7]. They contain chemicals such as turbines, phenols, lactates, and aldehydes. Such as thyme oil, jasmine oil, and cervine oil[8].Olive oil: Olive is a known plant, one of the best foods, has many medicinal benefits in its oil, and the oil extracted from mature olives is yellowish, sweet, slightly sharp, but extracted from the immature olive is green and acidic[9].The benefits of olive oil are as follows: Oil is prescribed for children because it contains the necessary ingredients for growth, high nutritional value, and vitamin D supplementation[10], which protects children from rheumatoid arthritis and osteoporosis Enzymes are immune to vitamin A[11], which is beneficial for strengthening the body's immunity It is useful in repelling toxins, by forming a layer in the stomach that prevents the absorption of toxins against the acidity of the stomach do not cause diseases of the blood circulation or arteries useful in strengthening the muscles and increase the immunity of the body[12]. Olive oil is more comfortable to digest and absorb than all other oils because the combination is close to the composition of fat in milk, and other benefits[13][14].

Experimental Part

The present study has dealt with several particular types of oils but the focus and attention to olive oil because of the health importance and unique specifications used in cooking. A fixed volume of oil individually heated to the frying degree. Olive oil in this study can take to used and record the preheating readings RT, then heat the oil by placing it inside the Pyrex beaker and heating it to a temperature of (50oC), then placing it inside the quartz cell to measuring both the absorption, fluorescence spectra of this oil. The previous step was repeated several times until reach the temperature of frying up to 200C by increasing the temperature of 50 degrees each step of heating. After each heating and transferred the sample after placing it in a cell of quartz as mention above and placed in a measuring system to get the absorption and emission spectra by using UV-visible absorption recordings systemSV2100(UV-Vis Spectrometer Detector,) spectral response within the range 250-800nm with grating400/600 line.

Result and Discussions

The olive oil used in this study was heated to a different degree of temperature after that measurement was taken on the absorption of heated samples at each heating. It was observed that the behavior of the absorbance spectra of the heated olive oil remained almost constant behavior to nearly above 50 °Figure (1a, b) but when the heating is approaching 100° C that there are new spectrum compositions appear at the short wavelengths, which indicate for formation of new compounds resulting from the fracture units of original olive oils, but the whole structure of the spectrum still unchanged figure (1c) but with red shift. In figure (1d)for the samples heated to 150° C, the spectrum structure changed clearly, but when reaching to 200° C, the spectrum changed because increasing heating caused to broking more olive oils and the structure of the samples changed figure (1e) also with high red shift. Figure(2) showed the fluorescence spectrums of unheated and heated olive oils this figures represented different behavior from room temperature to 100° C the spectrum behavior the same except in the intensity it decreasing with temperature increasing at this stage of heating the temperature quenching appears clearly, figure (2a) but when increasing temperature starting from (100 to 200)°C the effect of temperature affected on the composition of olive oils and breaking the π bonds and σ bonds formation as indicated in the absorption spectrum and the appearance of absorption bands at short wavelengths this is why the emission spectra look different from their behavior at higher temperatures than at low temperatures figure (2b).

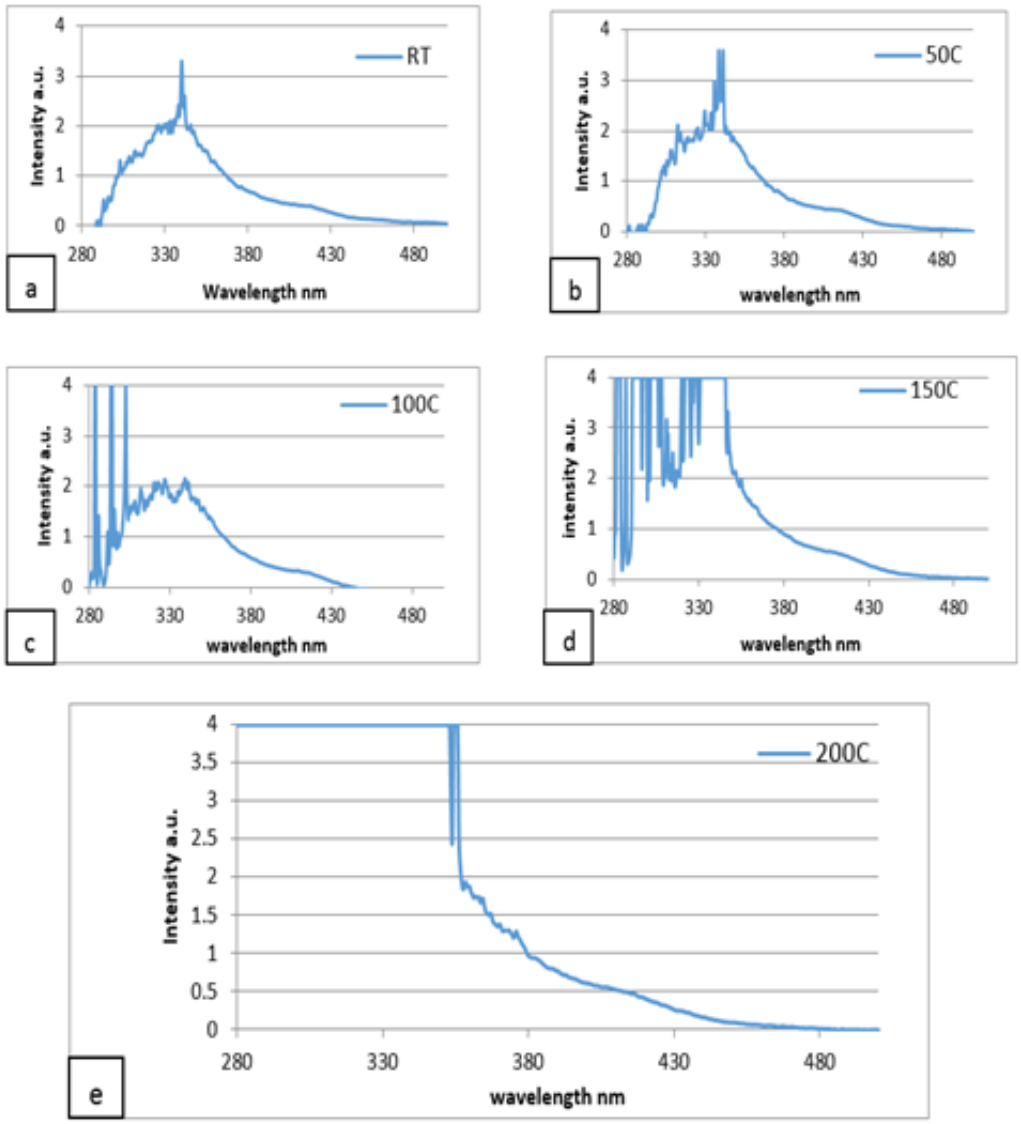

Figure 1. The absorption spectrums of olive oils in different temperature (a)R.T., (b)50° C, (c)100° C, (d)150° C,(e) 200°C

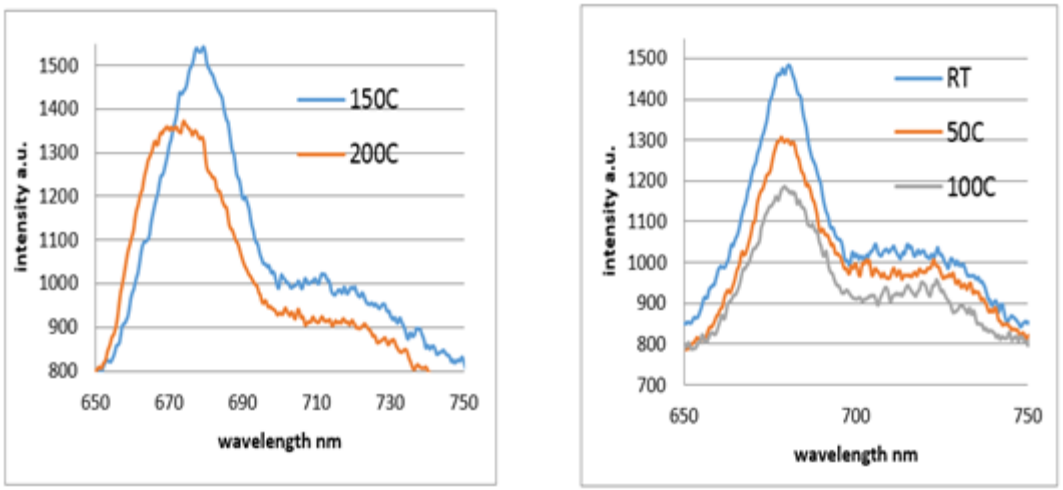

Figure 2. Showed the fluorescence spectrums of unheated and heated olive oil

Conclusions

The results showed that there is a significant change in the physical properties of oils, these changes appear in changing of the absorption and emission spectra, This study revealed that heating to high temperatures causes the breakdown of internal bonds of oils, which causes the generation of new compounds leading to loss of quality of oils and may possess these substances toxic make use of oil harmful and not useful. Therefore, it is necessary to use edible oils to fry for one time and not re-use it once again.

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