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Study of the electrical resistivity of vegetable and essential oils

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ABSTRACT

The aim of this study is to analyze the electrical resistivity fluctuations as a function of temperature. Our results demonstrated that the resistivity decreases when the temperature increases (20 - 140 °C). This inverse correlation can be attributed to the effect of thermal agitation on vegetable and essential oil composition, leading to the disorientation of their molecules.

Key words: Electrical resistivity, vegetable and essential oils, temperature.

INTRODUCTION

useVegetable oils and fats are principally used for human consumption but are also used in animal feed, medicinal purposes, and certain technical applications. Generally, the oils and fats are extracted from a variety of fruits, seeds, and nuts. The industry of oils involves the extraction and processing from vegetable sources. Therefore, several studies have been performed to assess the quality of the oil on the basis of their physical properties: viscosity, refractive index, electrical resistivity, etc. Pace, Risman, Bengtsson and El Al Shami [1] suggested that the electrical properties could be used as indicators of quality of vegetable oils. Several researchers have worked on the chemical and physical properties of vegetable oils [2-9].

The electrical properties of oil depend mainly on its chemical composition. Manifestly, the electrical resistivity ρ and dielectric strength are the main electrical characteristics of a substance. In the other hand,

The electrical properties of oil depend mainly on its chemical composition. Mainfestly, the electrical resistivity ρ and dielectric strength are the main electrical characteristics of a substance. In the other hand, the electrical conductivity of oil is due to the presence of free charges, which moves under the effect of an electric field, providing an electrical current. Consequently, the electrical resistivity is the reciprocal of the electric conductivity σ.

Since the electrical resistivity is a fundamental parameter in the non-destructive characterization of compounds [10, 11], the study of the electrical conductivity as a function of temperature of oils (Argan, Sunflower and Rapeseed) will allow us to better characterize their electrical properties.

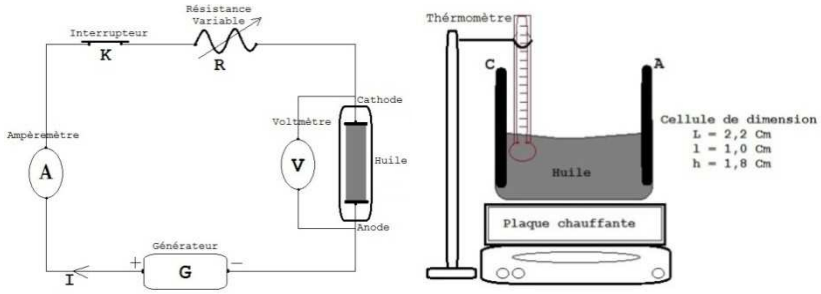
MATERIALS AND METHODS

2.1 Materials:

The resistivity measurement techniques called "colon" has been chosen for our investigation: the electrical resistance of the oil is determined by measuring the current and the potential difference (ddp) between two electrodes, which are mounted on the cell. The oil waspurchased on the market.

1.1.Materials:

Cell used to measure the electrical resistivity.



a. Construction Equipment **b. cell for measuring electrical resistivity**

2.2 Methods:

The following formula has been used to calculate the electrical resistivity ρ:

$$\rho = R \times \frac{S}{L}$$

Where ρ is: resistivity (Ω.cm); S: the section (cm^2); L: the length (cm)

S= l x L; l =1.1cm ; L= 2.2 cm (distance between the two electrodes).

RESULTS AND DISCUSSION

The measurements for electrical resistivity of vegetable and essential oils are shown in Figure 1.

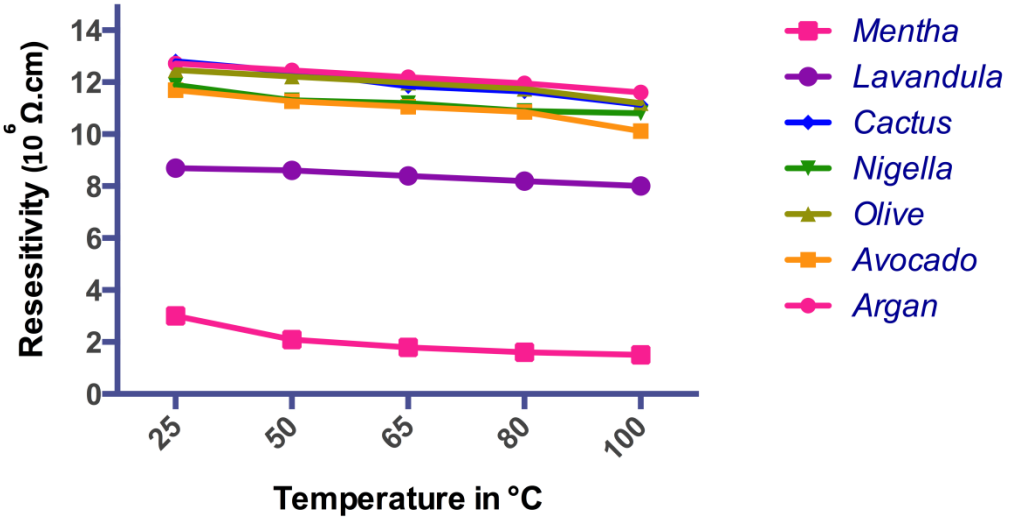


Figure 1: Electrical resistivity of vegetable and essential oils

✓Different chemicals changes occurring in oil.
✓The orientation of molecules facilitates the passage of current at the oil.
✓A. Tekin and all, studied the influence of temperature on the measurements of the electrical resistivity of soybean oil. These authors observed the same changes in resistivity as a function of temperature.
✓Our results are in good agreement with those of the reference.

CONCLUSION

The increase in the electrical conductivity of the investigated oils is favored by increase in temperatures.

Many papers tried to bring some of the data on this subject. To complete the scheme, a comparative approach of our data with those reported in literature, has been followed using electrical properties of samples.

The results that we have obtained in our study allowed us to conclude that the changes in the electrical measurements of oils depending on the temperature can be used as a strong indicator of food quality deterioration of oil at high temperature.

We intend to study the thermal conductivity and viscosity of these oils according to the temperature.

Our interest is the physico-chemical measurements of oils and to report the quality characteristics of the selected oils. According to our data, we propose to consider viscosity and thermal conductivity measurements correlated temperature variations for quality control.

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