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Modeling the electrical resistivity of vegetable oil Rapeseed

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ABSTRACT

In this work we report measurements of resistivity of rapeseed oil. The use of this electrical approach has been made between 25 and 80 ° C. These measurements show that the resistivity decreases as the temperature believes. This decrease in resistivity was attributed to the effect of thermal agitation on the structure of molecules of our oil. This study may be useful for a possible application of our oil in the technological field. The temperature dependence of resistivity of oil Colza is described using an Arrhenius-type equation. We plotted the curves of Logarithm of viscosity versus 1/T for each sample. The activation energy Ea and the infinite-temperature viscosity ($\eta\infty$) were determined from these plots for our oil, the correlation coefficients is 0.9616.

Key words: electrical resistivity, transformer dielectricIntroduction

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INTRODUCTION

Energy demand in the world today is experiencing tremendous growth mainly due to the development of the transport sector and industry. [1] Also, oil and hydroelectric sources prove they insufficient to meet that need. To get away from the rupture, the oil countries are trying to slow down the export of their reserves [2]. This attitude is the cause of various fluctuations and increases in oil prices, causing economic consequences all over the world and particularly in developing countries. Also, the exploitation of fossil energy she has harmful effects on the environment in which the heating of the earth and climate change [3, 4].

- Vegetable oils are increasingly used, in pharmacy, cosmetics etc ..

The electrical properties of oils depend upon their chemical composition and molecular.

- The electrical resistivity and dielectric strength are the main electrical properties of a substance. The electrical conductivity of an oil is due to the presence of free charges, and under the effect of an electric field, these charges move to thereby give an electric current.
- The electrical resistivity ρ is a fundamental parameter in non-destructive characterization of the compounds [5, 6].

The study of electrical conductivity as a function of oil temperature: Prickly pear allow us to better characterize this oil.

MATERIALS AND METHODS

2-1 resistivity
The electrical resistivity is a fundamental parameter in non-destructive characterization of compounds.

We used the method of measurement of said resistivity: the electrical resistance of the oil is determined by measuring the current and the potential difference (pd) between the two electrodes of the cell.

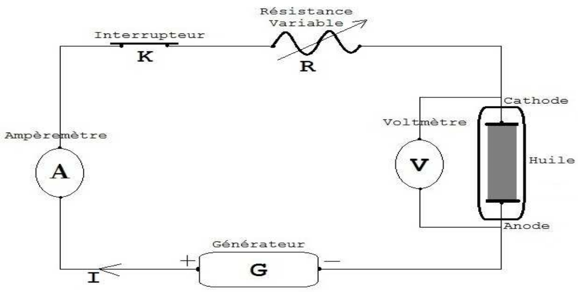

Figure 1: Installation of the equipment used

A: Variable Resistance
K: Switch
A: Ammeter
V: voltmeter
G: Generator

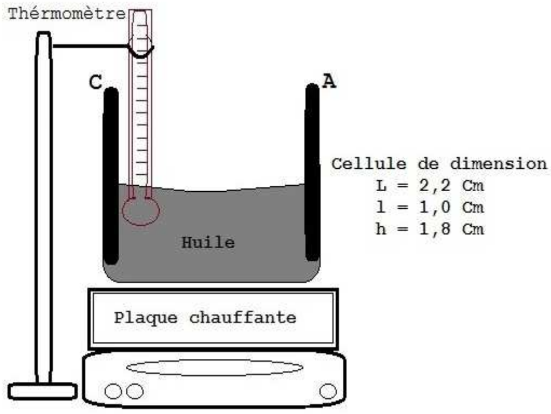

Figure 2: Measuring cell resistivity

2.2 Calculate the resistivity:
The method of measuring the electrical resistivity is as follows:

Passing electrical current and measure the current I and the voltage U at room temperature and then starts the heating and using a thermometer it falls at different temperatures the intensity and tension.

We used the formula (I) suivante, to measure the electrical resistivityρ:

$$\rho = R \times \frac{S}{L} \quad \textbf{(I)}$$

Where ρ represents: the resistivity (Ω.cm) ; S : the section (cm²); L : the length (cm); l : the width (cm). S= l x L ; l =1.1cm ; L= 2.2 cm (distance between the two electrodes).

2.3 **Modelisation**
The variation of the resistivity of vegetable oils as a function of the temperature is modeled with the Arrhenius equation:

$$\boldsymbol{\rho = \rho_0 \exp (Ea / RT)}$$

Where ρ is the resistivity, ρ_0 is the pre-exponential factor (Ω / m), Ea is the activation energy (J / mol); R is the ideal gas constant (J / mol / K), and T is the temperature (K). P_0 the value may be approximated as high-temperature resistivity (ρ_0 of ρ_∞).

Equation (1) can be rewritten as follows:

$\ln(\rho) = \ln(\rho_0) + (Ea / RT)$.

The objective of this work is to adapt our results by the Arrhenius equation, and determine from this modeling, the physico-chemical characteristics of the oil studied.

RESULTS AND DISCUSSION

Measuring the electrical resistivity of rapeseed oil is shown in Figure 1.

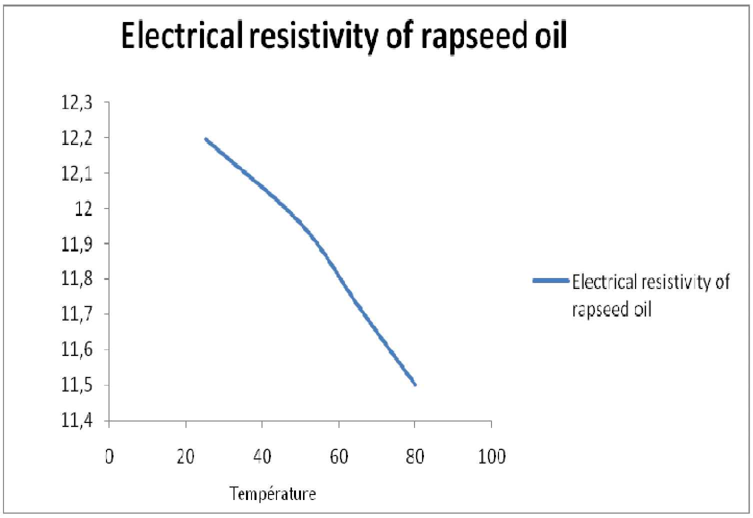

Figure 1: Electrical resistivity vegetable oils Rapeseed (106 Ω / cm)

The results of the modeling, rapeseed vegetable oil are shown in the Figure 2.

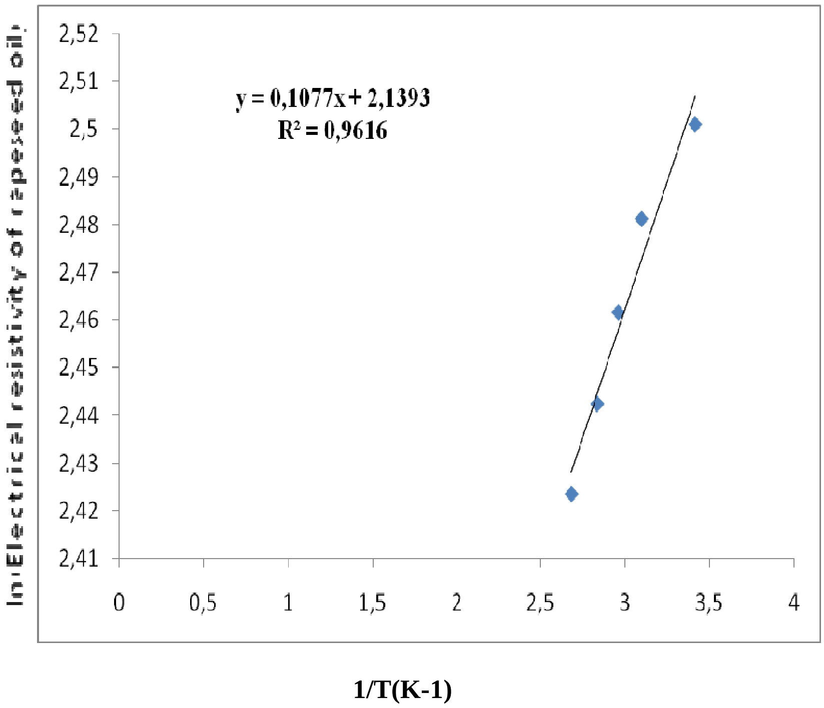

Figure 2: Ln (electrical resistivity) versus 1000 / T for the rapeseed oil

Table 1: Important parameters of the ln(resistivity) versus temperature fit

sample	ν_∞ (x$10^6\Omega$,cm)	E_a(KJ/mole)	R^2
Colza oil	**8,49**	0,895	0.9616

DISCUSSION

From these figures, it can be observed that the resistivity of the vegetable oil decreases with increasing temperature. we can compute the values of the activation energy Ea and preexponential factor ($\nu\infty$) from the slope and y-intercept of this straight line respectively. In table 1, we have reported the important parameters deduced from the data of this study

CONCLUSION

The resistivity of our oil decreased with temperature, experimentally and as pre-dicted by an Arrhenius equation. The activation energy, as well as the pre-exponential term were obtained. These results can be used as a way of characterizing the oil quality. These values depend on oil nature.

REFERENCES

[1]Ayhan Demirbas, *Energy Conversion and Management*, 50, pp. 14–34, **2009**.
[2]Jon Van, Gerpen, Gerhard Knothe, The Biodiesel Handbook, AOCS Press, **2005**.
[3]O.M.I.N Wafor, *Renewable Energy*, 29, pp. 119-129, **2004**.
[4] B. Tesfa, R. Mishra, F. Gu, A.D. Ball, *Renewable Energy*, 37, pp. 333 – 344, **2012**
[5]A.Tekin and Earl G. Hammond.*Journal of the American oil Chemists'Society*, volume 77,number 3, (281-283). **2000**.
[6]A.K.Mahapatra, B. L. Jones, C.N.NGuyen, and G.KANNAN Kannan. « An Experimental .Determination of the Electrical Resistivity of Beef ». *Agricultural engineering .international :* the CIGR Ejournal. Manuscript 1664.Vol. XX. July, **2010**.