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Modeling of the electrical resistivity of vegetable palm oil

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ABSTRACT

The objective of this study is to analyze the behavior of electrical properties depending on the temperature, for vegetable oil: palm. This study showed that the electrical resistivity ρ decreases as the temperature T increases (20 -140 °C). We attributed this decline to the effect of thermal agitation on the disorientation of the molecules of the oil.

Key words: electrical resistivity, palm and temperature.

INTRODUCTION

Vegetable oils are triglycerides, that is, triesters of glycerol and fatty acids. A triglyceride is a glycerol molecule connected to three molecules of monocarboxylic acids with a long hydrocarbon chain fatty acid called. Unlike hydrocarbons consisting exclusively of hydrogen and carbon.

Vegetable oils are increasingly used in pharmacy, cosmetics. Therefore, several studies have been conducted to assess the quality of the oil on the basis of their physical properties: viscosity, refractive index, electrical resistivity. Pace, Risman, Bengtsson and El-Shami [1] suggested that the electrical properties can be used as indicators of the state and quality of vegetable oils. Several researchers have worked on the chemical and physical properties of vegetable oils [2, 3, 4, 5, 6, 7, 8, 9].

The electrical properties of oils depend on their chemical and molecular composition. The electrical resistivity ρ and dielectric rigidity are the main electrical characteristics of a substance. The electrical conductivity of oil is due to the presence of free charges and under the influence of an electric field, the charges move to provide an electric current. The electrical resistivity is the inverse of electrical conductivity.

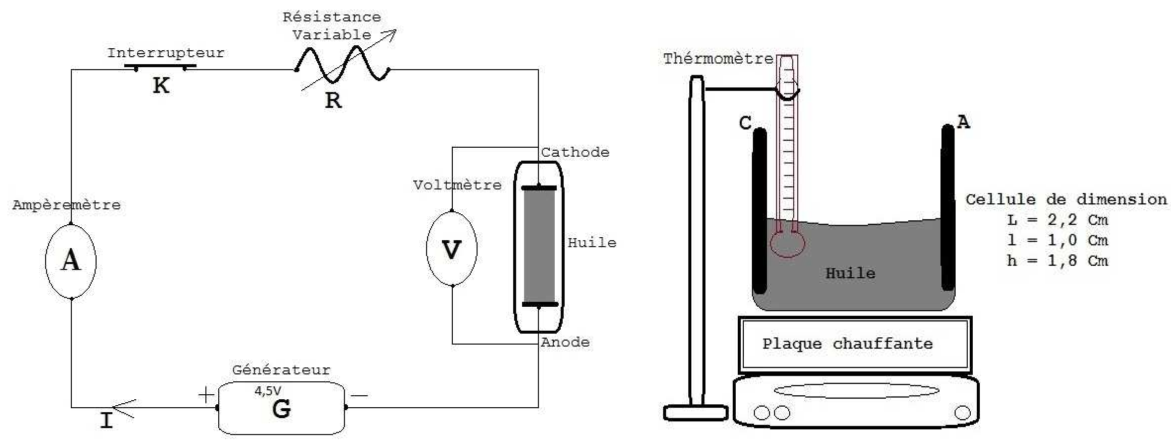
The electrical resistivity is a fundamental parameter, non-destructive characterization of compounds [10, 11].

MATERIALS AND METHODS

We used the resistivity measurement method known as "two points method": the electrical resistance of the oil is determined by measuring the current and potential difference between the two electrodes of the cell (see montage).

2.1. Materials

Schema of the cell used to measure the electrical resistivity.



a. Montage of the equipment used. **b. cell of measurement of reistivity**

2.2. Method

Computation of the resistivity was based on the following formula:

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

Where ρ : Electrical Resistivity (Ω.cm); R: Resistance (Ω); S: Section (cm²); L: length (cm)

2.3. Modelization

The variation of the resistivity of vegetable oils as a function of the temperature is modeled with the Arrhenius equation(1):

$$\rho = \rho 0 \exp\ (Ea / RT)$$

ρ is the resistivity, ρ_0 is the pre- factor Exponential (Ω /m), Ea is the activation energy (J/mol), R is the gas constant (J /mol/K), and T is the temperature (K) .

The ρ0 value may be approximated as high-temperature resistivity (ρ0 of ρ∞).

Equation (1) can be rewritten as follows: ln (ρ) = ln (ρ0) + (Ea / RT)

The aim of this study 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

3.1. Results

The measurements of the electrical resistivity of palm vegetable oil are shown in Figure 1.

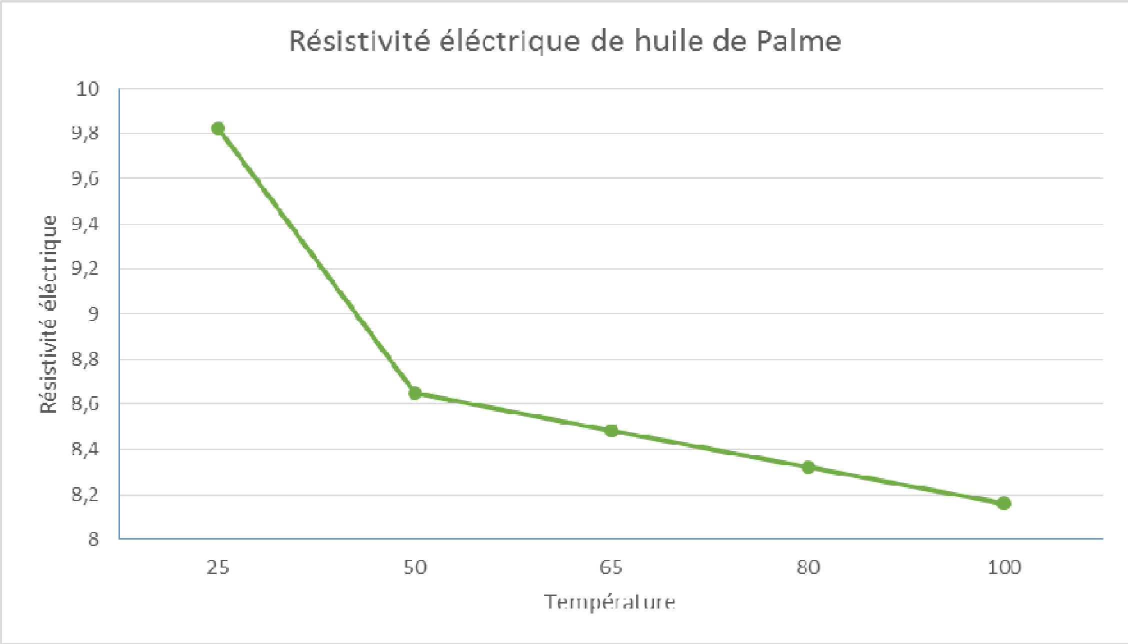


Figure 1: Electrical resistivity vegetable palm oil ($10^6\ \Omega$ / cm)

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

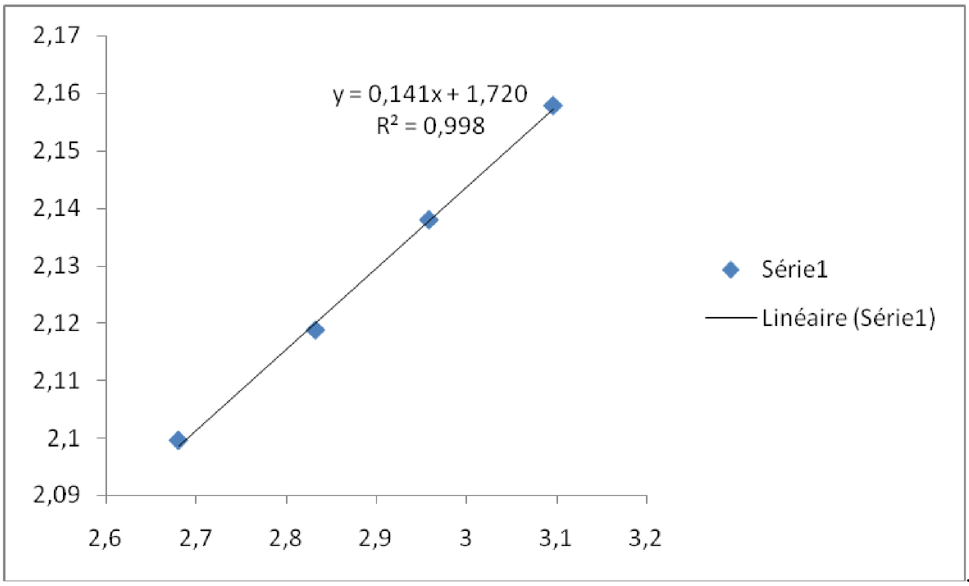


Figure 2: Modeling the electrical resistivity of the vegetable oil

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

Sample	v_∞ ($x10^6\Omega$,cm)	E_a(KJ/mole)	R^2
Palm oil	5.59	1.174	0.998

DISCUSSION

The causes we can give to explain this change (decrease in the electrical resistivity depending on temperature) are:
✓Different chemical changes occurring this oil.
✓The orientation of the molecules (decrease in viscosity) which facilitates the passage of current in the oil.
✓The electrical resistivity of vegetable palm oil, decreases with temperature, experimentally and as predicted by Arrhenius equation.
✓The activation energy and the pre-exponential term were obtained. These results can be used as a means to characterize the quality of the oil. These values depend on the nature of the oil.

RÉFÉRENCES

[1] W.E Pace, W.B Westphal and S.A. Goldblith, *J. of Food Science*, **1968**, vol 33-p30.
[2] Z Charrouf, Valorisation de l'arganier, résultats et perspectives, in Collin G Garneau F-X 5ème colloque , Produits naturels d'origine végétale. Proceeding Actes du colloque de Sainte Foy, Laboratoire d'analyse et de séparation des essences végétales. Université de Québec, du 4 au 9 août **2001**.
[3] F Khallouki, C Younos, R Soulimani, T Oster, Z Charrouf , B Spieglehalder, H Batsch and R Owen, *Eur J. cancer prev*, 12 : 67-75, **2003**.
[4] Norme marocaine homologuée de corps gras d'origines animale et végétale, huiles d'argan N M 08.5.090. Ministère de l'Industrie, du Commerce, de l'Energie et des Mines **2002**.
[5] M Charrouf, Contribution à l'étude chimique de l'huile d'Argania spinosa (L.) (Sapotaceae), Thèse Sciences Université de Perpignan, **1984**.
[6] M Farines, M Charrouf, J Soulier et A Cave, Etude de l'huile des graines d'Argania spinosa (L.) Sapotaceae, II- Stérols, alcools triterpéniques et méthylstérols de l'huile d'argan, *Rev.Franç.Corps Gras*, 31 , 443-448, **1984**.
[7] Rojas, LBS Quideau, et al, *J Agri Food Chem*, 53: 9122-7, **2005**.
[8] A Alaoui, Z Charrouf, G Dubreueq, E Maes, JC Michalski et M Soufiaoui, Saponins from the pulp of the fruit of argania spinosa (L.) skeels (sapotaceae), In: International symposium of the phytochemical society: lead compounds from higher plants, Lausanne, **2001**.
[9] B K Gosse, J N Gnabre, R B Bates, P Nakkiew, R C C Huang, *J Nat, Prod* **2002**, 65, 1942-1944.
[10] A Tekin and Earl G Hammond, *Journal of the American oil Chemist Society*, volume 77,number 3, (281-283). **2000**.
[11] A K Mahapatra, B L Jones, CNN Guyen , and G KANNAN , « An Experimental Determination of the Electrical Resistivity of Beef », Agricultural engineering international : the CIGR Ejournal, Manuscript 1664,Vol XX, July, **2010**.