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Research Article

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Study of the viscosity and density of rapeseed oil before and after heating

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ABSTRACT

We focus on the measurements of the viscosity and density of the rapeseed vegetable oil before and after heating as a function of temperature. These measurements were made between 20 and 80 ° C. These measurements showed that the viscosity and density of the rapeseed oil decreased when the temperature increases before and after heating. This decrease in viscosity and density of rapeseed oil can be considered as a strong indicator of the quality of the oil.

Key words: Viscosity, rapeseed oil, density, electrical measurements, temperature.

INTRODUCTION

Viscosity of oils is another physical property of paramount importance. Its knowledge is necessary for the designing and operation of the processing equipment. Conventional techniques for measuring viscosity, besides, being time consuming suffer from inherent shortcomings attribute to the handling of measuring equipment. There is a need to evolve cheap and accurate indirect techniques for on line determination of viscosity. In the present study viscosity and density of oils have been experimentally measured as a function of temperature.

The vegetable oil processing industry involves the extraction and processing of oils and fats from vegetable sources. Vegetable oils and fats are principally used for human consumption but are also used in animal feed, for medicinal purposes, and for certain technical applications. The oils and fats are extracted from a variety of fruits, seeds, and nuts. The oils and fats are extracted from a variety of fruits, seeds, and nuts.

Since ancient times, essential oils are recognized for their medicinal value and they are very interesting and powerful natural plant products. They continue to be of paramount importance until the present day. Essential oils have been used as perfumes, flavors for foods and beverages, or to heal both body and mind for thousands of years.
Therefore, several studies have been performed to assess 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 can be used as indicators of quality of vegetable oils. Several researchers have worked on the chemical and physical properties of vegetable oils [2, 3, 4, 5, 6, 7, 8 and 9].

The electrical properties of the oil depend on their chemical composition and molecular. The electrical resistivity ρ and dielectric strength are the main electrical characteristics of a substance. The electrical conductivity of oil is due to the presence of free charges and under the effect of an electric field, these charges move to thereby provide an electrical current. The electrical resistivity is the reciprocal of the electric conductivity σ.

The electrical resistivity is a fundamental parameter in the non-destructive characterization of the compounds [10, 11]. The study of the electrical conductivity as a function of temperature of rapeseed oil allowed us to better characterize these oils. The objective of this study is to analyze the behavior of the electrical resistivity.

EXPERIMENTAL SECTION

Vegetable oils have very low toxicity and excellent biodegradability. These qualities are due to the low of oxidation resistance and hydrolysis. These two characteristics have favorable eco-toxicological profile. Rapeseed oil has been bought in the market.

2.1 Density variation

Density or volumetric mass provides information about the establishment, the oxidation state or polymerization. The hydrometers are cylindrical tubes of glass, hollow, graduated, weighted with lead shot, immersed in liquids.

They are penetrated more or less deeply vertically, depending on the forces (downward due to its weight, and upward, duetto buoyancy) opposed. The weight of the displaced fluid is equivalent to the volume of the displaced liquid (submerged volume of the hydrometer) that multiple density of the liquid.

The submerged volume of the hydrometer varies inversely to the density of the liquid. This means that the lower the density, the more the hydrometer will sink in the liquid sample.

Figure 1: Standard glass hydrometer weighted with lead

2.2 Viscosity variation

Kinematic viscosity is a measure of the resistive flow of a fluid under the influence of gravity. It is frequently measured using a device called a capillary viscometer — basically a graduated can with a narrow tube at the bottom. When two fluids of equal volume are placed in identical capillary viscometers and allowed to flow under the influence of gravity, a viscous fluid takes longer than a less viscous fluid to flow through the tube.

The results for viscosity measurements (mm^2/s^1) of oil and biodiesel as a function of temperature were plotted.

Viscosity Measurement using Ostwald's Viscometer

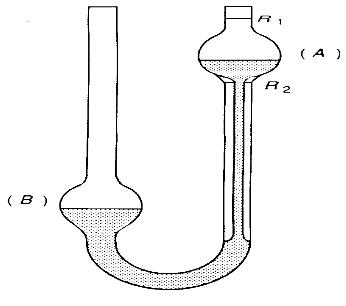

Figure 2 :Ostwald viscometer

2.3 Methods:

- **Viscosity measurement of rapeseed oil:**

Volume flow measurement of fluid through a capillary tube. The viscosity is proportional to the flow time:

$$\nu = K \cdot \Delta t$$

The viscometer constant K is given by the instrument Company.

RESULTS AND DISCUSSION

We have studied the variation of the viscosity and density as a function of temperature of the vegetable oil before and after heating. The obtained results are shown in Figures 3 and 4.

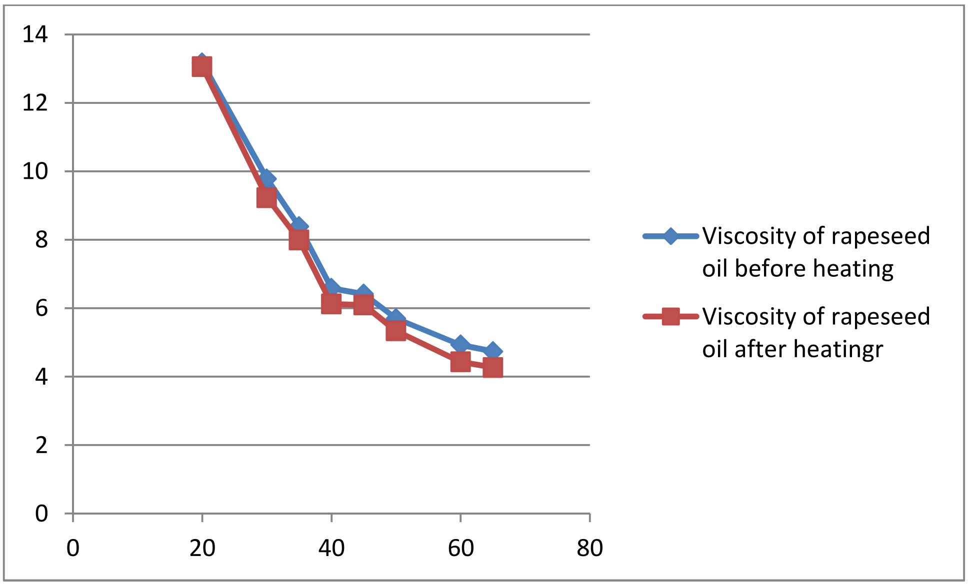

Figure 3: The variation of the viscosity as a function of temperature before and after rapeseed heating

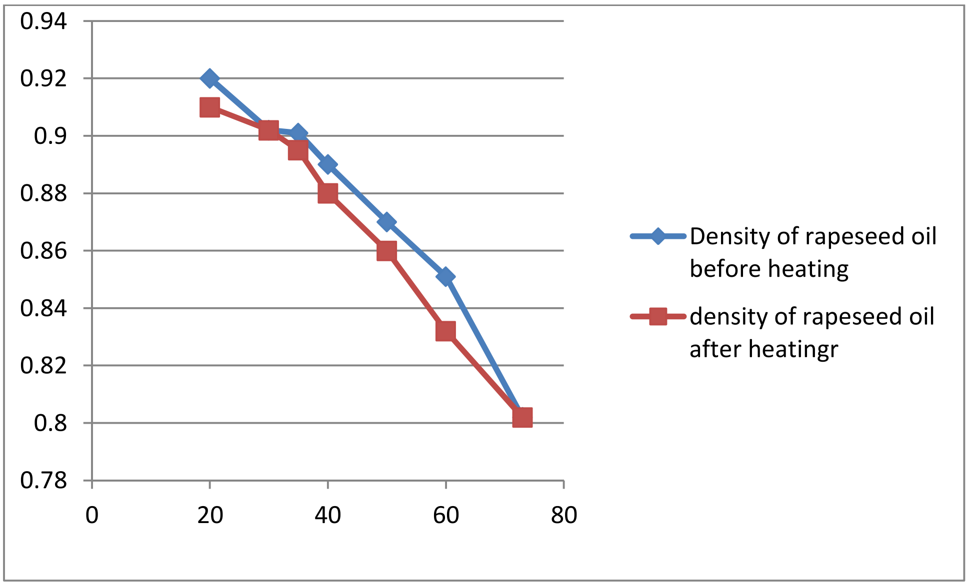

Figure 4: Representing the density variation of rapeseed oil before and after heating

We see from the curve 3 that viscosity decreases rapidly with increasing temperature. We note a significant difference between the values of the oil before and after heating which is a hamper for direct use of biofuels.

From the curve 4, it is remarkable that the densities of the two oil decreases with increasing temperature. From the curve 3, it is remarkable that the densities of the two oils decrease with increasing temperature. Moreover, this decrease is not similar for both types of oils, it is normal for the new oil, it is variable for the oil after heating, and this is probably due to the impurities existence in the last type of oil.

CONCLUSION

We conclude that the increasing of temperature facilitates the electrical conductivity of the oil. This work allowed us to study the behavior of the viscosity and density of rapeseed oil before and after heating as a function of temperature [13-14].

Electrical measurements of the oil as a function of the temperature, can be used as a strong indicator of the quality deterioration of the food oil to high temperature,

On perspective we intend to complete our work through a study of thermal resistivity and viscosity of the oil, according to the temperature.

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