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Brief communication

Rheology of Almond *(Prunus amygdalus)* oil Used as Biodegradable Lubricant

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ABSTRACT

Almond *(Prunus amygdalus)* oil is recommended for those for whom other treatments to remedy hair loss problems have not worked. Almond oil was studied at increasing temperatures and shear rates and we obtained the rheological parameters corresponding to the oil through regression. This paper reflects a study on the rheology of almond oil used as biodegradable lubricant using the Brookfield RVDV II I Ultra Rheometer system.

Keywords: Almond oil, Rheology, Biodegradable.

INTRODUCTION

Almond *(Prunus amygdalus)* oil is recommended for those for whom other treatments to remedy hair loss problems have not worked. Massaging the scalp with almond oil twice a week has a remarkable effect in this regard, and the hair will grow faster and be healthier. The explanation is that almond oil is an important source of vitamin E. Unprocessed almond oil improves the taste of food and can also be used for salads, cereals and sandwiches. Besides the fact that they are very nutritious, almonds have multiple uses in the cosmetic industry. Almond oil has a light yellow color and is extracted from the core of almonds.

With the help of almond oil, the desire to have beautiful skin will not be just a dream[1-3].

Here are some of the benefits of almond oil for the skin:

- Softens and preserves the glow of the skin
- Deeply hydrates the skin
- soothes irritations and inflammations on the skin
- Delays the aging process
- Improves dark circles
- Soothes dry skin and itchy skin and treats chapped lips and rashes on the body.

Health benefits of almond oil:

- Is a beneficial nutrient for brain and nervous system health
- Improves intellectual qualities and increases endurance
- Relieves the discomfort caused by tense muscles.

Table 1 shows the percentage of almond oil, the genotype, the origin of the oil or the country of origin and the bibliographic reference. The almond oil genotype is the complete set of genetic material. Genotype can also be used to refer to other or variants that an almond carries in a particular gene or genetic location.

Table 1: Percentage of almond oil (%), the genotype, origin of the oil

Percentage of almond oil	Genotype	Country of origin	Reference
53.1-61.7	19	Spain	[3]
53.6-56.1	5	USA	[4]
36.0-53.0	21	USA	[7]
30.1-51.0	12	Portugal	[1]
39.6-62.9	18	Iran	[2]
48.0-57.5	9	Argentine	[9]

This article includes the rheological study of almond oil used as a biodegradable lubricant studied at high shear rates and temperatures between 40 and 100°C.

MATERIAL AND METHODS

The method proposed by Li Meijing *et al.,*[10] was used to measure the rheological properties of oil almond. The rheological tests like viscosity measurement, Newtonian and Non-Newtonian behavior determination of oil almond were performed using a Brookfield RVDV III Ultra Rheometer with cylindrical spindle and ultra low (U L) adapter. Cylindrical spindle geometry was chosen due to the significantly wider range of shear rates and viscosities that could be measured. The UL adapter was used for low viscosity measurements. Shear rate was varied by adjusting the rate of spindle rotation. Instrument calibration was checked using nominally 990 mPas. Standards purchased from Brookfield. The effect of temperature on the viscosity of different oils was determined between the range of 20-30 'C by using the Brookfield TC-502 circulating bath. Newtonian and Non-Newtonian behaviours of oil almond were also determined at constant (25+0.1°C) temperature[10-17].

RESULTS AND DISCUSSION

Figure 1 shows the linear regression of shear stress versus shear rate for of almond oil.

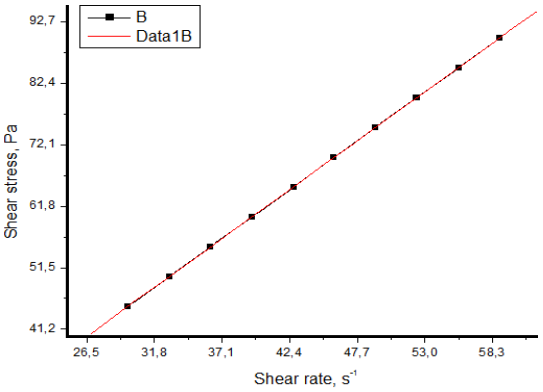

Fig. 1. Rheogram of almond oil

Figure 2 shows the dependence of the dynamic viscosity on the shear rate for almond oil. The graph shows an exponential decrease in dynamic viscosity with shear rate.

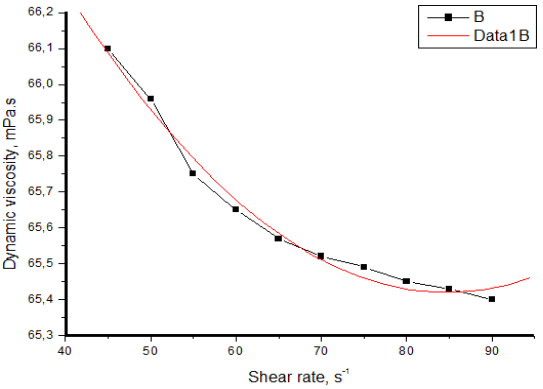

Fig. 2. Regression exponential for almond oil

Relation (1) accurately describes the behavior of almond oil at the studied temperatures (such as 40-85°C).

$$\eta = \eta_0 + A_1 \exp(\dot{\gamma} / t_1) \quad (1)$$

Where η_0=65.15153, A_1=4.73233 and t_1= 29.22427 R_2=0.96555.

Figure 3 shows the dependence of the dynamic viscosity on the shear stress for almond oil. The graph shows a decrease in dynamic viscosity with shear stress at the studied temperatures.

The dependence of the dynamic viscosity on the shear stress is described by the exponential equation (2). The correlation coefficient has a value close to one, so it faithfully describes the non-Newtonian behavior of almond oil.

$$\eta = \eta_0 + A_1 \exp(\tau / t_1) \quad (2)$$

Where η_0 =65.19414, A_1=5.04436 and t_1=17.9497 R_2=0.96513

Figure 4 shows the exponential regression of almond oil at increasing shear rates and temperatures between 40 and 85°C.

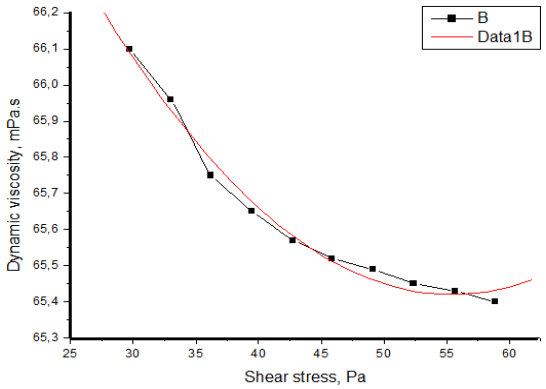

Fig. 3. Dependence dynamic viscosity of the shear stress for almond oil

CONCLUSION

Almond oil has a non-Newtonian behavior at the shear speeds and temperatures studied. The equations that describe this behavior are indicated in the text and are numbered (1), (2) and (3). The correlation coefficients have values close to 1.

The dependence of dynamic viscosity on temperature is described by the linear equation (3). The correlation coefficient has a value close to one.

$$\eta = A + B \quad (3)$$

Where A=-0.99363 B=1.54612 R_2=0.99999

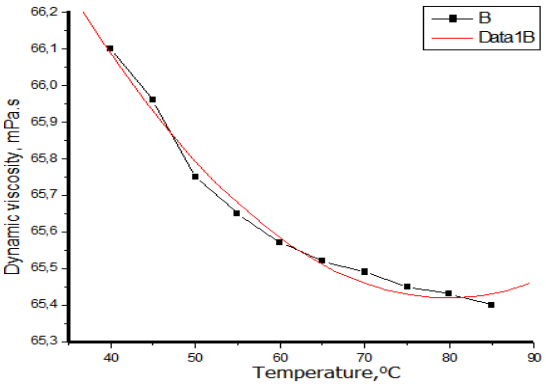

Fig. 4. Dependence dynamic viscosity on the temperature for almond oil

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Conflict of interest

The author declare that we have no conflict of interest.

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