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Brief communication

Variety of Energetic Consistency of Oxidized and Non-oxidized Corn oils with Temperature

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ABSTRACT

When corn oil is oxidized, the energy consistency increases compared to the unoxidized oil. Increasing the oxidation temperature from 110°C to 120°C results in further increases in the energy consistency for oxidized corn oil for 10 hours. The change in energy thickness for corn oils was studied with condition (1). The condition fits and can be used to estimate the change in energy consistency of oils as a function of temperature.

Keywords: Corn oil, Dynamic viscosity, Temperature.

INTRODUCTION

Vegetable oils and fats have an important role in human vital activity, representing an important energy source and an important food component. For this reason, vegetable oils are widely used in various fields of the food industry. The particularity of vegetable oils consists in their high content of unsaturated fatty acids and as a result their oxidation under the action of air oxygen, the speed of the oxidation process increasing with increasing temperature. The oxidation processes that take place at high temperatures in the food preparation process and the compounds that are formed reduce the quality of the oils, a fact that requires research into the changes that take place in the frying process. Lipid oxidation leads to a reduction in nutritional value and, as a result, negatively affects the sensory characteristics of lipid-containing products[1–5].

In fact, lipid autoxidation and limited antioxidant capacity play a key role in reducing the shelf life of vegetable oils, leading to alterations in color, texture, aroma, flavor, and the loss of vitamins[6-11].

Corn oil is derived from corn germs, which contain 20–30% oil and are a byproduct of corn degermination for sorghum or the production of starch, ethanol, and other products. The extraction process involves pressing and solvent extraction, followed by refining. Refined corn germ oil possesses excellent sensory qualities and a high content of essential fatty acids, making it valuable in dietary products due to its cholesterol-lowering effects. It also features low free acidity (maximum 0.3% oleic acid) and minimal water content[11-18].

MATERIAL AND METHODS

To determine how viscosity varies with temperature and shear rate, the Rheotest2 device was employed. Corn oil was subjected to oxidation at 110°C and 120°. Dynamic viscosity corn measured at both temperatures and oxidation periods, respectively test temperatures, dynamic viscosity decreases with increasing shear rate for corn oil.

RESULTS AND DISCUSSION

Graphs 1 and 2 show the change in viscosity as a function of temperature for corn oils oxidized at both oxidation times, and for each shear rate, the dynamic viscosity decreases as the test temperature increases.

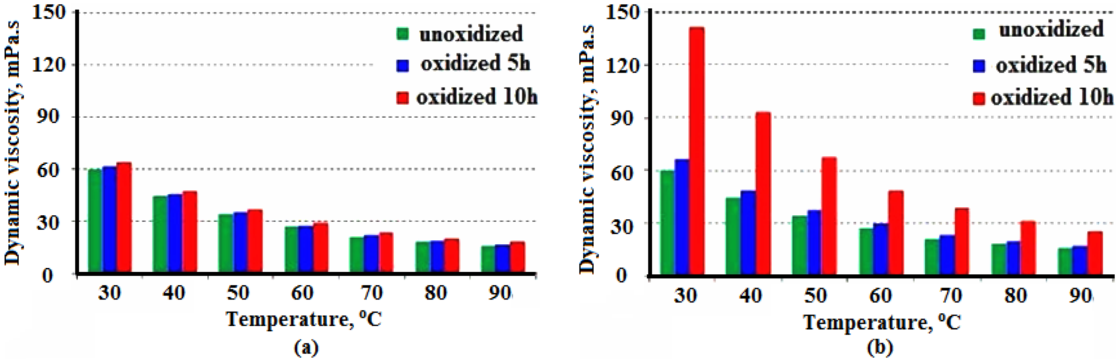

Fig. 1. Graph for a shear rate of 3.3 s^{-1} of oxidized corn oil at 110°C (a) and 120°C (b)

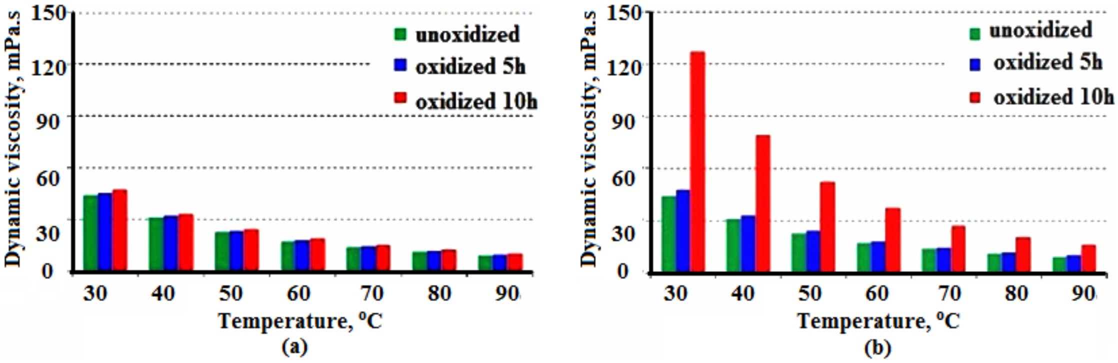

Fig. 2. Graph for a shear rate of 80 s^{-1} of oxidized corn oil at 110°C (a) and 120°C (b)

Oxidation of corn oil at high temperature does not lead to significant increases in dynamic viscosity compared to unoxidized oil. Increasing the oxidation temperature from 110°C to 120°C leads to an increase in the energy consistency of the oxidized oil for 10 hours. Azian equation (1) provides a good fit to the experimental data and is temperature dependent in the case of oils.

$$\ln \eta = A + \frac{B}{T} + \frac{C}{T^2} \quad (1)$$

Where T is the absolute temperature, and A, B and C are material constants[6,7].

Table 1 presents the material constants A, B and C as well as the correlation coefficients of the Azian equation.

Table 1: The values of the parameters of the Azian equation

Shear speed s^{-1}	A	B	C	Correlation coefficients
3.3	5.9965	-4232.83	1109561.25	0.9996
30	4.691	-3765.61	1059114.91	0.99998
80	3.795	-3452.73	1045690.15	0.9999

Graphs 3, 4 and 5 present viscosity maps showing the combined effect of temperature for corn oil.

Graphs 6 and 7 show the experimental values for corn oils oxidized.

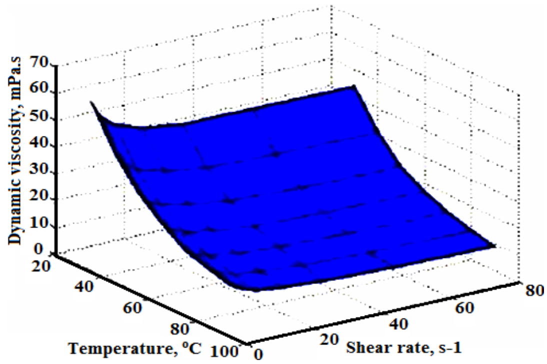

Fig. 3. Maps showing the combined effect of temperature for corn oil unoxidized

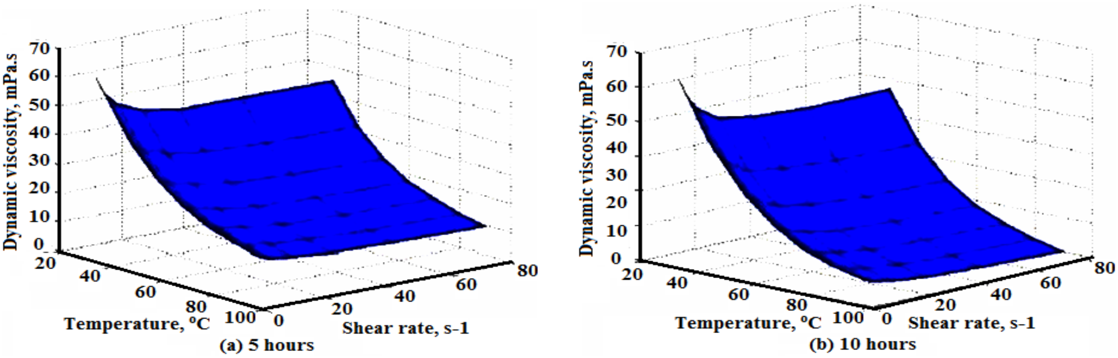

Fig. 4. Maps showing effect corn oil oxidized at 110°C

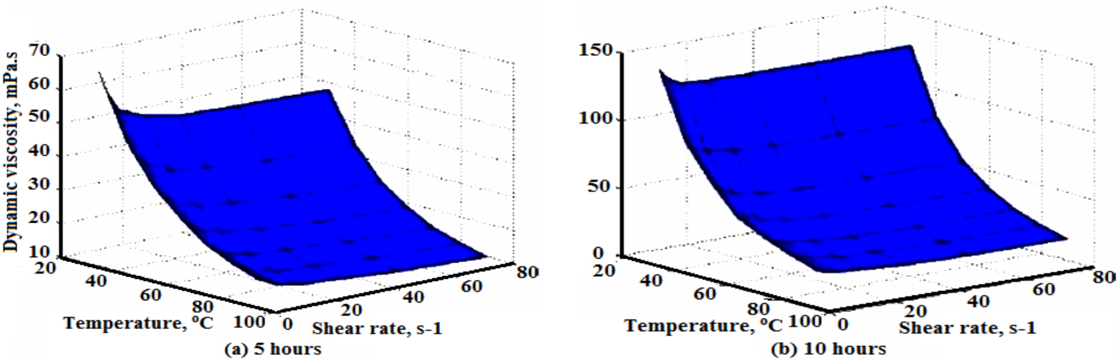

Fig. 5. Maps showing oil oxidized at 120°C

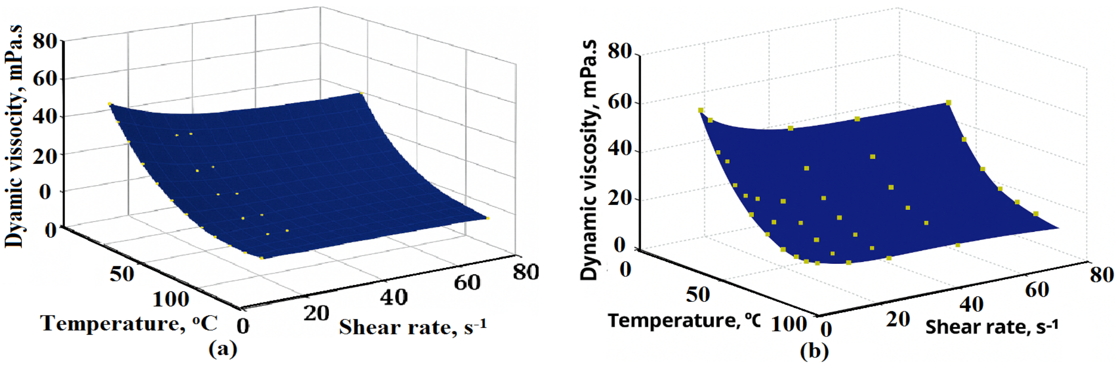

Fig. 6. Graph experimental results for corn oil oxidized at 110°C for 5 hours (a) and 10 hours (b).

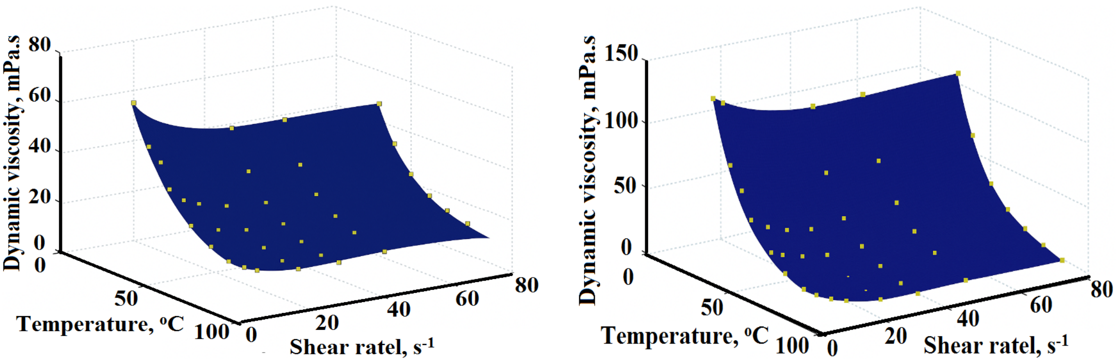

Fig. 7. Graph experimental results for corn oil oxidized at 120°C for 5 hours (a) and 10 hours (b)

CONCLUSION

Oxidizing corn oil at 110°C and 120°C for 5 and 10 h leads to an increase in dynamic viscosity compared to unoxidized oil-an effect observed across all test temperatures. A significant increase in dynamic viscosity is observed as the oxidation time extends from 5 to 10 hours. The most notable rise occurs at an oxidation temperature of 120°C for oil oxidized over 10 h, with the test temperature set at 30°C. When the test temperature is raised from 30°C to 90°C, the increase in dynamic viscosity becomes less pronounced.

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Conflict of interest

The author declare that we have no conflict of interest.

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