

# Surface properties determination as surface tension, energy and heat capacity of corn oil

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## ABSTRACT

Corn oil is widely used in foods, especially for a various diet. This work presented determination of some physicochemical parameters of the oil – density, surface tension, surface energy and surface heat capacity. The change in physicochemical and surface parameters was presented at five temperatures (25, 40, 60, 80 and 100°C). With increasing a temperature, all parameters decrease – density (from 0.924 to 0.899 g cm<sup>-3</sup>), surface tension (from 34.31 to 28.37 mN m<sup>-1</sup>), surface energy (from 143.74 to 142.70 mPa s) and surface heat capacity (from 8890.83 to 11127.34 N m<sup>-1</sup>K<sup>-1</sup>). The present results are the basis for future studies on the inclusion of corn oil in food products with improved functional characteristics.

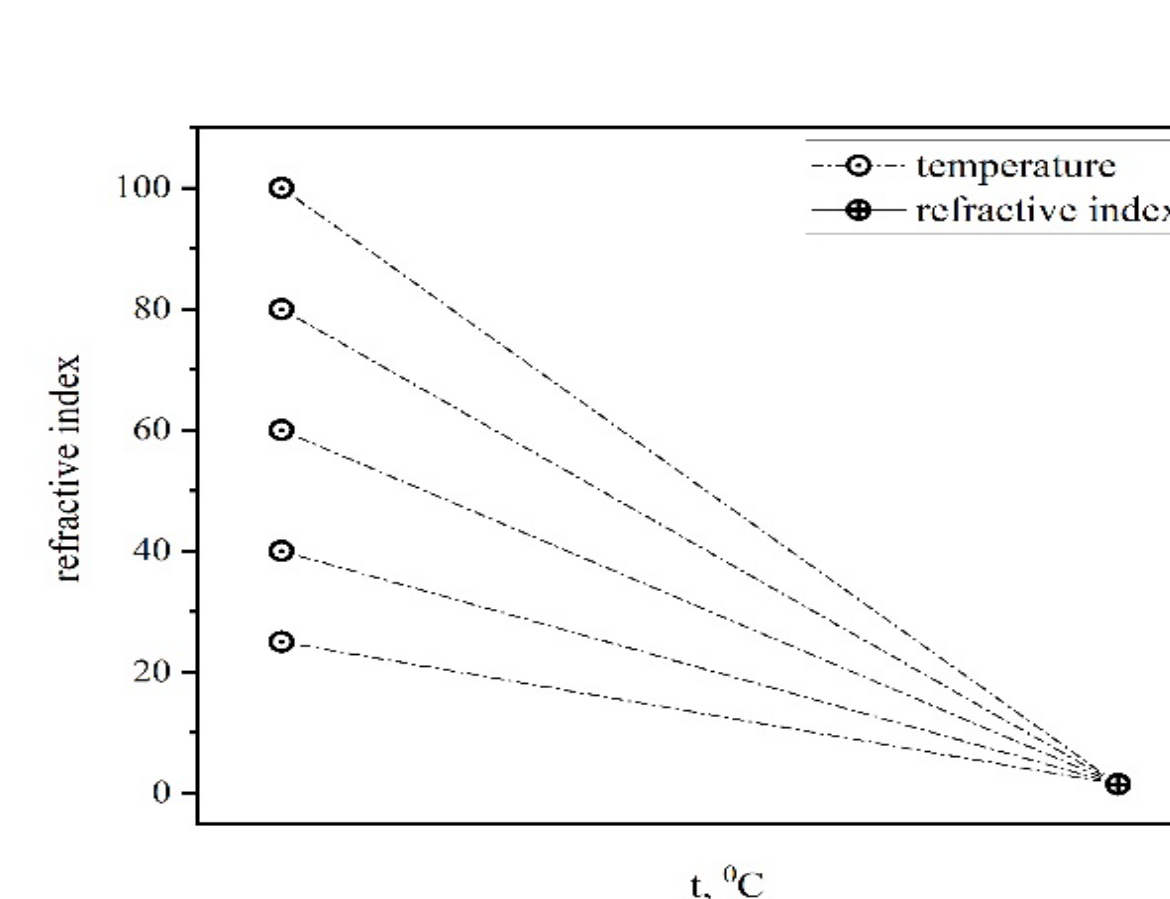
## MATERIALS AND METHODS

- Van der Waals – Guggenheim equation was used to calculated surface parameters. Temperature dependence of surface tension was used.
- The surface tension of the oil-air interface is determined at several different temperatures, for example in the range 25-100°C with a step of 10°C presenting the dependence  $\gamma = f(T)$ . For this purpose, a cell is used in which the initial sample of oil is thermostated. Measurements are carried out twice for each temperature: once at the increase in the given temperature range and a second time – at the decrease in the same range.

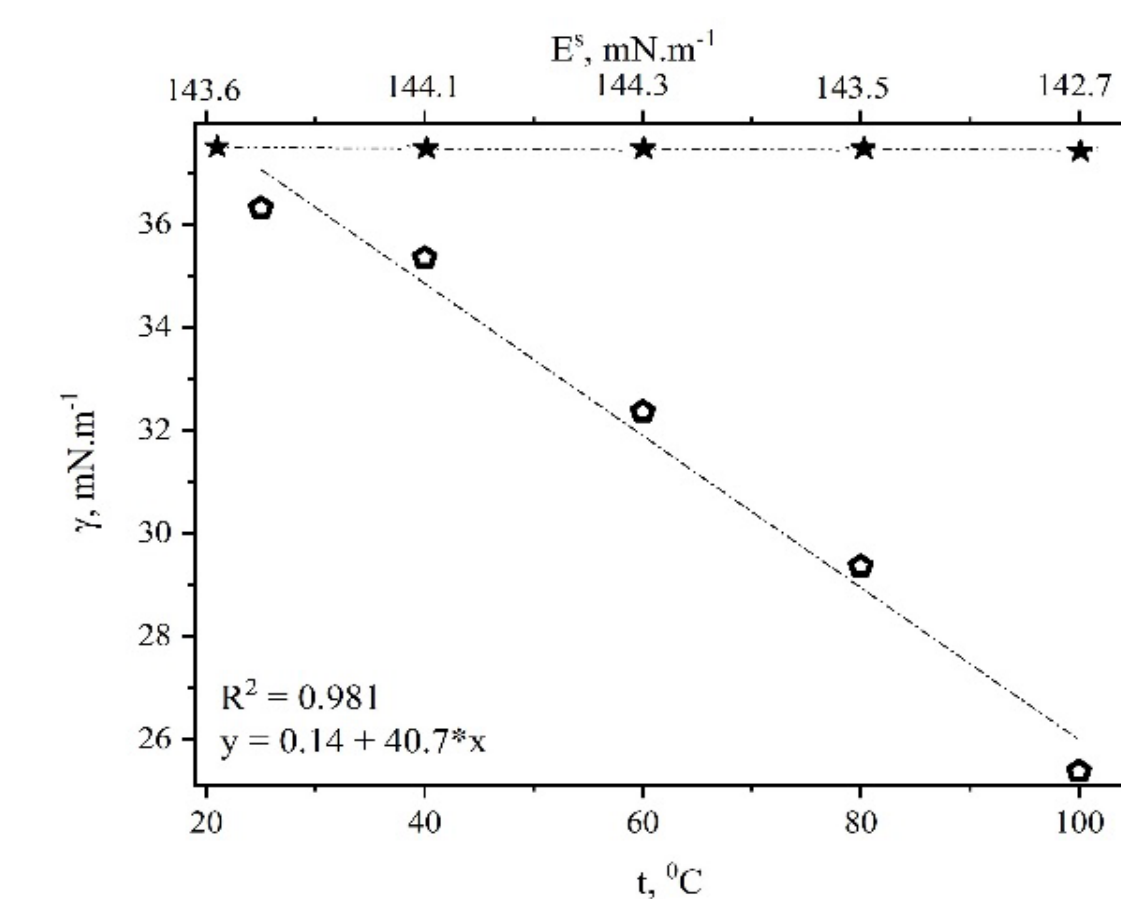
## RESULTS AND DISCUSSION

**Table 1.** Surface tension and density of corn oil.

| t, °C | Surface tension, $\gamma$ , mN m <sup>-1</sup> | Density, $\rho$ , g cm <sup>-3</sup> |
|-------|------------------------------------------------|--------------------------------------|
| 25    | 34.31±0.30                                     | 0.924 ± 0.06                         |
| 40    | 32.34±0.30                                     | 0.917 ± 0.07                         |
| 60    | 30.35±0.29                                     | 0.912 ± 0.11                         |
| 80    | 29.35±0.28                                     | 0.903 ± 0.14                         |
| 100   | 28.37±0.26                                     | 0.899 ± 0.17                         |



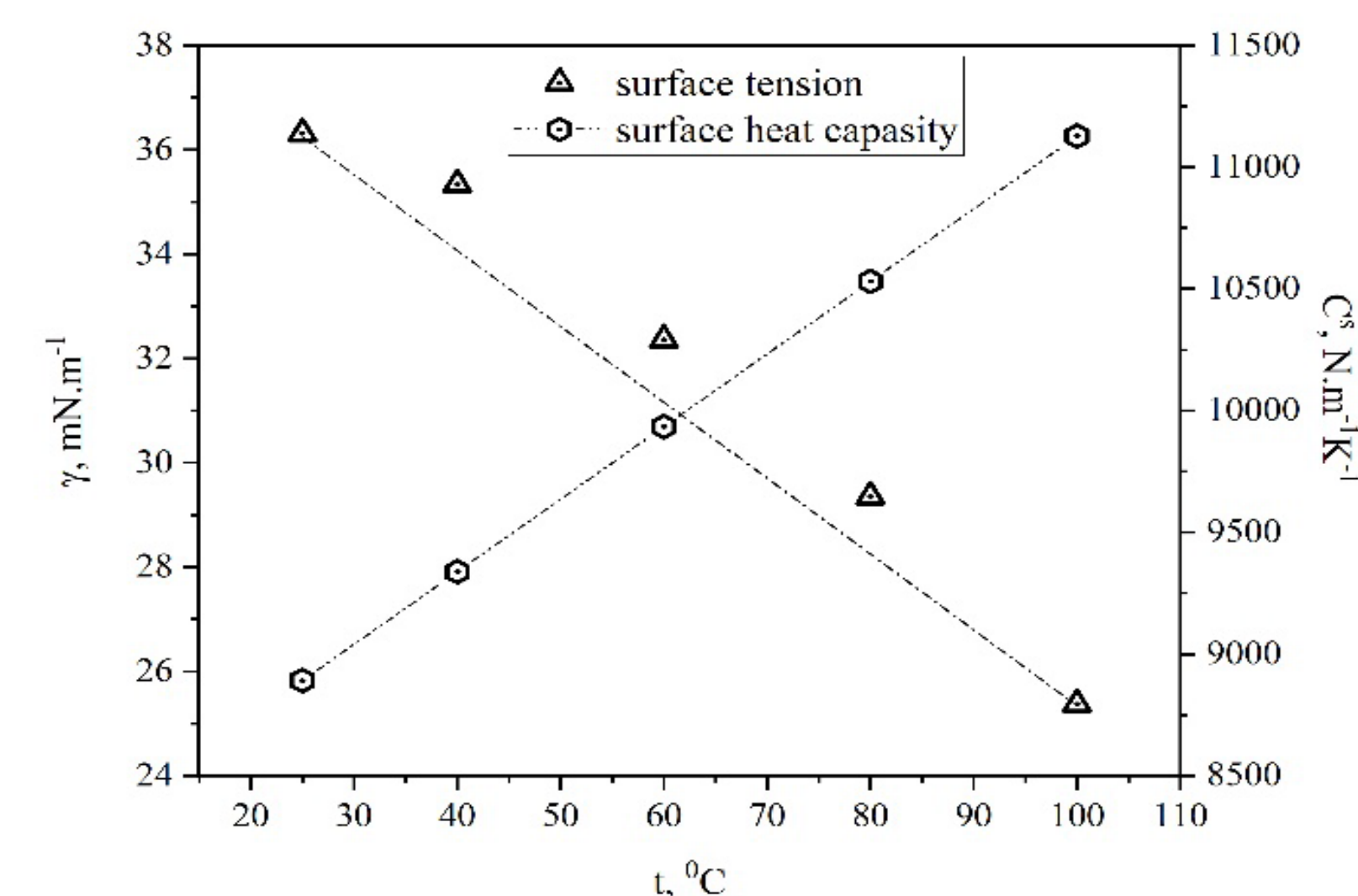
**Fig. 1.** Dependence between refractive index and temperature.



**Fig. 2.** Dependence between surface tension and surface energy.

**Table 2.** Surface energy and surface heat capacity of corn oil.

| t, °C | E <sup>s</sup> , mN m <sup>-1</sup> | C <sup>s</sup> , N m <sup>-1</sup> K <sup>-1</sup> |
|-------|-------------------------------------|----------------------------------------------------|
| 25    | 143.64±0.09                         | 8890.83±0.11                                       |
| 40    | 144.07±0.07                         | 9338.3±0.14                                        |
| 60    | 144.29±0.04                         | 9934.53±0.11                                       |
| 80    | 143.48±0.08                         | 10530.97±0.17                                      |
| 100   | 142.70±0.07                         | 11127.34±0.12                                      |



**Fig. 3.** Dependence between surface tension and surface heat capacity.

## CONCLUSIONS

The surface parameters of corn oil were investigated at temperature range. Surface tension, density and heat capacity presented a linear dependence. Energy do not depend of temperature. Mathematical model surface parameters. Stability of corn oil presented with heat capacities. This parameter showed values between 8890.83 and 11127.34 N m<sup>-1</sup> K<sup>-1</sup>. The corn oil investigation by different methods will be applicable for different food products. The calculated parameters serve to determine the stability of the product as well as to predict how long the system will be in equilibrium.