DETERMINATION OF PHYSICAL PARAMETERS FOR DIFFERENT EDIBLE OILS

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Abstract
Edible oils are vegetable fats, which are used in food in various forms: for frying, in salads, in batters, in cakes, etc. Among the many characteristics that are standardized for oils, some are especially important to traders and especially for the consumers namely: color, smell, density, viscosity, melting point, smoke point, boiling point, flame behavior, light resistance, rancidity resistance, etc. This paper presents the results obtained from the analysis of five types of local edible oils: sunflower, soybean, rapeseed, corn and pumpkin oil. The following physico-chemical parameters have been determined: refractive index, density, viscosity, surface tension and acidity (as oleic acid). The physico-chemical analyzed parameters shows different values, depending on the nature of the analyzed oil: 1.4704 (sunflower oil) – 1.4742 (soybean oil), for refractive index ; 0.9050 (rapessed oil) - 0.2023 (pumpkin oil) g/cm ^{3}– for density ; 32.5428 (soybean oil) – 37.6482 (rapessed oil) cp – for viscosity ; 21.12 (soybean oil) -35.02 (pumpkin oil) dyn/cm - for surface tension ; 0.06 (soybean) - 0.88 (pumpkin oil) % oleic acid – for acidity. The values of the physico-chemical parameters of the analyzed vegetable oils show that they are suitable for use in human consumption.

Introduction
It is a well-known the fact that different cooking oils have been known since ancient times. Vegetable oils, together with fats, are indispensable components of a healthy diet and perform a series of vital functions in maintaining the human body. Choosing cooking oils it does not only influence the taste of food but also our health. Therefore it is useful to know what we choose and why. Because oil is an important ingredient in our diet, it is important to consume a healthy oil [1]. Along with carbohydrates and proteins, the basic nutrients for the body, they provide energy, protect against cold, ensure absorption of fat-soluble vitamins and serve as flavor carriers. Oils and fats are important parts of the human diet, constituting a rich source of dietary energy. Edible oils play an important role in the body through their content of essential fatty acids (EFA). The types of fatty acids in oils decide choosing the best oil. In general, healthy oils have more polyunsaturated and monounsaturated fatty acids and less saturated fat. Due to their high energy potential, vegetable oils and fats are used both in the food industry and for industrial, medical and fuel purposes. Due to its nutritional content (vitamins A, B1, B2, B6 C, E, D, carotenes, minerals: selenium, zinc, potassium) and the beneficial intake of saturated fats, it helps to reduce inflammatory processes and health problems such as diabetes, cholesterol, blood pressure [2, 3]. Edible oils become unhealthy when they are consumed in excess or when the quality of the cooking oil is questionable. Among the appropriate parameters for establishing the food quality of oils, a series of organoleptic and physicochemical parameters

can be mentioned, such as: color, smell, density, viscosity, melting point, smoke point, boiling point, flame behavior, light resistance , resistance to rancidity, etc. [4]. Therefore, we need to consider the physico-chemical properties for selecting a good type of edible oil. Considering the above presented, this experiment aims to determine some physico-chemical parameters of five varieties of autochthonous vegetable oil sold in local specialty stores.

Experimental

The analyzed edible oil samples were made up of local, autochthonous oils (sunflower, soybean, rapeseed, corn and pumpkin oil) sold in local markets in Timisoara (Romania).

Three sets of samples corresponding to each type of oil were formed for each of them, determining: refractive index, density, viscosity, surface tension and acidity (as oleic acid). Experimental determinations were carried out in accordance with the recommendations of Cozma et al., 2019 [5]. The refractive index were obtained using the refractometry method, with the Abbe refractometer corrected to the equivalent reading at 25°C (AOAC, 1995). The oils density was measured using the pycnometer by weighing on the analytical balance and for the dynamic viscosity was used the Ostwald type viscometer. The surface tension was determined using the stalagmometer [7].The free oils acidity is an important indicator due to the free fatty acids present in the product. The oils acidity was determined by titration with a 0.1 n KOH solution.

Results and discussion

The obtained results of the physico-chemical characteristics of alimentary (edible) oils taken in the experiment are presented in table 1 and figures 1-2.

For the utilised oils, it can be observed that their values are different from one category to another.

Table 1. The physico-chemical characteristics of some food edible oils sold in local markets

Parameters	Values	Sunflower	Soybean	Rapeseed	Corn	Pumpkin
Refractive index	Limits	1.4704 - 1.4718	1.4734- 1.4742	1.4713- 1.4725	1.4723- 1.4732	1.4716- 1.4724
	Mean value	*1.4710± 5.7x10^{-4}*	*1.4738± 3.3x10^{-4}*	*1.4719± 4.9x10^{-4}*	*1.4728± 3.7x10^{-4}*	*1.4721± 3.5x10^{-4}*
Density, g/cm^3	Limits	0.9127- 0.9132	0.9121- 0.9133	0.9050- 0.9149	0.9111- 0.9122	0.1959- 0.2023
	Mean value	*0.9130± 2.2x10^{-4}*	*0.9127± 4.9x10^{-4}*	*0.9100± 4.0x10^{-3}*	*0.9116± 4.4x10^{-4}*	*0.1991± 3.5x10^{-4}*
Viscosity, cp	Limits	34.1242- 34.8756	32.5428- 33.5162	33.2175- 34.2316	36.5672- 37.6482	34.3541- 35.3152
	Mean value	*34,4953± 0.31*	*33,0349± 0.40*	*33,7066± 0.41*	*37,0761± 0.44*	*34,8484± 031*
Surface tension, dyn/cm	Limits	23.45- 24.95	21.12- 27.87	23.58- 25.06	25.69- 26.67	33.56- 35.02
	Mean value	*24.24± 0.62*	*27,91± 0.66*	*24,29± 0.61*	*26,13± 0.41*	*34,24± 0.60*
Acidity, (%) oleic acid	Limits	0.08- 0.15	0.06- 0.09	0.18- 0.25	0.11- 0.22	0.61- 0.88
	Mean value	*0,12± 0.02*	*0,08± 0.01*	*0,21± 0.03*	*0,20± 0.02*	*0,74± 0.11*

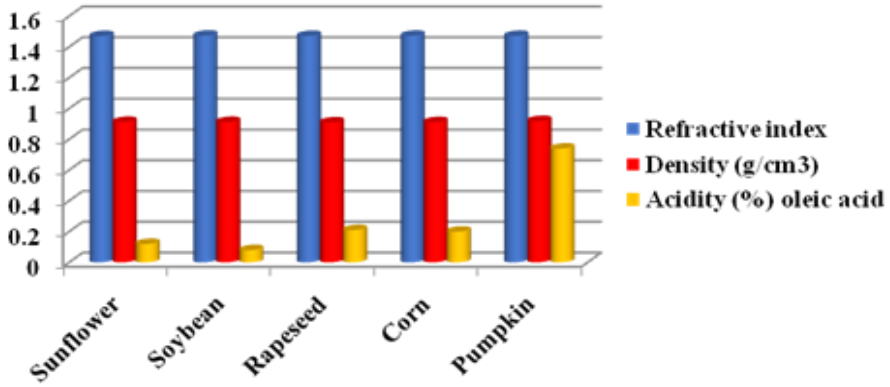

Figure 1. The refractive index, density and acidity of some edible oils

Measuring the refractive index can provide insight into the quality of the oils because any change in their optimal composition will also affect the refractive index value. The evaluation of the refractive index as a quality parameter helps to differentiate between types of vegetable oils or fats [5,6]. Refractive index values for oil samples at 25 ° C are included in the interval 1.4704 (sunflower oil) – 1.4742 (soybean oil). Many studies show that oils with lower density values are highly appreciated by consumers.The oils density varies with the type of analyzed oil and also with the temperature [7]. The results presented in table 1 show that, at room temperature of 25°C, the highest and lowest values of the densities are (0.9050) and (0.2023 g/ml) for the rapessed and pumpkin oil, respectively. Compared to water, which has a density of 1.00 g /ml, oils are less dense. Acidity is a measure of the free fatty acid content of the oil. Is defined as the number of milligrams of potassium hydroxide required to neutralize the free acids present in one gram of oil.The free acidity oils studied was determined according to STAS 145-67. Acidity is determined by direct titration of the oil sample in an alcoholic medium, against a standard solution of potassium hydroxide, in the presence of phenolphthalein as an indicator [8]. The values of free acidity values for the analyzed oils are between 0.06 (soybean) - 0.88 (pumpkin oil) % oleic acid [9].

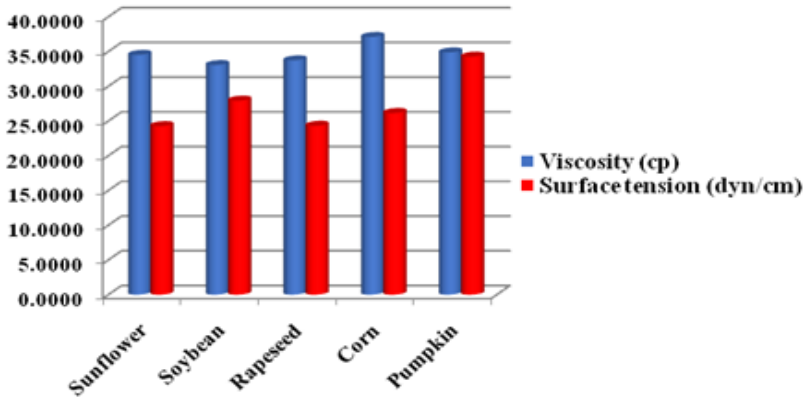

Figure 2. The viscosity and surface tension of some edible oils

Viscosity is considered an important physical property which offers indications regarding the oils fluidity. The viscosity of edible oils depends on the composition of saturated fatty acids in

different oils. From table 1, the obtained data showed that the viscosity of corn oil (37.6482 cP) is highest and is lowes for soybean oil (32.5428 cP). This highlight the fact that the sample of corn oil contains more fat than soybean oil. The ratio between the surface force and the length of the contour on which it acts is called the coefficient of surface tension (or surface tension) [7]. The surface tension values of the oil types, analyzed at 25℃ , are in the range of 21.12 (soybean oil) -35.02 (pumpkin oil) dyn/cm. It is shown that, pumpkin oil contains more fat compared to soybean oil. The high surface tension of the oil means less spreading of the oil on the surfaces and consequently more energy loss. With an increase in temperature, the surface tension within the limits of a specific concentration, decreases. As can be seen from table 1 and from figures 1-2, the physico-chemical parameters present values within concentration limits depending on the assortment of edible oil analyzed: 1.4704 (sunflower oil) – 1.4742 (soybean oil), for refractive index ; 0.9050 (rapessed oil) - 0.2023 (pumpkin oil) g/cm ^{3}– for density ; 32.5428 (soybean oil) – 37.6482 (rapessed oil) cp – for viscosity ; 21.12 (soybean oil) -35.02 (pumpkin oil) dyn/cm - for surface tension ; 0.06 (soybean) - 0.88 (pumpkin oil) % oleic acid – for acidity. The average values of the refractive index, density, viscosity, surface tension and acidity: 1.4710 - 1.4738, 0.9100 - 0.1991 g/cm^3, 33.0349 – 37.0761 cp, 24.24 – 34.24 dyn/cm, and 0.08 – 0.74 % acid oleic, shows that the analyzed oils are comparable to the edible oils used in consumption. Therefore, these oils can be used for cooking or in other food formulas. It is desired that these parameters can be used to identify the varieties of food oils from oil mixtures.

Conclusion

The physico-chemical parameters: refractive index, density, viscosity, surface tension and acidity of the analyzed oils are important criteria for establishing the quality and choosing the appropriate oil for consumption. Therefore, it is necessary to monitor oil quality parameters. The results obtained (average values) for the determination of the physico-chemical parameters refractive index, density, viscosity, surface tension and acidity of the analyzed food oils show specific values depending on the oil assortment. The values of the physico-chemical parameters of the food oils analyzed: sunflower, soybean, rapeseed, corn and pumpkin are comparable with the data from the specialized literature and can find applications in different food formulas.

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