PHYSICO-CHEMICAL CHARACTERIZATION FOR DIFFERENT TYPES OF FOOD OILS

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Abstract

Lipids are indispensable food components, which in large measure determine the energy value as well the nutritional, biological and sensory qualities. The aim of this paper was to evaluate some of the physicochemical characteristics (total soluble solids (TSS), relative density, viscosity and acidity index) in case of three alimentary oils. The analyzed oil assortments, in these works are soybean, rape and corn oil purchased from the commercial market having different origins. Oils density varies from species to species and at the same oil with the conservation conditions (conservation period, climatic conditions in which the plant has developed). Viscosity gives relevant indication of the degree of oil fluidity. The experimental results showed that the highest value for viscosity was registered in rapeseed oil (38,7088cP) and the smallest in soybean oil (34,0174cP). Rape oil from improved varieties is very good cooking oil for human consumption while soybean oil has a neutral taste and is recommended for the preparation of various types of salad.

Introduction

Vegetable and animal oils and fats play an important role in nutrition because of their high energy potential and as raw materials used to obtain technical products. Due to their nutritional principles (vitamins A, B1, B2, B6 C, E, D, carotenes, minerals: selenium, zinc, potassium) are used mainly in the food and cosmetics industry [2]. Vegetable oils are found in nature in plant tissues, inside fruit kernels, in tubers, or in germs. In our country the main raw material is seed oil plants. Most plants contain oils to a greater or lesser extent, especially in seeds, fruits, kernels, germs. The oil plants in which the oil is concentrated in the seeds are: soybean, rape, sunflower, and plants producing oil fruits: olive, palm, coconut. In Romania, raw materials are used as plant seed oil and corn germs. [1]. Corn germ oil is obtained by pressing or extracting. It is a yellow or reddish oil, being refined in food. Soybean oil obtained is dried in about nine days and forms a dry and non-polluting substance [1]. Rape oil is the highest Omega 3 oil and is recommended in the hypertensive diet [2]. Vegetable oil is often used for cooking, but is also used for industrial, medical and fuel purposes. Moderate intake of unsaturated fats helps to reduce inflammatory processes, regulate blood cholesterol levels, and promotes metabolism in slimming or body modeling [3].

Rape (*Brassica napus oleifera* and *Brassica rapa oleifera*) is a plant of the Brassicaceae cruciferous family with yellow flowers and long, branched stem. Rapeseed is grown for seeds and the oil is used in food and industry (biofuel). Due to its high erucic acid content (up to 30%) rapeseed oil has been considered to be toxic to the human body. Animal experiments have led to the conclusion that the consumption of rapeseed oil with high erucic acid content does not cause negative effects if the proportion in the diet does not exceed 5%. Its introduction into food was possible after world war II when new genetically modified

varieties were created, degraded to erucic acid (less than 2%) and very low glucose (less than 30 μmol / gram) known as "canola". The oil is dark green, has no specific taste and smell and is used in refined form in food.

Soybean (*Glicina hispida Max*) is part of the Glycin family of Oriental Asian legumes. The soy is very rich in protein - 40% (while the meat has only 15-25%), carbohydrates (10-15%), minerals (calcium, iron, magnesium, phosphorus, sulfur), vitamins (A, B1, B2 , D, F, E), lecithin (as well as egg yolk), waxes, resins, cellulose. Essential and non-essential amino acid content is a percentage double of meat. From this content come the general properties for which soy oil is highly recommended in food, representing a completely constructive (muscle, bones, nerves) and easily digestible food, is an energetic, remineralizing and balanced cell nutrition, preventing fattening [4]. The oil obtained from the corn germ, *Zea mays*, is light yellow or orange, if unrefined and almost tasteless. Corn oil is a mono and polyunsaturated oil. Percentage contains 54.7% polyunsaturated fatty acids, 27.6% monounsaturated fatty acids and 13% saturated fatty acids. Of saturated fatty acids, 80% are palmitic acid, 14% stearic acid and 3% arachidic acid [5]. Of the monounsaturated fatty acids, 99% are oleic acid. 98% of the polyunsaturated fatty acids are linoleic acid, an omega-6 and 2% linoleic acid, an omega-3.

Experimental

In the experimental part, have been analyzed in terms of physicochemical and nutritional characteristics three types of food oils commonly used in the food industry to prepare dishes and culinary products.The oil assortments analyzed in these works are soybean, rapeseed and corn oil purchased from the supermarket.These are used and appreciated due to the nutritional principles in the preparation of various sauces, salads, dressings especially in the cold kitchen as they also highlight the characteristics of the other ingredients.

The purpose of the study was to was to analyze and compare some physico-chemical characteristics as total soluble solids content (TSS), relative density (ρ_r) the dynamic viscosity (η) and also acidity index in case of the three vegetable food oils. The total soluble solids (TSS) and the refractive index were obtained using the refractometry method, with the Abbe refractometer corrected to the equivalent reading at 20°C (AOAC, 1995). Relative density determination was made using the pycnometer by weighing the analytical balance and for the dynamic viscosity was used the Ostwald type viscometer. The free oils acidity is an important indicator due to the free fatty acids present in the product. The acidity index represents the amount of potassium hydroxide, in mg, required to neutralize free fatty acids from one gram of product.

Results and discussion

From the determinations of the physico-chemical analyzed parameters, for the oils used it was observed that their values differ from one category to another. The values of the main physico-chemical characteristics are presented in table 1.

Table 1. The physico-chemical characteristics of the three types of analyzed oil

Nr.crt	Oil	n	η (cp)	ρ_{rel}	ρ (g/cm^3)	Acidity % acid oleic
1	S_1 rapeseed	1.4714	38,7088	0,9134	0,91024	0.24
2	S_2 corn	1.4724	37,2518.	0,9145	0,91134	0.18
3	S_3 soybean	1.4733	34,0174	0,9161	0,91293	0.11

The variable composition of the different oils and fats allows their characterization also by measuring the refractive index. The refractive index of animal and vegetable fats and oils is a qualitative parameter, easily identified in a short time. Refractive index values for oil samples at 27 ° C is in the range 1.4714 -1.4733 .

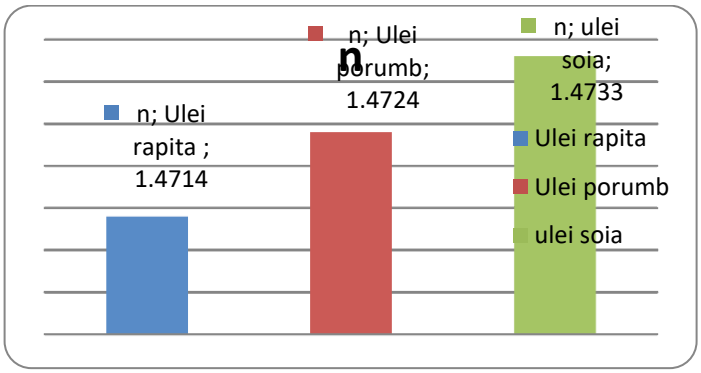

Figure 1. Refractive index value for rapeseed, corn and soybean oils

Density of oils varies from one species to another, and in the same type of oil with conservation conditions (storage life and climatic conditions in which the plant is developed). The oils density varies according to each type of oil and the temperature [6]. The value of the relative density of the investigated oils at 27 ºC varies between 0.9134 and 0.9161. Compared to water, which has a density of 1.00 g / ml, oils are less dense.

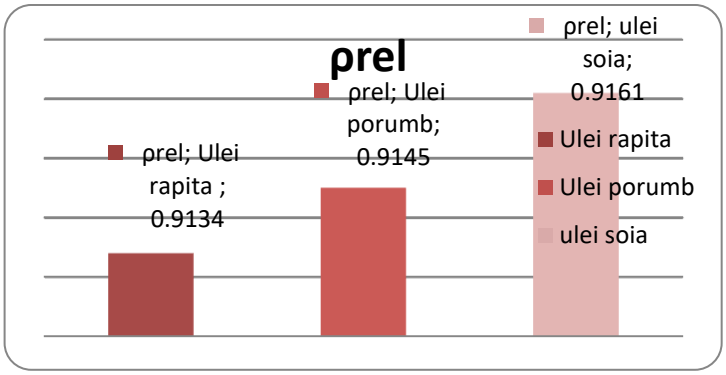

Figure 2. Relative density values for rapeseed, corn and soybean oils

Viscosity is considered an important physical property for the quality of liquid foods. The investigated oil samples generally have a Newtonian fluid behavior, the saturated fatty acid content playing a major role in the viscosity size. All edible oils consist of triglycerides with a variety of fatty acids that differ depending on chain length, saturation degree and position, as well as the geometry of the double bond in the carbon chain [3]. The viscosity provides mainly indications of the degree of the oils fluidity.

The viscosity of edible vegetable oils increases with the chain length of triglyceride fatty acids and decreases with unsaturation. Distinctive behavior of the oils subjected to the same thermal stress is due to the composition of saturated, monounsaturated and polyunsaturated fatty acids together with the concentration of minor compounds, mainly phenols and tocopherols[4].

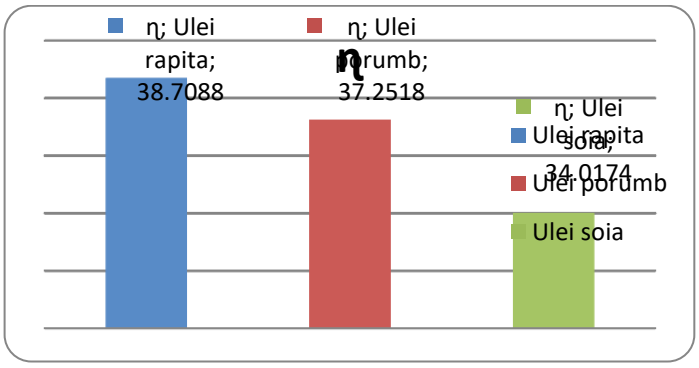

Figure 3. Viscosity coefficient values for the analyzed food oils

The free acidity oils studied was determined according to STAS 145-67. Free acidity is the percentage of free fatty acids found in the analyzed oil are conventionally expressed in the most representative fatty acid [7]. For ordinary soybean oils, sunflower, peanut, pumpkin is expressed in oleic acid; for coconut and palm oil in lauric acid; for palm oil in palmitic acid for rapeseed oil in erucic acid. The free acidity values for the analyzed oils correspond to the standards in force, the values being between 0.11 - 0.24% oleic acid [8].

Conclusion

Refractive index values for oil samples at 27^{o}C are in the range of 1.4714-1.4733. The recorded values are comparable with the literature values. Viscosity is considered an important physical property for the quality of liquid food, indicating the degree of fluidity of the oil in this case. Rapeseed oil has a higher viscosity than corn and soybean oils. This can be directly related to the content of saturated fatty acid. The viscosity of refined rapeseed oil is higher than that of soybeans.Increased viscosity may be the result of the presence of saturated fatty acids in the chemical composition of vegetable oil, higher molecular weight acids than unsaturated ones. The density of oils varies from one species to another, and in the same type of oil with conservation conditions (storage and climatic conditions in which the plant is developed). The value of the relative density of the investigated oils at 27 ºC varies between 0.9134 and 0.9161. These are in the range of values presented in the literature. The oils density varies according to each type of oil and the temperature.

The free acidity of the analyzed oils corresponds to the standards in force, but the rapeseed oil still has a higher value.

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