

Determination of the Effect of Different Roasting and Extraction Methods on the Viscosity of Flax (*Linum usitatissimum* L.) Seed Oil

Zeliha Değerli, Nurhan Uslu, Mehmet Musa Özcan*

Department of Food Engineering, Faculty of Agriculture, University of Selçuk, 42031 Konya, Turkey

Abstract

In this study, it was aimed to determine the effect of roasting process (90 °C and 120 °C in the drying oven at 1 hour) and oil extraction methods (solvent extraction, ultrasonic extraction and cold press) on the viscosity values of flaxseed oils.

The highest 36.00 mPas and the lowest 31.95 mPas viscosity values were determined in 120 °C roasted oils obtained by ultrasonic extraction and raw oils obtained by cold press, respectively. Viscosity values differed depending on oil extraction methods and roasting processes.

Keywords: Flax seed, viscosity, oil extraction

1. Introduction

Functional foods supply requirement of body for essential nutrients, as well as additional benefits on human physiology and metabolic functions. Thus foods or food components contribute to prevent diseases and achieve a healthier life [1].

Flax (*Linum usitatissimum*) is the only plant which is species of economic importance from the Linaceae family [2], which includes 22 genera and an average of 300 species [2,3].

Flax (*Linum Usitatissimum*) is a cultured plant 30-100 cm tall, blue-flowered and single annual. Flax is a plant that has been cultivated since the Egyptians and used for many different purposes. Flax seeds are 4-6 mm in length, egg-shaped, flat, shiny, reddish brown color, odorless, oily and delicious [4,5].

Linum usitatissimum, which is also known as whip seed, siyelek and zeyrek seeds, is cultivated for its fiber and oil obtained from its seed. In addition to being rich in unsaturated fatty acids (linoleic and linolenic acids), flax seeds are also a source of nutrients that are rich in lignans, and especially secoisolarikiresinol diglucoside.

Thanks to this rich content, its importance in human nutrition is increasing day by day. Flax is stated to be an important source in terms of α -linolenic acid, one of the plant-derived fatty acids.

Flax seed contains 35-45% fat, and the polyunsaturated fatty acid amount is 70-71%, while the saturated fat content is 18%. It is known that more than half of polyunsaturated fatty acids form α -linolenic fatty acids [7,8]. Flax seed contains 10-31% protein [9,10], 3-10% mucilage, steroids, cyanogenic glycosides (0.1-1.5%), highly soluble and insoluble fiber [11], abundant potassium, a small amount of magnesium, iron, copper, zinc mineral substances such as various vitamins, especially vitamin A.

The aim of this study is to determine the effects of flax seeds roasted at different temperatures (90 °C and 120 °C) on the viscosity values of the oils obtained by different oil extraction methods.

2. Material and Methods

2.1. Material

In this study, flax seeds were obtained from a local market in Konya. After removing the foreign, damaged and broken grains in the seeds supplied, they were kept in refrigerator conditions until analysis.

2.2. Methods

Flax seeds were mixed in the drying oven at different temperatures (90 °C and 120 °C) intermittently and exposed to heat treatment for 1 hour. Raw and roasted flax seeds were ground in the grinder and made ready for analysis.

2.2.1. Oil extraction

Flax seed samples were kept in ultrasonic water bath for 20 minutes with petroleum ether. Then oil was extracted in 5 hours in the soxhlet device. In solvent extraction, petroleum ether was added as a solvent to flax seed samples and oil was obtained in the soxhlet device in 5 hours. Cold press device was used as another oil extraction method. The obtained flax seed oil was prepared for analysis.

2.2.2. Viscosity

Measurements were made with AND Sine-Wave Vibro Viscometer, 0.3 to 10000mPa s, Model SV-10 device under suitable conditions at constant temperature.

2.3. Statistical analysis

Research are arranged according to random parcels 3 x 3 factorial experiment model. The results of research were evaluated with variance analysis and differences between groups were determined by Duncan Multiple Comparison Test [12].

3. Results and discussions

Duncan test analysis results of the viscosity values of flax seed oils are given in Table 1. It was observed that viscosity values of flax seed oil samples varied between 31.95 mPas and 36.00 mPas. The viscosity values of raw, 90 °C and 120 °C roasted flax seed oils obtained by solvent extraction were between 35.85 mPas (25 °C), 33.55 mPas (25 °C) and 35.15 mPas (25 °C), respectively, it was also determined between 34.15 mPas (25 °C), 35.05 mPas (25 °C) and 36.00 mPas (25 °C), in ultrasonic extraction, respectively. In addition, the viscosity values of the oil obtained in the cold press were measured as 31.95 mPas (25 °C), 33.50 mPas (25 °C) and 35.00 mPas (25 °C), respectively. It was observed that the viscosity value increases as the roasting temperature increases in cold press and ultrasonic extraction. While the viscosity value of flax seed oil roasted at 90 °C in solvent extraction compared to raw flax seed oil decreased, viscosity value of roasted flaxseed oil increased at 120 °C (Fig. 1).

Şimşek [13] found viscosity value of raw flax seed oil obtained by solvent extraction as 21.28 mPas, and Şimşek [13] determined viscosity value of flax seed oil roasted at 90 °C obtained by solvent extraction, as 22.68 mPas.

Table 1. Viscosity analysis results of flax seed oils

Oil Extraction	Temperature	Viscosity (mPas)
Cold Press	Control	31.95±0.50 ^c
	90°C	33.50±0.28 ^{bc}
	120°C	35.00±0.99 ^{ab}
Solvent	Control	35.85±0.07 ^{ab}
	90°C	33.55±0.50 ^{bc}
	120°C	35.15±0.78 ^{ab}
Ultrasonic	Control	34.15±0.78 ^{abc}
	90°C	35.05±0.50 ^{ab}
	120°C	36.00±0.57 ^a

(a, b, c; P<0,05)

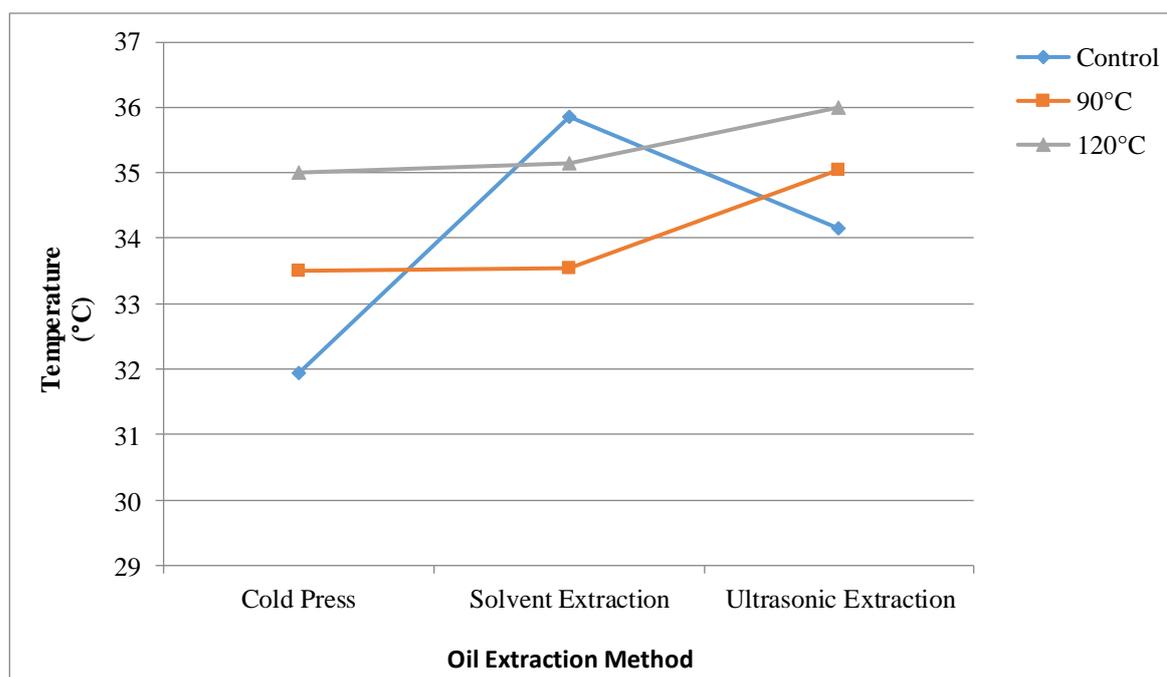


Figure 1. Viscosity analysis results of flax seed oils

4. Conclusions

The aim of our study is to obtain quality oil with high efficiency with a suitable roasting temperature for flax seed oil production and with an extraction method that is not harmful to health. For this, raw and roasted flax seed samples at 2 different temperatures (90 °C and 120 °C) were used. The oils of flax seed were extracted by cold press, solvent extraction and ultrasonic extraction methods. Viscosity analysis was performed on the obtained flax seed oils.

The highest (36.00 mPas) and the lowest (31.95 mPas) viscosity values were determined in 120 °C roasted oils obtained by ultrasonic extraction and raw oils obtained by cold press, respectively.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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