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Effect of Different Enzymes and Ultrasonic Extraction on the Viscosity of Crude Sunflower Oil

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Abstract

In this study, the viscosity of sunflower oil obtained by protease (alkalase), hemicellulase and ultrasonic extraction method, which is used to obtain oil from sunflower seeds, was investigated. The highest viscosity value in crude sunflower oil with protease enzyme was measured as 44.2 Pa.S (25° C). When the hemicellulase enzyme was used at 2.0% concentration in crude sunflower oil, the viscosity value was 43.9 Pa.S (25° C). In the ultrasonic extraction method, the viscosity values of crude sunflower oils for 10 min, 20 min and 30 min were measured as 38.4 Pa.S (25° C), 38.9 Pa.S (25° C), and 33.2 Pa.S (25 ° C), respectively.

Keywords: Sunflower seeds, enzyme, ultrasonic extraction, viscosity, oil

1.Introduction

Sunflower oil, which is the most preferred oil in our country due to its low price and excess production, is the third most produced and consumed oil after soy and palm oil in the world ranking. The average composition of sunflower seeds contains 37% crude oil, 24% crude protein, 4% crude ash, cellulose 28%, nitrogen-free extract 28% [1]. Oily sunflower types are generally black, thin-skinned and contain linoleic and oleic fatty acids. Sunflower oil is an oil obtained from the seeds of the *Helianthus annuus* plant, the oil ratio of which varies between 39-45%. The main countries where sunflower cultivation is made in the world; Russia, Ukraine, Argentina, Hungary, France, Spain, India and Turkey. The cultivation of sunflower plants has an important place in our country especially in Thrace and Marmara regions [1]. Sunflower is highly tolerant depending on the development period at high and low temperatures. For the seeds to germinate best, soil temperature of 8-10 °C is required. Sunflower plant seedlings can withstand -4 ° C temperature in the cotyledon circuit. The best growing temperatures for sunflower are between 21 and 24 °C [2]. It usually requires cool weather in the vegetative period and open and sunny weather in the generative period. Sunflower oil is a pale yellow liquid with a pleasant taste and smell. Titration degree is 17-20 ºC and freezing degree is 17-18 ºC [3]. Sunflower oil contains 15 percent saturated and 85 percent unsaturated fatty acids, 14-43 percent of unsaturated fatty acids constitute oleic acid, 44-75 percent of linoleic and up to 0.7 percent of linolenic acid. Sunflower oil; 0.025-0.31 percent hydrocarbons, 0.542-0.584 percent sterols, 0.008-0.044 percent wax-free substances [4]. The oil-free pulp obtained after the solvent extraction process in sunflower oil production is used in animal feed production as a by-product. Due to its high protein content, sunflower meal is a very valuable by-product. The oil content of sunflower seeds depends on the proportion of the husk in the seed. Lower sunflower heads (less than 20 cm in diameter) are shown to carry 40% more oily seeds than larger diameter heads (greater than 30 cm). Sunflower seeds grown under irrigation conditions contained more oil than grown under non-irrigated conditions [5]. *Rosenthal et al*. [6] further improved their oil and protein extraction efficiency, increasing their soy yield to 58% and 67% using Protease (Alkalase) enzyme, respectively. These yields were higher than those obtained when cellulase, hemicellulase and pectinase enzymes were used separately. The aim of this study is to determine the effects of different enzymes and ultrasonic extraction on the viscosity of crude sunflower oil.

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2.Materials and methods

2.1. Material

In this study, sunflower seeds were used as material. Raw and roasted sunflower seeds were ground and oil was obtained for later analysis.

2.2. Methods

Sunflower seeds were roasted in a commercial electric oven at 130 ° C for 20 minutes. After the roasted samples were cooled in the desiccator, the samples were ground into powder using a grinder before analysis.

2.2.1. Oil extraction: Crude and roasted ground sunflower seed samples were kept in ultrasonic water bath with petroleum ether for different times (10min, 20min, 30min). Then, the oil was removed in the soxhlet device.

In the enzyme extraction method, raw and roasted ground sunflower powders were treated with the prepared buffer solution. Protease and hemicellulase enzymes were used as enzymes at concentrations of 1.0, 1.5 and 2% (w / w). Na_2HPO_4 + KH_2PO_4 buffer solution prepared in pure water was used in the experiment. After activation of enzymes, after adding in the samples, after waiting for 24 hours at about 40° C in benmarid, their oils are obtained by pressing.

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.

2.2.3. Statistical analysis: Research are arranged according to random parcels 2 x 3 x 3 factorial experiment model. The results of research were evaluated with variance analysis (Minitab, 1991) and differences between groups were determined by Duncan Multiple Comparison Test [7].

Table 1. Viscosity values of sunflower oils extracted by enzyme and ultrasonic systems (Pa.s)

Enzyme extraction			
Processing	**Enzyme**	**Concentrations (%)**	**Viscosity ((Pa.s)**
Raw seed	Control		43,25± 0,07
	Protease	1	37,35± 0,07
		1.5	42,60±0,00
		2	44,15± 0,07
	Hemicellulase	1	42,95± 0,07
		1.5	44,30± 0,00
		2	43,90± 0,14
Roasted seed	Control		43,95± 0,07
	Protease	1	44,30± 0,00
		1.5	53,80± 0,28
		2	51,95± 0,07
	Hemicellulaese	1	43,60± 0,14
		1.5	42,60± 0,00
		2	41,60±0,00
Ultrasonic extraction			
Processing	**Time (Min)**	**Viscosity(Pa.s)**	
Raw seed	Control	34,80±0,00	
	10	38,40±0,00	
	20	38,95±0,07	
	30	33,30±0,14	
Roasted seed	Control	46,65±0,07	
	10	44,70±0,00	
	20	42,40±0,00	
	30	41,15±0,07	

3.Results and Discussion

Duncan test analysis results of viscosity values of sunflower milled seed oils are given in Table 1. The viscosity values of oil samples obtained from sunflower seeds were changed between 43.25 Pa.s and 41.15 Pa.s. Protease enzyme extraction obtained by enzyme extraction was measured as 37.35 Pa.s at 1% concentration and 44.2 Pa.S (25° C) at 2% concentration. Increasing the concentration of protease enzyme addition to oils obtained from sunflower seeds obtained as crude has been determined to increase the viscosity. In oil samples obtained by roasting sunflower seeds at 130C, protease enzyme has a more enhancing effect compared to hemicellulase enzyme. In the ultrasonic extraction method, the viscosity values of crude sunflower oils for 10 min, 20 min and 30 min were measured as 38.4 Pa.S (25° C), 38.9 Pa.S (25° C), and 33.2 Pa.S (25° C), respectively. The sonication process applied to the raw sunflower in the experiments obtained by ultrasonic methods increased the viscosity up to a certain level (up to 20 minutes), while this time increased further (increasing to 30 minutes), the viscosity value of which was applied in the roasting process at the concentration of 1.5% protease. enzyme applied sample is 53.80 Pa.s. The lowest viscosity value of 37.35 Pa.s is the crude protease enzyme applied oil samples. *Georing et al*. [8] used corn, cotton, sesame, sunflower, soy seeds, etc. in its Works, and they stated that the viscosity values of the oils changed between 27.2 and 297 mPA.

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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