JAP&T
TPA-Timişoara

Available online at http://journal-of-agroalimentary.ro

Journal of Agroalimentary Processes and Technologies 2011, *17*(4), 398-401

Journal of Agroalimentary Processes and Technologies

Characterization of sour cherries (*Prunus cerasus*) kernel oil cultivars from Banat

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Received: 15 June 2011; Accepted: 25 November 2011

Abstract

The sour cherries were collected from Banat, west Romania. The microbiological quality, the mineral composition (Cu, Fe, Ca, Mg, Zn) and the chemical composition, including moisture, total oil content and ash, was determined. The technique of oil extraction was implemented organic solvent extraction. Iodine value, saponification value, acid value and peroxide value of obtained sour cherries kernel oil was analyzed.

The fatty acids composition was analyzed with HPLC method according to AOAC standards. Sour cherries kernel oil was found to contain high levels of oleic (42.9 %), followed by linoleic (38.2 %), while the dominant saturated acids were palmitic (11 %) and stearic (6.4%).

Keywords: fatty acids, sour cherries oil, HPLC, microbiological quality, mineral composition

1. Introduction

Currently, large amounts of fruit seeds are discarded yearly at processing plants. This not only wastes a potentially valuable resource but also aggravates an already serious disposabil problem. To be economically viable, however, both oil and meal from these fruits seeds must be utilised [1].

At present there is no systematic collection and utilisation of this material; thus, a valuable product with a large industrial potential remains unexploited. Some of the seeds are difficult to collect because of the direct consumption of the fresh fruit by consumers, but the bulk of the fruit is used in food processing plants; i.e., the fruit kernels can be obtained as a byproduct from the many food companies that process fruits and are available at a very low cost [2].

Scientists around the world are exploring alternate and nontraditional seed sources for oils Traditional oils and fats are very limited in their chemical constitution as their triglycerides mainly comprise stearic, oleic and linoleic acids. Michigan is the largest producer of tart cherries in the United States. Michigan's total cherry production is about 90.7 milion kg/year and generates about 7.26 milion kg/year of pits. These pits currently contribute to a waste disposal problem. Since the seed oils are chemically diverse, scientifically interesting and versatile in utility we have investigated the oil from Montmorency cherry pits for its chemical composition and potential use in cooking [3].

Analysis of Montmorency cherry pits has shown that the dried pits contained 22.7% core which produced 31.8% oil [4]. Our results confirmed that the seed oil from Montmorency cherry pits contained only unsaturated fatty acids, 63.5% oleic and 31.5% linoleic acids, as compared to olive, safflower, sesame, soybean, peanut and sunflower oils [3].

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Since the oil from Montmorency cherry pits is free from saturated fat and possesses a TD value of 352°C, it could be used in food preparations along with olive or canola oils [3].

Cherry pits were obtained from processing plants and after removal of hard shells the kernels were separated and analyzed, and crude oil was extracted with petroleum ether. Crude oil was 26.0% of dry matter of cherry kernels respectively; crude protein content was 25.3%; crude fibre 9.5%; total carbohydrates 34.5% of which 11.3% were reducing sugars; and ash 4.6% respectively. The kernels were found to contain considerable amounts of K,P, Mg and Ca. Oil characteristics were: iodine value 116; saponification number 198; unsaponiflable matter 3.12%; refractive index (40°C) 1.4693; and specific gravity (20°C) 0.9419 for cherry kernel oil respectively [5].

Several indigenous and imported cherry cultivars or varieties from 2 different genera, *Prunus avium* (sweet cherries) and *Prunus cerasus* (sour cherries) are grown in Iran. In addition to fruit pulp being consumed in human nutrition in Iran, the fruit stern and stone kernel of some cultivars are used for traditional curing of certain diseases [6].

Cherry seed oil, from the Rosaceae family, prunoid subfamily, is characterized by the existence of about 10% α-eleostearic acid. The triacylglycerols of this oil were identified and quantitated by high-performance liquid chromatography by means of several types of detectors. α-Eleostearic acid was not found in the seeds of previously studied prunoids (almond, peach, apricot and plum). The main fatty acids found in the seeds of cherry and other prunoids were linoleic (L), oleic (O) and palmitic acids, and the major triacylglycerols were LLO, LOO and OOO [7].

2. Materials and Method

Seed of sour cherries (*Prunus cerasus* L) were collected from local markets. Samples of cherry pits were obtained from processing plants of Banat, Romania. After the harversting of the kernels, manual separation of the seeds, druing in an oven at 60°C and crushing, all analyses were performed in triplicate. For determination of oil content, dried seeds were ground in a mortar, transfered into a thimble, and extracted with petroleum ether in Soxhlet apparatus for 4 h and stored after solvent extraction at -5°C.

Kernel moisture was determined gravimetrically by placing a small amount of specimen into an oven at 102°C for 6 h or at constant weight. Ash content was determined by overnight heating at 550°C [8].

Analysis of mineral elements (Ca, Fe Mg, Cu and Zn) was determined by atomic absorption spectrophotometer Varian AA 1100.

Oils were analysed in triplicate for iodine value,saponification number, acid value and peroxide value by AOAC (**1999**) methods [8].

Fatty acids methyl esters were prepared by AOAC Method and analyzed by HPLC (High Performance Liquid Chromatography).

*Reagents:*NaOH (40%); H_2SO_4; ethyl ether; BF_3 in methanol. Chromatographic conditions were: Waters HPLC, Column: LiChrospher C18 (5µm), UV spectrophotometric detector, 215 nm, mobile phase: ethyl acetate, flow 1mL/min, albumin stationary phase is.

*Microbiologic qualities evaluation of oils obtained from sour cherries kernels.*The existence of a load microbiological composition of ground cherry stones or composition of oils obtained using these stones as raw material. Microbiological analysis aimed at highlighting the **total number of germs (TNG)**, presence and number of coliforms, the presence of lipolytic bacteria and yeasts or molds. To identify and confirm the presence of these microorganisms have used biochemical and microscopic examination. The purpose of this evaluation is to verify the microbiological those oils derived from seeds using the Soxhlet method and comparing results with current standards for edible oils [9].

Microbiological parameters followed were: the amount of colony forming units (**CFU**), presence and number of coliform bacteria (Escherichia coli, Salmonella, Shigella, Proteus), presence and number of lipolytic bacteria, fungi and yeasts in the samples of flour from fruit kernels and oil from fruit kernels.

The methods, techniques and materials used for detection are specific to each trait. Determination of **CFU**, the number of coliforms (**C**), lipolytic microorganisms and the number of yeasts and molds (**YF**) were performed using different culture media [10].

3. Results and Discussion

Table 1. The raw materials quantitys of analysed and the quantitys of products obtained

Raw materials	Fruits	Kernels	Oil
Sour cherries	3000 g	240 g	54 g

Table 2. Aproximate composition of sour cherries kernels

Assay	Sour cherries
Crude Oil (%)	22.5
Moisture (%)	7.2
Ash (%)	4.4

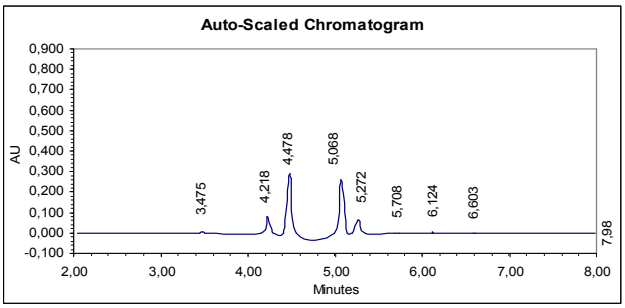
Table 3. Mineral content (mg/100g) of sour cherries kernels and sour cherries kernels oil

Assay	Sour cherries	Sour cherries oil
Ca	23.2	1.02
Fe	2.4	0.255
Mg	65.3	std
Cu	1.2	std
Zn	0.8	0.05

Table 4. Characteristics and fatty acids composition of the sour cherries kernels oil

Assay	Sour cherries
Oil characateristics	
Acid value (mg KOH/g)	1.0
Saponification number (mg KOH/g)	183
Peroxide value (mE O_2/kg)	1.6
Iodine value (g I_2/100 g)	122.5
Fatty acids (%)	
Myristic acid C14:0	0.5
Palmitic acid C16:0	11
Stearic acid C18:0	6.4
Oleic acid C18:1	42.9
Linoleic acid C18:2	38.2
Arachidic acid C20:0	0.9

In table 4 and figure 1 are the results obtained for samples of fatty acids in sour cherries kernels oil samples.



Name	RT	Area	Height	Amount	Units
miristic	3.475	48	5	0.5	%
palmitic	4.218	991	82	11	%
linoleic	4.478	3450	287	38.2	%
oleic	5.068	3878	259	42.9	%
stearic	5.272	576	64	6.4	%
unk1	5.708	11	1		%
arahnidic	6.124	80	5	0.9	%
unk2	6.603	4	0		%

Figure 1. The chromatogram HPLC of fatty acids for cherry kernels oil

Microbiologic parameters influence at oils qualities. Culture medium was inoculated by flooding and Petri dishes were incubated up to 72 hours under optimal conditions. Lipolytic micro-organisms produced colonies that are surrounded by clear zones in an otherwise turbid culture medium. Total number of molds and fungi is in the tens or even miilor/10 grams. Following the evaluation of microbiological culture media: **ADCL (deoxycholate citrate lactose agar**), **TSI (triple sugar iron**), **MIU (mobility indole urea), FAD (phenyl alanine deaminase)**, we determined the presence of various types of mushrooms in flours obtained by grinding kernels of fruits: *Penicillum, Aspergillus, Rhizopus, Mucor, Cladosporium*.

Table 5. Microbiologic evolutions for grinding cores from fruit kernels and fruit kernels oil

The type of sample	UFC /g	C/g	L/g	YF/10 g
Sour cherries kernels	900	6	12	1450
Sour cherries kernel oils	180	5	8	280

The number of microorganisms is higher than the of ground fruit kernels composition of oils obtained from ground. fruit kernels composition. All microbiological parameters analyzed for oil have lower values than ground kernels, appropriate.

Microorganisms isolated from the oils and fruits kernels belong to different families: *Streptococcaceae Micrococcaceae, Enterobacteriaceae*. Were highlighted and eukaryotic organisms: fungi - yeasts and molds. The values parameters are analyzed within the limits allowed by current standards.

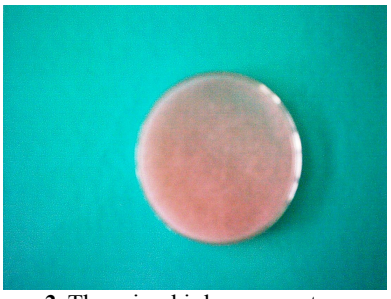


Figure 2. The microbiologyc spectrum constituted from germ of genus *Penicillium, Aspergillus, Rhizopus, Mucor, Cladosporium* for sour cherries kernel

Figure 3. The microbiologyc spectrum constituted from germ of genus *Penicillium, Aspergillus, Rhizopus, Mucor, Cladosporium* for sour cherries kernel oil

Regarding fatty acid composition , the saturates composed an average of 18.8% of the total fatty acids. The major saturated fatty acid was palmitic (16:0) and stearic acid consisting ca 92.5% of the total saturates. In lower concentrations to traces were also found myristic (14:0) and arachidic (20:0) acid. The major unsaturated fatty acid in the oils samples was oleic (18:1), followed by linoleic (18:2). The composition of oils confirms that found by the literature [1,5-7]

4. Conclusions

Based on this study, the indications are that sour cherries kernels, a substantive byproduct of sour cherries processing, could be a potential source of a edible oil and possibly supplementary protein. The results of this research indicated that the chemical properties of sour cherries kernel oils from west Banat area, Romania were generally similar.

The fatty acids profile shows a high content of unsaturated fatty acids: oleic acid (42.9%) and linoleic acid (38.2%).

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