Technical sciences

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WALNUT UHF-TREATMENT INFLUENCE ON OIL LIPID FRACTION FATTY ACID COMPOSITION

Fatty acid composition of the cold-pressed oil lipid fraction, yielded with walnut ultra high frequent (UHF) treatment application in comparison to the control oil sample was assayed by gas chromatography.

The results of this study suggested that UHF electro-magnetic field application practically did not influence on quality and quantitative composition of fatty acids being in walnut oil. Total saturated fat acids content diminished while unsaturated fat acids one increased insignificantly.

Key words: walnut oil, UHF-treatment, fatty acid composition, gas chromatography.

I. Introduction

With the aim of vegetable oil yielding process intensification raw material physical influence methods are applied, that allows increasing oil yield and improving its quality indexes. Thermal food treatment processes in the UHF electromagnetic field (EMF) are characterized by small duration and comparatively low specific energy expense. Thus UHF-heating is considered to be "soft", as there is no raw material overheating and burning. UHF-treatment advantage is very rapid local heating of separate subcellular units [1]. Unlike an ultraviolet or gamma-radiation, the UHF EMF action is not ionizing, so it shows no destructive operating on the raw material organic substances [2].

UHF EMF energy approximately equals to molecule rotation one and is insufficient for chemical connections breaking. It mutually reacts with the system components according to water dipole rotation strengthening and ionic conductivity mechanisms. As a result of such mutual action a reactive mixture rapid local heating and cellular lipid freeing occurs throughout the system, which cause oil yield increasing.

UHF EMF influence has been known to allow intensifying oil yielding process and to increase considerably its yield. It has been proven while soy seed processing into oil [3]. However, UHF-treatment influence on walnut oil quality indexes has been researched little.

Oils are the basic source of essential polyunsaturated fatty acids (PUFA) such as omega-6 and omega-3. PUFA biological value is determined by their role in cardiovascular diseases reduction, anti-inflammatory and anti-allergic effects, development and function of brain and nervous system and protection against certain types of cancer.

Presently, a great attention is paid to the use of unconventional types of oils. Among them an important place is occupied by walnut oil due to its well-balanced fatty acid composition (FAC).

II. Statement of the problem

The purpose of this study was to analyze quantitative FAC of oil yielded with walnut ultra high frequent (UHF) treatment application in comparison to the control oil sample. UHF-treatment of the ground walnut conducted in equipment MC - 7643D (2450 MHz, 900W, 100^{o}C, exposure time 5 min).

Principle of oil sample preparation for FAC assay includes alkaline hydrolysis of triglycerides to free fatty acids with further etherification to yield fatty acid methyl ethers [4]. Fatty acids methyl ethers compound was determined by gas chromatography at such conditions: column capillary 50m, temperature of vaporizer, column and detector 180^{o}C, 200^{o}C and 220^{o}C, respectively; flamingly-ionization detector; carrier gas - nitrogen. Results processed with the use of the computer program "NET - chrom WIN".

III. Results

The use of high-efficient capillary column allowed identifying 26 fatty acids and their isomers from $C_{4:0}$ to $C_{24:1}$. FAC of the investigated oil samples is shown in the table 1.

Table 1

Walnut oil fatty acid composition

Fatty acids	Walnut oil (%w/w)	
	control sample	walnut UHF-treatment application
1	2	3
C 4:0 butanoic	0,0014	-
C 6:0 caproic	0,0012	-
C 8:0 caprylic	0,0084	0,0022
C 10:0 capric	0,0015	0,0024
C 11:0 undecanoic	-	-
C 12:0 lauric	0,023	-
C 14:0 myristic	0,026	0,024
C 15:0 pentadecanoic	0,042	0,025
C 16:0 palmitic	7,46	7,26
C 16:1 palmitoleic	0,13	0,12
C 17:0 margaric	0,031	0,036
C 17:1 heptadecenoic	0,025	0,07
C 18:0 stearic	0,68	0,49
C 18:1 n9c oleic	16,98	17,5
C 18:2 n6c cis- linoleic	60,2	60,88
C 18:2 n6t транс- linoleic	0,039	0,0086
C 18:3 n6 linolenic	0,068	0,034
C 18:3 n3 α- linolenic	12,24	11,82
C 20:0 arachic	0,075	0,07
C 20:1 n9 gadoleic	0,13	0,14
C 20:2 cis-11,14- eicosadienoic	0,04	0,022
C 20:3 n6 cis-8,11,14- eicosatrienoic	0,54	0,0077
C 20:3 n3 cis-11,14,17- eicosatrienoic	-	0,0028
C 20:4 arachidonic	0,0034	0,0027
C 20:5 n3 цис-5,8,11,14,17-eicosapentanoic	0,019	0,0081
C 22:0 behenic	0,057	0,16
C 22:1 n9 erucic	0,0044	0,027
C 22:2 docosadienoic	0,0029	-
C 24:0 tetracosanoic	0,0075	0,011

Quantitative content of acids (C4: 0 - C10: 0) was insignificant in comparison to that of higher hydrocarboxylic acids (C>10) (table 1). Content of 6 higher fatty acids prevailing in walnut composition is shown in table. 2.

Table 2

Walnut oil prevailing fatty acids

Fatty acids	Walnut oil (%w/w)	
	control sample	walnut UHF-treatment application
1	2	3
Saturated fatty acids:		
palmitic (C16:0)	7,46	7,27
stearic (C18:0)	0,68	0,49
Monounsaturated fatty acids:		
oleic (C18:1)	16,98	17,5

erucic (C22:1)	0,004	0,03
PUFA:		
ω_6 linoleic (C18:2)	60,21	60,88
ω_3 linolenic (C18:2)	12,24	11,82

Consequently, content of the identified higher fatty acids changed after walnut UHF-treatment.

The obtained data testified that walnut UHF-treatment application caused decrease of total saturated fatty acids and increase monounsaturated fatty acids and PUFA content. These changes confirm the conclusions of Bryuhnova about capacity of plant cells to change FAC upon the temperatures outside of the tolerance zone [3]. On the whole it is worth to mention that walnut UHF EMF treatment did not cause any substantial changes of quantitative walnut oil FAC.

IV.Conclusions

The results of this study suggested that UHF electro-magnetic field application insignificantly influences on quality and quantitative composition of fatty acids being in walnut oil.

Thus, walnut UHF-treatment is possible to apply in oil industry without any harm for lipid fraction as well as decline biological value of oil.

LITERATURE

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