EFFECT OF ULTRA-HIGH FREQUENT PRE-TREATMENT OF WAINUT ON PROPERTIES OF OIL

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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 [1].

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 high lipid content and well-balanced fatty acid composition (FAC).

Conventional vegetable oil extraction is carried out by pressing or solvent extraction. Solvent oil extraction is the most efficient method; however, its application presents some industrial disadvantages such as plant security problems. Mechanical pressing oil extraction is technically less extensive and less labor-intensive than the extraction solvent method. The safety and simplicity of the whole process is advantageous than the more efficient solvent extraction equipment. Furthermore, materials pressed out generally have better preserved native properties, end products are free of chemicals and it is a safer process. However, extraction by just pressing the seeds is relatively inefficient. It is advisable to research new methodologies for pretreating substrates that also allow for better retention and availability of desirable plant metabolites [2].

Microwave heating is known as an exceptional alternative energy to other thermal applications due to its effective volumetric heat production. Microwave operations have extensive applications in food technologies such as oil extraction, pasteurization, sterilization, baking, blanching, cooking, drying, and thawing of different food products [3].

In addition, within different conventional pretreatments including de-hulling, size reduction, breaking, grinding, thermal treatment (cooking) and enzymatic hydrolysis, the utilization of irradiation microwave as a pretreatment method enables to save energy and reduce processing times due to delivering energy directly to materials through molecular interaction with the electromagnetic field, so generating heat throughout the volume of the material occurs and makes possible to obtain rapid and uniform heating of materials. By using microwave irradiation as pretreatment procedure before extraction of oil from the seeds, the higher extraction yield can be achieved due to cell membrane rapture; generating permanent pores and transferring oil from permeable cell walls [4, 2].

The effect of microwave treatment on walnut kernels was investigated as a pre-treatment process prior to oil processing by cold pressing. The quality characteristics (fatty acid composition, peroxide

value, acid value and iodine value) were measured. These results were compared to those of oil obtained from walnuts without any treatment.

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. Fatty acids methyl ethers compound was determined by gas chromatography. Fatty acid contents of walnut oil were 8,4% and 8,1% of saturated fatty acids for control sample and oil obtained with UHF-treatment of walnuts, respectively. Contents of unsaturated fatty acids were 90,5% and 90,7% for untreated and UHF-treated samples, respectively. Linoleic acid constitutes 66,5% and 67,1 of the unsaturated fatty acids, while palmitic acid makes 88,8% and 89,8% of the saturated fatty acid of control and treated oil sample, respectively.

The ω-3/ω-6 ratio in both samples is 1:5 that confirms that PUFA is well balanced. Peroxide value increases almost twice after UHF-treatment of walnuts, although both oil samples have low meaning of this index. Acid value is almost stable (0,42 and 0,36 mg KOH/g oil).

Iodine value increased from 117 for control sample to 156 g J_2/100g oil for oil obtained with microwave treatment of walnuts. High value of iodine index in both samples reflects a high degree of unsaturation. Increase of iodine value in oil sample obtained with treatment of walnut accord with increase of unsaturated fatty acids content. The obtained data testified that walnut UHF-treatment application caused decrease of total saturated fatty acids and increase monounsaturated fatty acids and PUFA content.

On the whole, results of this study suggested that UHF electro-magnetic field application insignificantly influences quality indices and fatty acids being in walnut oil.

References:

1. Azadmard-Damirchi. S. Effect of pretreatment with microwaves on oxidative stability and utraceuticals content of oil from rapeseed, S. *Azadmard-Damirchi, F. Habibi-Nodeh, J. Hesari, M. Nemati, B. Fathi Achachlouei* // Food Chemistry. – 2010. - vol.121. - P.1211–1215.

2. *Ignat A.* New formulation and processing strategies for the manufacturing of cheese fortified with omega-3 /Ignat A, Gulotta A et al//. Fats, oils and lipids: from science and technology to health: materials of10th Euro Fed Lipid Congress, 23 - 26.09.2012., Cracow., Poland. / Jagiellonian University of Cracow. - Cracow, 2012. - P. 234.

3. *Uquiche E*. Effect of pretreatment with microwaves on mechanical extraction yield and quality of vegetable oil from Chilean hazelnuts (Gevuina avellana Mol) / E. Uquiche, M. Jerez, J. Ortiz // Innovative Food Science and Emerging Technologies. - 2008. - vol. 9. - P. 495–500.

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