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## FATTY ACIDS IN THE COMPONENTS OF VIBURNUM OPULUS FRUIT

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**Abstract**

**Aim.** To study the composition of fatty acids of the components of *Viburnum opulus* fruit collected in Ukraine. The object of the study was fatty acids obtained in the kernel and the pericarp of domestic *Viburnum opulus* fruit. The study of fatty acids was performed by GC/MC.

Eight fatty acids in the kernel and 14 fatty acids in the pericarp have been identified, among of them 8 acids are common. Oleinic and linoleic acids (each – approximately 50 % from the total amount of fatty acids and about 30 % from the amount of fatty acids, respectively) were found in significant amounts in the kernel and in the pericarp. These compounds are of interest in pharmacy and medicine as components with the anti-inflammatory, energetic and plastic activity.

**Conclusions.** The qualitative composition of fatty acids in the kernel and the pericarp of domestic *Viburnum opulus* fruits has been studied. The results obtained indicate the prospects of creating new drugs based on the biologically active complex Omega-9 containing in the kernel and the pericarp of *Viburnum opulus* fruit.

**Keywords:** Viburnum opulus; GC; fruits; fatty acids

Recently the popularity of unsaturated fatty acids has grown steadily in medicine [1, p. 75, 2, p. 6849, 3 p. 1445]. Depending on the location of double bonds in the fatty acid molecule there are three families of these compounds. Calculations start from the methyl group at the end of the fatty acid chain. These are polyunsaturated fatty acids named Omega-3, Omega-6 and Omega-9. First of all, Omega-3 polyunsaturated fatty acids are promising to use, primarily hexadecatrienoic and eicosapentaenoic acid in the prevention of premature aging and the treatment of chronic obstructive pulmonary disease [1, p. 75]. Compounds of this class of biologically active substances (BAS) are effective in promoting growth, treating coronary heart disease, arrhythmias, cardiomyopathy, and dyslipidemia. Representatives of Omega-6 polyunsaturated acids – γ-linolenic and arachidonic acids – play the same role as Omega-3 in the normal growth, but they have a better effect for the skin and the kidney function. However, the representatives of Omega-6 fatty acids under the action of some enzymes give rise to inflammatory substances – eicosanoids: prostaglandins, thromboxanes, prostacyclins and leukotrienes. Omega-3 forms eicosanoids much slower, and their role in formation of inflammation is less. When it has been known that Omega-6 eicosanoid thromboxane affects platelet sticking, and leukotrienes play an important role in the immune-inflammatory response of the body in arthritis, lupus erythematosus, asthma and infectious diseases, this competitive effect of Omega-3 and Omega-6 acquires particular importance. The most effective way of reducing the synthesis of Omega-6 eicosanoids is to consume more Omega-3 polyunsaturated fatty acids for the optimal ratio of Omega-3: Omega-6 – 1 : 2. In the human body the Omega-9 complex, which main component is monounsaturated oleic acid, has anti-inflammatory, energy and plastic properties. Humans do not need Omega-9 so much due to its synthesis in the body. However, the most important factors are the ratio of Omega-3 and Omega-6, as well as the intensity of the synthesis of Omega-9 [1, p. 75]. Therefore, obtaining a representative of the Omega-9 family – oleic acid from external sources is relevant. Recently, the popularity of studying lipid-containing the raw material has increased [4, p. 113, 5, p. 101, 6, , p. 128, 7, p. 711, 8, p. 260].

*Viburnum opulus* is a common bush of the domestic flora, one of the representatives of the genus *Viburnum* and family *Caprifoliaceae*. It is found in wild and cultivated state. The bark of *Viburnum* is the pharmacopoeial type of the raw material and has the hemostatic activity [9, p. 360]. The fruits of *Viburnum opulus* are

juicy drupe kernels, most often of a red or orange color. The exocarp (peel) is leathery dense translucent colored. The mesocarp (pulp) consists of large juicy cells. The endocarp with seed (kernel) is flat, round or heart-shaped, yellowish or pinkish. The studies on seeds of *Viburnum opulus* are known [10-15]. Most likely, the object of research in these works were kernels of the drupe (the endocarp with the seed enclosed in it), but not the seeds themselves. Thus, the effects of frost on the lipid composition of *Viburnum opulus* seeds [10, p. 636], changes in indicators (moisture content, fatty oil content, peroxide and acid numbers, protein content) in the crushed seeds of this plant during storage [11, p. 423], changes in the qualitative composition of lipids and substances of lipophilic nature in the process of fruit ripening were studied [12, p. 245]. The study of the fatty acid composition of seed lipids showed the fatty acid predominance in the ratio of 18 : 2 [13, p. 560]. However, there is no information found about the study of the fatty acid composition of the domestic raw material in the available literature. Therefore, the study of the qualitative composition of fatty acids in the components of *Viburnum opulus* fruits: the pericarp (exo- and mezocarp) and kernels (endocarp with seed), is of undoubted interest.

The **aim** of this work was to study the composition of fatty acids of the components of *Viburnum opulus* fruit collected in Ukraine.

**Materials and methods**

The fruits of *Viburnum opulus* were collected in September 2017 in the Chuguev district of the Kharkiv region on the edge of a pine forest. The raw material was ried in a SATURN ST-FP0114 dryer to an air-dry state at a temperature of 50-60 °C. The kernel was separated from the rest of the fruit. The raw material was crushed to a particle size of 2-3 mm.

Lipophilic fractions were obtained by exhaustive extraction with hexane. Methyl esters of fatty acids were formed during the hydrolysis. The method of gas chromatography and a "Selmichrom-1" with a flame-ionization detector were used. The gas chromatographic column made of a stainless steel was 2.5 m in diameter and 4 mm in the internal diameter, the stationary phase was inerton treated with 10 % diethylene glycol succinate (DEGS).

The working conditions were as follows: the temperature of the column thermostat – 180 °C, the temperature of a desiccator – 230 °C, the temperature of a detector – 220 °C, the flow rate of the gas carrier (nitrogen) – 30 cm3/min, the sample volume – 2 mm3 of the solution of acid methyl ester in hexane.

Identification of methyl esters of fatty acids were per-formed by the retention time of compounds compared to the retention time of a standard mixture (reference standards for saturated and unsaturated fatty acid methyl esters by *Sigma*). The composition of methyl esters was calculated by the method of internal normalization. Methyl esters of fatty acids were obtained by the modified Peisker method [16, p. 272], which provided full methylation of fatty acids. For methylation 30-50 mkl of the lipophilic fraction were measured in glass ampoules, 2.5 ml of a reaction mixture was added (a mixture of chloroform with methanol and sulfuric acid in the ratio of 100 : 100 : 1). The ampoules were sealed and placed in a thermostat at a temperature of 105 °C for 3 hours. After completion of methylation the ampoules were opened, their contents were transferred to a test tube, 0.2 g of a zinc sulphate powder, 2 ml of purified water and 2 ml of hexane were added for extraction of methyl esters. After careful shaking and settling the hexane extract was filtered and used for the chromatographic analysis.

**Results and discussion**

The results of the study of the fatty acid composition of the kernel and the pericarp of *Viburnum opulus* are given in Table. Eleven fatty acids (8 were identified) were found in the kernel. In the pericarp there were 15 fatty acids (14 were identified). Eight fatty acids were common to the both objects: 2 saturated and 6 unsaturated. It is noteworthy that the content of the amount of unsaturated fatty acids in the kernel was 97.37 % of the total amount, while the content of unsaturated fatty acids in the pericarp was in 1.5 times lower and was 66.77 % of the total amount. Monounsaturated oleic acid was dominant, its content in the kernel was 52.12 % of the total amount, and in the pericarp it was almost twice lower – 29.72 % of the total amount. In the pericarp, the content of polyunsaturated linoleic acid (26.80 % of the total amount) and saturated palmitic acid (23.12 % of the total amount) were comparable with the content of oleic acid. Thus, in the domestic raw material the ratio of fatty acids of 18 : 1 prevails, but not 18 : 2.

Table

**The quantitative content of fatty acids in the components of *Viburnum opulus* fruit (% of the amount)**

| Index according to IUPAC | Acid name | | Component of the fruit | |
|---|---|---|---|---|
| | according to IUPAC | trivial | kernel | pericarp |
| | | Saturated FA | | |
| **C 12 : 0** | Dodecanoic | Lauric | – | 1.12 |
| **C 14 : 0** | Tetradecanoic | Myristic | – | 2.02 |
| **C 16 : 0** | Hexadecanoic | Palmitic | 1.72 | 23.12 |
| **C 18 : 0** | Octadecanoic | Stearic | 0.57 | 3.45 |
| **C 20 : 0** | Eicosanoic | Arachidic | – | 1.67 |
| **C 22 : 0** | Docosanoic | Behenic | – | 0.85 |
| **C 24 : 0** | Tetracosanoic | Lignoceric | – | 0.90 |
| | | The amount of saturated FA | 2.29 | 33.13 |
| | | Unsaturated FA | | |

| Index according to IUPAC | Acid name | | Component of the fruit | |
|---|---|---|---|---|
| | according to IUPAC | trivial | kernel | pericarp |
| | | Saturated FA | | |
| **C 14 : 1** | (9Z)-tetradecenoic | Myristoleic | 0.04 | 0.38 |
| **C 16 : 1** | (9Z)-hexadec-9-enoic | Palmitoleic | 0.22 | 1.14 |
| **C 18 : 1** | cis-9-octadecene | Oleic | 52.12 | 29.72 |
| **C 18 : 2** | 9,12-octadecadienoic | Linoleic | 44.07 | 26.80 |
| **C 18 : 3** | 9,12,15-octadecatriene | Linolenic | 0.54 | 7.64 |
| **C 20 : 1** | 11-Eicosenoic | Gondoic | 0.37 | 0.12 |
| **C 22 : 1** | *cis*-13-docosenoic | Erucic | – | 0.97 |
| | The amount of unsaturated FA | | 97.37 | 66.77 |
| | Unidentified compound | | 0.07 | 0.10 |
| | Unidentified compound | | 0.25 | – |
| | Unidentified compound | | 0.03 | – |
| | The total amount of FA | | 100.01 | 100.00 |

CONCLUSIONS

The qualitative composition of fatty acids in the kernel and the pericarp of domestic *Viburnum opulus* fruits has been studied. The results obtained indicate the prospects of creating new drugs based on the biologically active complex Omega-9 containing in the kernel and the pericarp of *Viburnum opulus* fruit.

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