THE COMPOSITION OF VOLATILE SUBSTANCES OF COWBERRY LEAVES

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The qualitative composition and quantitative content of volatile substances of cowberry leaves (Vaccinium vitis-idaea L.) has been studied by gas chromatography. Identification of substances has been performed based on comparison of the mass spectra obtained with the data of the NIST05-WILEY library (approximately 500000 mass spectra). The retention indices of the components have been calculated according to the results of control tests of substances with addition of the mixture of normal alkanes (C₇-C₉). In cowberry leaves 51 substances have been found, 50 of them have been identified; squalene, palmitic acid, ethyl palmitate, oleic acid prevail. It has been determined that the content of volatile substances is 0.025%. Monoterpenes are presented by 14 substances, derivatives of linalool, geraniol, thymol and eugenol are prevalent. Caryophyllene oxide and farnesyl acetone C prevail among sesquiterpenes. Among organic and fatty acids the predominant substances are lauric, myristic, pentadecanoic, palmitoleic, palmitic, linoleic and linolenic acids.

In the world there is a tendency of growing interest in phytotherapy. Microorganisms have developed resistance to many existing antibacterial agents; therefore, the use of the medicinal plant raw material for creating antimicrobial drugs is an urgent direction of development of pharmaceutical science. The promising plant to create a new herbal medicine is cowberry (Vaccinium vitis-idaea L.), its resources are sufficient in Ukraine.

In traditional and official medicine a decoction of cowberry leaves is used as a highly effective medicine for the treatment of diseases of the kidney and the urinary tract. However, this dosage form has a number of disadvantages: difficulty to prepare, the absence of standardization, impossibility of long-term storage, continuous losses the trace amounts of the essential oil adsorbed on the inner surface of the refrigerator were washed twice from a small amount of the plant raw material was used in the chemist’s shop (batch 0715, manufactured by “Phyto svit” firm).

To obtain the essential oil from the raw material studied the method allowing to isolate the essential oil from a small amount of the plant raw material was used [6]. For distillation 22 ml “Agilent” vials (part number 5183-4536) with open lids and silicone seal were used. The weighed quantity of 2.0-3.0 g of the plant material was placed in a vial and filled with water to half the volume. The vial was closed with a lid with an air refrigerator and boiled on a sand bath for an hour. To avoid losses the trace amounts of the essential oil adsorbed on the inner surface of the refrigerator were washed twice with 1-2 ml of petroleum ether; the washings were collected to the vial.

The qualitative composition and quantitative content of terpenoids were determined by gas chromatography using an Agilent Technology 6890 gas chromatograph (GC) with a mass spectrometric detector 5973 (MS). For analysis the HP-5 chromatographic column with the length of 30 m and the internal diameter of 0.25 mm was used. The analysis was carried out under the following conditions: the thermostat temperature was programmed from 50°C to 250°C at the rate of 4°C/min; the temperature of the sample injection heater was 250°C; the carrier gas was helium; the flow rate – ml/min; the flow from GC to MS was heated to 230°C; the source temperature was maintained at 200°C; electron ionization was carried out at 70 eV in the mass ranging from m/z 29 to 450. Identification was performed based on comparison of the mass spectra obtained with the data of the NIST05-WILEY library (approximately 500000
The chemical composition of volatile substances of cowberry leaves

| No. | Retention time | The substance identified | The content of volatile substances (mg/kg) |
|-----|----------------|--------------------------|------------------------------------------|
| 1   | 8.886          | trans-linalool oxide     | 0.74                                     |
| 2   | 9.333          | cis-linalool oxide       | 0.49                                     |
| 3   | 9.803          | linalool                 | 5.03                                     |
| 4   | 12.124         | terpinene-4-ol           | 0.78                                     |
| 5   | 12.217         | p-cumene-8-ol            | 0.30                                     |
| 6   | 12.556         | p-ment-1-en-8-ol         | 14.05                                    |
| 7   | 15.301         | geraniol                 | 2.03                                     |
| 8   | 16.033         | thymol                   | 3.64                                     |
| 9   | 17.637         | eugenol                  | 2.84                                     |
| 10  | 19.002         | capryllic acid           | 1.55                                     |
| 11  | 19.241         | 1,2,3,4-tetrahydro-2,5,8-trimethylnaphthalene-1-ol | 0.35 |
| 12  | 19.557         | oct-7-en-2-ol            | 0.26                                     |
| 13  | 19.942         | tetradecane              | 0.59                                     |
| 14  | 20.451         | *                        | 0.46                                     |
| 15  | 20.79          | geranyl acetone          | 5.10                                     |
| 16  | 21.577         | trans-β-ionone           | 0.64                                     |
| 17  | 21.662         | cis-β-ionone             | 1.11                                     |
| 18  | 22.541         | α-muuroleone             | 0.87                                     |
| 19  | 22.826         | γ-cadinene               | 0.92                                     |
| 20  | 23.042         | α-bisabolol              | 0.83                                     |
| 21  | 24.514         | caryophyllene oxide      | 4.15                                     |
| 22  | 24.807         | lauric acid              | 2.03                                     |
| 23  | 25.185         | benzophenone             | 3.06                                     |
| 24  | 26.218         | tau-muorol               | 1.65                                     |
| 25  | 26.519         | α-cadinol                | 1.26                                     |
| 26  | 27.136         | vinyl laurinate          | 0.37                                     |
| 27  | 27.622         | 6,10-methyundecane-2-one | 0.22 |
| 28  | 29.194         | myristic acid            | 9.11                                     |
| 29  | 29.472         | ethyl myristate          | 1.39                                     |
| 30  | 30.297         | 6,10,14-pentadec-2-one   | 4.24                                     |
| 31  | 30.736         | pentadecanoic acid       | 5.47                                     |
| 32  | 31.222         | farnesyl acetone C       | 3.03                                     |
| 33  | 31.901         | palmitoleic acid         | 19.14                                    |
| 34  | 32.34          | palmitic acid            | 49.39                                    |
| 35  | 32.464         | ethyl palmimate          | 11.02                                    |
| 36  | 32.626         | 14-β-pregnane            | 2.36                                     |
| 37  | 34.144         | linoleic acid            | 4.29                                     |
| 38  | 34.299         | linolenic acid           | 5.99                                     |
| 39  | 34.345         | oleic acid               | 10.14                                    |
| 40  | 34.43          | ethyl linoleate          | 0.98                                     |
| 41  | 34.476         | ethyl linolenoate        | 0.52                                     |
| 42  | 34.538         | ethyl oleinoate of stearic acid | 1.05 |
| 43  | 34.615         | ethyl stearate           | 4.32                                     |
| 44  | 34.885         | tricosane                | 0.48                                     |
| 45  | 36.226         | tetracosane              | 0.91                                     |
| 46  | 36.789         | pentacosane              | 0.25                                     |
| 47  | 37.259         | hexacosane               | 0.69                                     |
| 48  | 38.269         | heptacosane              | 4.10                                     |
| 49  | 40.128         | squalene                 | 2.74                                     |
| 50  | 41.168         | nonacosane               | 47.70                                    |
| 51  | 41.862         | trans-linalool oxide     | 2.22                                     |

Fig. The chromatogram of volatile substances of cowberry leaves.
Results and Discussion

The yield of volatile substances was calculated from the sum of all areas on the chromatogram. The content of volatile substances is 0.025%.

In cowberry leaves 50 volatile substances have been identified, identification of 1 substance has not been successful. Monoterpenes are presented by 14 substances, derivatives of linalool, geraniol, thymol and eugenol are prevalent. Caryophyllene oxide and farnesyl acetone C prevail among sesquiterpenes. Among organic and fatty acids the predominant substances are lauric, myristic, pentadecanoic, palmitoleic, palmitic, linoleic and linolenic acids.

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