Assessment of the nutritional value of southern dogwood oil

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Abstract. The paper presents the results of the research on the extraction and study of the composition of the oil from the fruit pulps and seeds of Southern Dogwood (Swida australis). The method of circulating extraction was used to produce oil. The resulting extracts were converted to fatty acid methyl esters and studied using a mass spectrometer. It is found that the total amount of lipids that can be used in the food industry is more than 70%. The oil composition includes a significant amount of omega acids, as well as a small amount of organic acids, hydrocarbons and esters. During the research we found Squalene in the oil of fruit pulps of Southern Dogwood. It is a valuable biologically active substance, which is absent in seed oil and used in medicine and cosmetology. Southern Dogwood is a promising source of edible vegetable oils and biologically active substances.

1. Introduction

Downstream processing and production from the raw materials of complex composition of the most valuable products is necessary for the integrated use of plant resources [1]. Therefore, the study of plant materials for the determination of its component composition in order to establish areas of application is relevant. In this regard, it is relevant and promising to search for new essential oil plant species as well as to assess resource potential and cultivation possibilities, isolate and study oil and also screen biologically active compounds in the biomass of such plants in order to create new therapeutic and prophylactic drugs based on them. Different authors studied the qualitative characteristics of vegetable oils [2-5].

One of the types of essential oil crops with great resource potential is Southern Dogwood - Cornus sanguinea susbp. australis (C.A. May) [6,7]. Southern Dogwood is spread in the territory from Western
Europe to European Russia. A plant was used in culture for a long time, but due to little knowledge, there is no information on the lipid composition of seed vessel oil and Southern Dogwood seeds.

Southern Dogwood is resistant to urban conditions and therefore can be used for planting in cities. Southern Dogwood is not moisture sensitive, it survives well in hot climates, but it is much less resistant to severe frosts. Due to its resistance to urban gas pollution and harmful impurities in the environment, Southern Dogwood can serve as a natural filter for air purification and oxygen production.

It is also known that seeds and seed vessel contain drying oils used for lighting; greenish-blue paint can be extracted from the fruit pulp. Due to its special flexibility wood can be used for weaving and can be a source of activated carbon and excellent heating oil. In the conditions of Northern Dagestan, Southern Dogwood may be an acceptable planting material for the recreation of salt-saturated lands.

The purpose of this research was to extract oil and determine the component and quantitative chemical composition of the oil from the fruit pulps and seeds of Southern Dogwood to find the areas of its application.

2. Materials and methods

We took the pulp and seeds of Southern Dogwood were selected as the research object. It is known that the fruit pulp of Southern Dogwood may contain up to 45% of fatty oils [8]. We selected the samples of fruits and seeds of Southern Dogwood, grown in the park zone of Makhachkala (at the altitude of 10 m above sea level), in the area of Mogokhsky bridge (at the altitude of about 1000 meters above sea level) and the Kuppinsky Pass area, which is located at an altitude of 1385 m. All the samples of Southern Dogwood were obtained from experimental sites of the Mountain Botanical Garden of the Dagestan Scientific Center of the Russian Academy of Sciences.

In order to extract oils from the pulp and seeds of Southern Dogwood we used the method of hexane multiple extraction (GOST 25828-83) [9]. The method consists in repeated processing of pulp and seeds of Southern Dogwood with the same dose of a low boiling extraction agent - hexane in a closed cycle. This method is used in the case of highly volatile extraction agent and heat-resistant extractable substances. Extraction was carried out in a Soxhlet apparatus by repeated processing of plant materials with hexane in a closed cycle. Hexane was then removed in a rotary evaporator under vacuum.

The analysis of hexane extracts was carried out in the form of fatty acid methyl esters on a gas chromatography-mass spectrometer (GC / MS) by Maestro 7820/5975 Agilent Technologies.

Chromatograms were obtained in the full ion current mode and in the scanning range of 30–550 m / e. Temperature programming mode was 70 ° C / 5 min 10 ° C / min 210 ° C / 25 min. The temperature of the evaporator was maintained at 230 ° C; the temperature of the interface line was 210 ° C. The samples were injected manually with a volume of 1 μl with split ratio 1:10. The flow rate of the carrier gas (He) was 1 ml / min, the ionization energy was 70 eV and the temperature of the ion source was 250 ° C. The analysis was carried out on a capillary quartz polar column (50 m x 0.25 mm) with a stationary FAPP phase. In order to identify the components, the obtained mass spectra were compared with the NIST 08 library.

3. Study of Southern Dogwood oil composition

The studies showed that the oil yield depends both on the agroclimatic conditions of cultivation and on the varietal characteristics of a tree. The smallest amount of lipids was extracted from the fruit pulps of Dogwood grown in the park zone of Makhachkala. In this case, the lipid content was less than 20% by weight of the pulp. The intermediate amount of lipids - more than 20% was obtained from the pulp of the samples collected in the Kuppinsky Pass. The largest amount of lipids more- than 40% was extracted from the samples collected in the Mogokh bridge area [8].
Table 1. Lipid composition of the oil from Dogwood fruit pulps during hexane extraction

| №  | Time yield, min. | Substance content, % | Substance                        | Chemical formula |
|----|-----------------|----------------------|----------------------------------|-----------------|
| 1  | 5.95            | 0.1                  | Tetradecanoic acid methyl ester  | C14:0           |
| 2  | 8.59            | 19.4                 | Hexadecanoic acid methyl ester   | C16:0           |
| 3  | 9.10            | 1.7                  | 9-hexadecenoic acid methyl ester | C16:1ω-6       |
| 4  | 10.10           | 0.1                  | Hentriacontane                   | C31H64          |
| 5  | 10.44           | 0.2                  | 15-methylhexadecanoic acid methyl ester | C17:0       |
| 6  | 11.13           | 0.1                  | Cis-10-heptadecenoic acid methyl ester | C17:1ω-6     |
| 7  | 13.06           | 2.5                  | Stearic acid methyl ester        | C18:0           |
| 8  | 14.07           | 35.0                 | 9-octadecenoic acid methyl ester | C18:1ω-9       |
| 9  | 15.85           | 34.9                 | 9,12-octadecadienoic acid methyl ester | C18:2ω-6   |
| 10 | 18.36           | 2.3                  | 9,12,15-octadecatrienoic acid methyl ester | C18:3ω-3   |
| 11 | 19.45           | 0.3                  | Succinic (amber) acid            | C4H6O4          |
| 12 | 21.07           | 0.2                  | 18-methylnonadecanoic acid methyl ester | C20:0       |
| 13 | 22.40           | 0.5                  | Cis-eicosenoic acid methyl ester | C20:1ω-9       |
| 14 | 23.63           | 1.7                  | Heptacosane                      | C27H56          |
| 15 | 25.75           | 0.2                  | Methoxacetic acid 2-pentadecyl ester | C18H36O3    |
| 16 | 27.84           | 0.8                  | Octadecenoic acid                | C18:1ω-9       |

According to Table 1, the main lipid components are fatty acids contained in triacylglycerides of the Southern Dogwood oil, such as hexadecanoic, 9-octadecenoic, 9,12-octadecadienoic acids. The total fatty acid content of the oil is more than 97%. The content of all other oxygen-containing compounds is 0.5%, and hydrocarbons - 1.8%. The total amount of unsaturated omega acids that can be used in medicine and cosmetology is 75.3%. The content of saturated acids, mainly hexadecanoic and stearic, is 22.4%.

The comparative analysis of the oil composition showed that seed vessel lipids contained a greater amount of omega acids in comparison with their content in seeds, and also contained such a biologically active substance as squalene [10], which is absent in seed oil. However, it is necessary to note that squalene, being an intermediate in the biological synthesis of steroids, easily passes into other compounds during drying and long-term storage. Therefore, in order to obtain squalene, it is necessary to use freshly picked fruits of Dogwood. According to published data, the % content of omega acids in olive oil is: ω-9 - 81, ω-6 - 15, ω-3 - 0.

The % content of unsaturated acids in sunflower oil is: ω-9 - 24 - 40, ω-6 - 46 - 72, ω-3 - 1. It was found that the oil from the fruits and seeds of Southern Dogwood contains ω-9 - 36.8 %, ω-6 - 36.7%, ω-3 - 2.3%. According to the presented data the oil from the fruits and seeds of Southern Dogwood is as qualitative as sunflower oil. We should note that omega-9 acids can be produced in the human body, and omega-6 and omega-3 acids are not synthesized in the body and come only with food.

In addition, omega-6 and omega-3 actively react with atmospheric oxygen when heated, forming carcinogenic oxidation products that adversely affect the entire body. Omega-9 acids, unlike omega-6
The high content of unsaturated acids (75.3%) indicates that the fruits and seeds of Southern Dogwood are a potential source of healthy edible vegetable oil. After the extraction of biologically active substances from seed vessel oil and seeds to obtain medical drugs, it is possible to use oil residues as additives that improve the characteristics of diesel fuel. Pulp after lipid extraction is of interest as a nutrient medium - a multi-component substrate used for the cultivation of microorganisms or biocytocultures of higher organisms.

4. Conclusion

Thus, the lipid composition of the oil from the fruits and seeds of Southern Dogwood of hexane extraction is determined. It is shown that seed vessel oil contains squalene and omega acids, which can be used in the pharmaceutical industry and cosmetology. Seed oil is also rich in omega acids.

The references include:

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and omega-3 acids, are more resistant to oxygen and temperature, and oils containing omega-9 acids are preferable to use for frying. According to the results of the research, we can conclude that the oil from fruits and seeds of Southern Dogwood can be eaten, and their biologically active substances can be used in medicine and cosmetology.