# A COMPARATIVE ANALYSIS OF *ARTEMISIA DRACUNCULUS L.* EXTRACTS.

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**Introduction**

*Artemisia dracunculus L.* is a popular spice and widely used in food industry [1, 2], but its application in the medicine was known from ancient times to the present day [3 - 6].

The most important classes of biologically active substances in *Artemisia dracunculus L.* are essential oil, coumarins, flavonoids, phenolcarboxylic acids, vitamins. Much attention of researchers is given to the essential oil, its composition, comparative analysis, and dynamics of variability [7 - 9].

A technique of the supercritical extraction from the plant raw materials can discover new possibilities for a more wide application of tarragon in food, medicine, and cosmetology industry.

The purpose of the work is to show both a difference between extracts of different sorts of tarragon and a distinction in extracts obtained by different techniques.

**Experimental procedure**

In framework of put problems dried tarragon of «French» and «Russian» sorts well-milled to 0.5-1.0 mm is carried out the supercritical (SC) extraction by $CO_2$ at pressure 20 MPa and temperature 31.5$^{o}$C. Then obtained «French» and «Russian» extracts and essential oil of «Russian» sort are analyzed by a technique of the gas chromatography with a mass-spectral and UV-detection in a device Saturn-2000 (Varian) in a column Stabilvax [10]. The raw material was grown in Vavilov Institute of Plant Cultivation (Derbent, Russian Federation) at a height of world ocean level.

**Results and Discussion**

The investigated two sorts of *Artemisia dracunculus L.* are obtained by means of artificial selection on taste qualities. The «French» sort is accepted to have more sharp taste and piquant aroma in comparison with «Russian» one. Probably such a distinction in taste and aroma is caused by a difference in composition of investigated extracts.

Basic distinctions are revealed between compositions of SC-$CO_2$: a composition of conditionally «light» fraction of «Russian» sort is multifarious, but its total portion is 19.224 %, while «French» sort has 35.670 %. The SC-$CO_2$ – extract of «Russian» sort is substantially saturated and various by a composition of «heavy» fraction determining the basic distinctions between essential oils and SC-$CO_2$ –extracts. A sum of coumarin derivatives in SC-$CO_2$ – extract of «Russian» sort is 16.591 %, in SC-$CO_2$ – extract of «French» sort is 25.370 %. The essential oil of «Russian» sort does not contain coumarins (Table 1).

In essential oil, as expected, a substantial portion (72.012 %) belongs to the «light» fraction; almost a half part occupies only one substance - methyleugenol (46.550 %). A portion of saturated hydrocarbons in the essential oil is 4-5 times much then in SC-$CO_2$ – extract.

Unlike the SC-$CO_2$ – extraction a steaming, in addition to steam effect, is connected with a content of water at the end of the process; after full cooling a condensate has several phases: hard phase composed of “resinous” substances; water phase, which dissolves a number of polar compounds; essential oil phase composed of nonpolar substances – terpenoids, aromatics, esters, and

Table 1.

A comparative analysis of SC-$CO_2$ extracts and the essential oil from *Artemisia dracunculus L.* dried green biomass (extract and essential oil are obtained out of 70 plant)

| Substances | % in quantity from the total mass of obtained compounds | | |
|---|---|---|---|
| | «French» sort | «Russian» sort | |
| | SC-$CO_2$ extract | SC-$CO_2$ extract | essential oil |
| β-Phellandrene | – | 1,773±0,104 | 12,485±0,781* |
| β-Pinene | – | 0,106±0,007 | 0,392±0,021* |
| α- Phellandrene | – | – | 0,076±0,004 |
| Limonene | 0,983±0,059* | 0,514±0,029 | 0,555±0,035 |
| Bicyclohept-2-en | – | 0,093±0,005 | 1,447±0,090 |
| γ-Terpinene | – | 0,584±0,034 | 1,154±0,072 |
| Ocimene | – | – | 1,398±0,087 |
| Cymol | – | 0,111±0,006 | 0,310±0,016* |
| Terpinolene | – | 0,048±0,002 | 0,401±0,024* |
| Linalool | – | – | 0,110±0,005 |
| Methyl-2-cyclohexenoat | – | – | 0,160±0,008 |
| 4-Terpineol | – | 0,380±0,021 | 3,218±0,189* |
| Bicycloheptane | 0,133±0,007* | 0,601±0,035 | 1,023±0,054 |
| Estragol (methylchavicol) | 28,309±1,887* | 0,280±0,014 | 1,023±0,057* |
| α- Terpineol | – | – | 0,179±0,009 |
| γ-Elemene | – | 0,159±0,008 | 0,147±0,008 |
| Nerylacetate | – | 0,162±0,008 | 0,491±0,027* |
| Methyleugenol | 4,841±0,302* | 13,774±0,912 | 46,550±3,103* |
| Methyl-pentadecanoat | 0,416±0,024* | 0,120±0,006 | 0,090±0,006 |
| Spathulenol | 1,164±0,065* | 0,441±0,027 | – |
| Methylisoeugenol | 1,699±0,099* | 1,747±0,097 | 2,029±0,119 |
| Methyl-hexadecanoat | 2,092±0,131* | 0,812±0,047 | 0,527±0,031 |
| Isoelemecine | 2,052±0,128* | 6,478±0,405 | 1,919±0,113* |
| Methyl-9-hexadecanoat | 0,865±0,051* | 0,194±0,010 | 0,171±0,010 |
| Ethyl-hexadecanoat | - | 0,193±0,011 | – |
| Elemicine | 0,029±0,001* | 0,125±0,006 | 0,077±0,005 |
| 3,4-Dimethyl benzaldehyde | – | 0,102±0,005 | – |
| Azaron | 6,981±0,411* | 21,693±1,356 | 4,949±0,275* |
| Methy octadecanoat | 0,515±0,029* | 0,210±0,010 | 0,159±0,009 |
| Ethyl oleate | – | 0,111±0,005 | – |
| 3, 4, 5- Trimethyl benzaldehyde | 0,466±0,026* | 0,885±0,052 | – |
| 9, 12, 15-Octadecatrienoic acid | – | 0,171±0,009 | – |
| 3-Methoxycinnamaldehyde | 0,788±0,044 | | – |
| Phytol | 1,416±0,079 | | – |
| Tetradecanoic acid | 2,843±0,178 | 2,121±0,132 | – |
| Pentadecanoic acid | – | 0,754±0,042 | – |
| n-Hexadecanoic acid | 7,743±0,484* | 9,512±0,594 | 1,070±0,063* |
| 7-Methoxycoumarine | 12,388±0,774* | 0,637±0,037 | – |
| Hexadecenoic acid | – | 2,894±0,181 | – |
| Squalen | 4,653±0,291* | 8,604±0,574 | 1,976±0,110* |
| 9-Octadecenoic acid | – | 2,134±0,118 | – |
| 3, 4, 7-Trimethoxycoumarine | 7,318±0,457* | 3,887±0,243 | – |
| 6, 7- Dimethoxycoumarine | 5,664±0,354* | 12,067±0,754 | – |
| Saturated hydrocarbons | 5,238±0,327 | 4,884±0,287 | 1,805±0,106* |

Note:* -the volue is statisticaly correct with respect of SC-$CO_2$ – extracts, at $P \leq 0,05$

others. The SC-$CO_2$ – extraction empowers to preserve a variety of substances composing the lipophilic fraction of the feed stock, as it realizes at the room temperature without contact with oxygen (this is confirmed by a presence of aldehydic compounds in SC-$CO_2$ - extracts). Thus the carbonic acids (saturated and unsaturated) in a composition of the SC-$CO_2$ – extraction of «Russian» sort occupies 17.855 %, in the SC-$CO_2$ – extraction of «French» sort – 11.374 %, whereas in the essential oil presents only 1.183 %. Perhaps they are generated under the hydrolysis of high-molecular esters (waxes), being an organic part of cuticle and lipid membranes of the plant cells with carbonic acid's participation, which creates from $CO_2$ and residual water of the feed stock and under the pressure becomes a reagent. Also in the supercritical processes the carbonic acid prevents a contamination of final products, preserves and stabilizes them.

In Table 1 are shown the data on the chemistry of SC-$CO_2$ – extracts of *Artemisia dracunculus L.* dried green biomass for «French» and «Russian» sorts, «Russian» essential oil.

Besides compounds, listed in Table 1, there are unidentified saturated hydrocarbons 5 % in quantity from the extract total mass in both extracts. A bulk of «Russian» sort extract falls at methyl eugenol, isoelemecine, azarone, hexadecenoic acid, squalen, 9-octadecenic acid, 3,4,7-trimethoxycoumarine, 6,7- dimethoxycoumarine (total 81 %). In «French» sort extract a basic portion falls at tarragol, methyl eugenol, methylhexadecanoat, isoelemecine, azarone, tetradecanoic acid, n-hexadecanoic acid, 7-methoxycoumarine (total 85 %).

As can be seen from the Table 1 the low-molecular terpenes are main components of SC-$CO_2$ – extracts of both sorts. A majority of them has a considerable biological activity and is used in medicine and perfumery for a long time.

**Conclusion**

A comparative analysis of the essential oil and SC-$CO_2$ – extract from *Artemisia dracunculus L.* of «Russian» sort shows that SC-$CO_2$ – extract substantially differs from an essential oil composition, obtained by steaming. The questions of SC-$CO_2$ – extracts pharmacological activity are particularly topical taking into account their active application in food industry and cosmetology as substitutes of essential oils and spices. For example, if the essential oil of «Russian» *Artemisia dracunculus L.* can be considered to be nontoxic, then a content of coumarines in its SC-$CO_2$ – extract would necessitate more profound estimation of possible by-effects.

A great variety of the lipophilic biologically active substances, contained in SC-$CO_2$ – extracts composition of «French» *Artemisia dracunculus L.* generate interest and give occasion to further biochemical and pharmacological investigations.

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