# GC-MS Investigation of Composition of Essential Oils, Extracted from Mentha Piperita and Pelargonium Roseum

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***Abstract***

*In the research the composition of essential oils extracted from medicinal plants "Mentha Piperita" and "Pelargonium Roseum" has been investigated by GC-MS method. It was determined that the content of essential oil extracted from "Mentha Piperita" is rich in menthol and its derivatives, that of "Pelargonium Roseum" is rich in citronellol and geraniol, as well as their derivatives and the content of menten, which adversely affects the quality of the oil is low.*

**Keywords** - *essential oil, Mentha Piperita, Pelargonium Roseum, ultrasound heating, composition, GC-MS, quantitative analysis*

## I. INTRODUCTION

Chromatography is primarily a powerful separation method. Today, it has taken a leading place among the methods of analyzing complex mixtures, and it is difficult to find the area of natural sciences, in which an achievement of chromatography would not be used. However, it should be considered that in the chromatographic process, the slightest differences in the physicochemical properties of the system components are realized due to multiple repetition of compounds distribution processes between stationary phase (liquid or solid, the general term is sorbent) and a mobile phase (liquid or gas). Therefore, the position and shape of the chromatographic peaks give not only the information needed to complete analytical characteristics of substances, and are determined by the basic thermodynamic regularities and reflect various kinetic parameters. In connection with this, chromatography is applied not only as an analytical method, but also as a measurement method of physico-chemical values. Today chromatography is used to study adsorption phenomena, thermodynamics of solutions, phase transitions, in kinetics, catalysis, and other sections of physical chemistry. Gas chromatographic study of the equilibrium vapor phase of various systems, including the composition of essential oils occupies special place [1].

The vegetation cover of Uzbekistan has about 4230 species, 1028 genera from 138 families. Among them - 492 cultivated and bred plants from 79 families. About 577 species of wild plants are medicinal plants and essential oil plants. The focused use of which is an actual task. Therefore, there are real prerequisites for the development of the essential oil industry and the creation of the production of essential oils in the Republic of Uzbekistan. Studying the chemical composition of essential oils plays an important role for the solution of such problems. In this regard, we studied the chemical composition of some essential oils by the method of GC-MS [2,3,4,5].

In the world the production of essential oils from Mentha Piperita and Pelargonium Roseum plays an important role. Lately the main application area of Mentha Piperita is pharmaceutical industry and menthol is prepared from it. Its use in the perfume and food industry is based on its fragrance. At the same time the essential oils, extracted from Pelargonium Roseum play an important role to meet the needs of the industry (perfume, pharmaceutics, food and etc.) for essential oils [6,7,8,9]. An extraction of essential oils from them is important from the point of view of meeting the needs of the manufacturing plants in the Republic of Uzbekistan. The main indicator of the extracted oils is evaluated on their qualitative and quantitative content. Therefore the Gas-chromatography and mass spectrometric (GC-MS) investigation of the content of the essential oils, extracted from Mentha Piperita and Pelargonium Roseum grown in the climate of the Republic of Uzbekistan is actual. The purpose of the research is to study the content of essential oils, extracted from Mentha Piperita and Pelargonium Roseum by GC-MS method.

## II. MATERIALS AND METHODS

**Plant sample**

Mentha Piperita samples were collected from Zerafshan mountain ridges, Pelargonium Roseum samples from the plant grown in home condition.

**Extraction of essential oils**

The essential oils have been extracted from composition of the plants, grown in 2016-2017 by ultrasound heating and hydrodistillation methods [10,11].

**GC-MS analysis**

The qualitative and quantitative content of the essential oils has been analyzed on the capillary column coated with HP-5 MS as a stationary phase in thickness of 0.25 μm and with the size of 30m x 0.25 mm in GC-MS Agilent 5975 in the Center of High technologies in Tashkent. The probe for the analysis was prepared by dissolving 10 mkl essential oil in 0.5 ml hexane. Chromatographic analysis of the sample has been carried out in isothermal and temperature programming (planning) regime. The temperature planning was combined in the interval from 100 to $280^0$C. For that, at first the temperature $100^0$C has been kept for 1 minute, then it was increased up to $200^0$C with the rate $10^0$C/min. The temperature $200^0$C has been kept for 5 minutes, then it was increased up to $280^0$C with the rate $5^0$C/min and it has been kept for 10 minutes.

## III. RESULTS AND THEIR DISCUSSIONS

Qualitative analysis of the components in the essential oils extracted from Mentha Piperita and Pelargonium Roseum has been carried out on mass spectra catalog and by the method of the structure group contributions.

The composition of the identified components was determined using the method of internal standards [12]. Qualitative and quantitative composition (C, %) of essential oil, extracted from Mentha Piperita are presented in table 1.

Table 1: Qualitative and quantitative composition of essential oil, extracted from Mentha Piperita (C, %)

| № | Compound name | τ, min | C, % |
|---|---|---|---|
| 1 | Tetrahydro-4-methyl-2- (2-methyl-1-propenyl-2H-pyran | 3,34 | 0,34 |
| 2 | 5-methyl-2- (1-methylethyl) cyclohexanone | 3,85 | 0,46 |
| 3 | 5-methyl-2-(1-methylpropyl) cyclohexanone | 3,97 | 0,98 |
| 4 | Menthol | 4,03 | 6,46 |
| 5 | 3,7-dimethyl-6-octene-1-ol | 4,64 | 27,08 |
| 6 | 3,7-dimethyl-6-octene-1-ol acetate | 4,79 | 0,71 |
| 7 | 5-methyl-2- (1-methylethyl) -4-hexene-1-ol | 4,90 | 4,17 |
| 8 | 3,7-dimethyl-6-octen-1-ol formate | 5,17 | 14,56 |
| 9 | 3,7-dimethyl-2,6-octadien-1-ol | 5,47 | 1,76 |
| 10 | Tetrahydro-4-methyl-2- (2-methylethyl) -2H-pyran | 5,85 | 1,01 |
| 11 | 3,7-dimethyl-6-octene-1-ol acetate | 6,07 | 0,86 |
| 12 | 3,7-dimethyl-2,6-octadien-1-ol | 6,43 | 0,40 |
| 13 | Kapapen | 6,49 | 1,00 |
| 14 | Cyclobutt [1,2:3,4] dicyclo-penten | 7,00 | 3,52 |
| 15 | Cariofillin | 7,05 | 1,07 |
| 16 | Dikagidro-1,1,7-trimethyl-4-methylene-1H-cyclopropioacylen | 7,15 | 1,15 |
| 17 | 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7-naphthalene | 7,46 | 0,31 |
| 18 | α – Cariofillen | 7,53 | 0,91 |
| 19 | Butane acid-3,7-dimethyl-6-octene-1-ol ester | 8,18 | 3,81 |
| 20 | 1,2,3,4-tetrahydro-1-naphthalene | 8,24 | 0,92 |
| 21 | Butane acid-3,7-dimethyl-2,6-octadiene-1-ol ester | 8,56 | 1,70 |
| 22 | Z-3-heptadeken-5-in | 8,63 | 0,62 |
| 23 | 2,3-dimethyl-2-hexanol | 8,69 | 0,36 |
| 24 | Propionic acid-2-phenylethyl ester | 8,92 | 3,58 |
| 25 | Carifillin oxide | 9,02 | 6,11 |
| 26 | Guanol | 9,09 | 0,45 |
| 27 | 3-oxatricyclo [4.1.1.02.4] octane | 9,29 | 2,08 |
| 28 | 1,2,3,4,4a,7-hexahydro-naphthalene | 9,46 | 0,49 |
| 29 | Cariofillin | 9,58 | 0,54 |
| 30 | 2-Cubebene | 9,63 | 0,93 |
| 31 | 3,7-dimethyl-6-octene-1-ol propionate | 9,76 | 2,93 |
| 32 | Phenylacetic acid-3,7-dimethyl-6-octene-1-ol ester | 9,95 | 1,64 |
| 33 | Geraniol residue | 10,16 | 3,24 |
| 34 | 3,7-dimethyl-2,6-octadiene-1-ol | 10,32 | 0,65 |
| 35 | Geraniol pentanate | 10,70 | 0,31 |
| 36 | Butane acid-3,7-dimethyl-6-octene-1-ol ester | 11,36 | 0,36 |
| 37 | 7,7'-dimethyl-bicyclo [2,2,1] heptane | 11,74 | 0,50 |
| 38 | (2-methylpropyl) – cyclopentane | 12,03 | 0,40 |
| 39 | 3,7-dimethyl-6-octene-1-ol propionate | 12,45 | 0,42 |
| 40 | 3,7-dimethyl-2,6-octadiene-1-ol | 12,85 | 0,27 |
| 41 | 2,3,6-trimethylhept-3-en-1-ol | 17,11 | 0,60 |
| 42 | 3,5-dimethyl-1,6-heptadiene | 17,62 | 0,34 |

Qualitative and quantitative composition (C, %) of essential oil, extracted from Pelargonium Roseum are presented in table 2.

Table 2: Qualitative and quantitative composition of essential oil, extracted from Pelargonium Roseum (C, %)

| № | Compound name | τ, min | C, % |
|---|---|---|---|
| 1 | 3,7-dimethyl-1,6-octadiene-3-ol | 3,22 | 0,47 |
| 2 | Tetrahydro-4-methyl-2- (2-methyl-1-propenyl-2H-pyran | 3,35 | 1,20 |
| 3 | 5-methyl-2- (1-methylethyl) cyclohexanone | 3,86 | 0,53 |
| 4 | 5-methyl-2- (1-methylpro-pyl) cyclohexanone | 3,98 | 1,40 |
| 5 | 5-methyl-2- (1-methylbutyl) cyclohexanone | 4,03 | 1,33 |
| 6 | 3,7-dimethyl-6-octene-1-ol | 4,65 | 29,26 |
| 7 | 3,7-dimethyl-2,6-octadien-1-ol | 4,92 | 5,66 |
| 8 | 3,7-dimethyl-6-octen-1-ol formate | 5,18 | 16,33 |
| 9 | 3,7-dimethyl-2,6-octadien-1-ol formate | 5,49 | 2,12 |
| 10 | 3,7-dimethyl-2,6-octadien-1-ol acetate | 6,07 | 0,46 |
| 11 | Kapaen | 6,49 | 1,25 |
| 12 | Cyclobutt [1,2: 3,4] dicyclopenten | 6,63 | 3,26 |
| 13 | Cariofillin | 7,06 | 5,82 |
| 14 | 3,7-dimethyl-6-octene-1-ol propionate | 7,16 | 1,32 |
| 15 | Dikagidro-1,1,7-trimethyl-4-methylene-1H-cyclopropioacylen | 7,29 | 0,37 |
| 16 | 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7-(1-methylethyl)-naphthalene | 7,37 | 0,52 |
| 17 | α – Cariofillen | 7,46 | 1,32 |
| 18 | 3,7-dimethyl-2,6-octadien-1-ol acetate | 7,54 | 1,04 |
| 19 | Germacren D | 7,79 | 2,13 |
| 20 | 2,5,6-trimethyl-1,3,6-heptatriene | 7,97 | 1,52 |
| 21 | Butanoic acid 3,7-dimethyl-6-octenyl ester | 8,18 | 2,11 |
| 22 | 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-naphthalene | 8,24 | 1,89 |
| 23 | Butane acid-3,7-dimethyl-2,6-octadiene-1-ol ester | 8,56 | 1,16 |
| 24 | 5-methylene-6-bicyclo-3-cyclohexen-1-ol | 8,63 | 0,32 |
| 25 | Propionic acid-2-phenylethyl ester | 8,93 | 2,87 |
| 26 | Cariofillin oxide | 9,01 | 2,82 |
| 27 | Levomenol | 9,29 | 0,72 |
| 28 | 1,2,3,4,4a,7-hexahydro-1,6-dimethyl-4-(1-methylethyl)-naphthalene | 9,33 | 0,46 |
| 29 | Camphor | 9,53 | 0,38 |
| 30 | 4,11,11-trimethyl-8-methylene-bicyclo [7.2.0] undec-4-ene | 9,59 | 0,47 |
| 31 | α-Cubebene | 9,64 | 0,91 |
| 32 | Ment-1 (8)-en | 9,77 | 2,44 |
| 33 | 3-(2-methylpropyl)-cyclohexene | 9,95 | 1,06 |
| 34 | Geraniol residue | 10,16 | 3,07 |
| 35 | 3,7-dimethyl-2,6-octadiene-1-ol propionate | 10,32 | 0,49 |
| 36 | Limonen | 10,7 | 0,33 |
| 37 | D-Limonen | 11,74 | 0,27 |
| 38 | Camfen | 12,85 | 0,39 |

## IV. CONCLUSIONS

1. The composition of essential oils extracted from medicinal plants "Mentha Piperita" and "Pelargonium Roseum" has been investigated by GC-MS method.
2. It was determined that the content of essential oil extracted from "Mentha Piperita" is rich in menthol and its derivatives, that of "Pelargonium Roseum" is rich in citronellol and geraniol, as well as their derivatives and the content of menten, which adversely affects the quality of the oil is low.

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