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GC- MS Analysis of Essential Oil Extract from Leaves and Stems of Tarragon (Artemisia dracunculus L.)

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Abstract:
The aim of this study was to investigate the phytochemical diversity of essential oil of leaves and stems of tarragon (*Artemisia dracunculus* L.) with main functional components, essential oils extracted by hydro-distillation using Clevenger apparatus and the phytochemical compound screened by GC-MS instrument. Forty bioactive phytochemical compounds were identified in the essential oil of (Artemisia dracunculus L.). The detection of phytochemical compounds is based on the peak area, retention time, molecular weight, molecular formula, chemical structure, MS Fragment ions and pharmacological actions. GC-MS analysis of (*Artemisia dracunculus* L.) revealed to the existence of the α-pinene, Camphene, β-Thujene, L-β-Pinene, 3-Octanone, β.-Myrcene, dl-5-Hydroxylysine,N,N,o-tris(tert-butyldimethylsilyl)-,tert-butyldimethylsilylester, α-Terpinene, m-Cymene, Eucalyptol, γ-Terpinene, cis-Sabinene hydrate, (+)-4-Carene,β-Methylisoallylbenzene , Linalool, Chrysanthenone, Camphor, Evonine, Carbamic acid, [2-[[1-(diphenoxyphosphinyl)-2-phenylethyl]amino]-2-oxo-1-, (-)-Borneol , (-)-terpinen-4-ol (3-Cyclohexen-1-ol,4-methyl-1-(1-methylethyl)-,(R)-), Phenol,2-ethyl-4,5-dimethyl-, α-Terpineol (3-Cyclohexene-1-methanol,.alpha.,.alpha.,4-trimethyl-,(S)-), Borneol, cis-Verbenone,cis-Carveol, (-)-cis-Myrtanol, Dihydrocarveol (Cyclohexanol,2-methyl-5-(1-methylethenyl)-), p-Benzoquinone,2-(3-hydroxy-3,7,11,15,19,23,27-heptamethyl-6,10,14,18,22,26-oct, Methyl nerolate (3,6-Octadienoicacid,3,7-dimethyl-,methylester,(Z)-), Isopiperitenone (2-Cyclohexen-1-one,3-methyl-6-(1-methylethenyl)-,(S)-), bornyl ester, 2-Methylbicyclo[4.3.0]non-1(6)-ene, Piperitenone, Cyclopentane,1-acetoxymethyl-3-isopropenyl-2-methyl-, 3,5-Heptadienal,2-ethylidene-6-methyl-, Caryophyllene, 1,4,7,-Cycloundecatriene,1,5,9,9-tetramethyl-,Z,Z,Z-, Caryophylleneoxide, 1-Oxaspiro[2.5]octane,5,5-dimethyl-4-(3-methyl-1,3-butadienyl)-, The analysis of Artemisia dracunculus L. leaves and stems showed the presence of Alkenes, Aliphatic fluoro compounds, Alcohols, Ethers, Carboxylic acids, Esters, Nitro compounds, Alkanes, Aldehydes, Ketones compounds. These founding confirm that beside the uses of Tarragon as seasoning due to containing a wide range of essential oil diversity, it can be also useful for various herbal therapy, as anti-inflammatory, cardiac tonic analgesic, antipyretic, antiepileptic, laxative, antispasmodic, carminative remedy and anti-asthmatic.
Keywords: GC-MS Analysis, Essential oils, Tarragon, Medicinal plants, Health benefits.

INTRODUCTION

Tarragon (Artemisia dracunculus L) is one of the medicinal plants. Tarragon is a woody, perennial subshrub with stem heights ranging from 40 to 150 cm (Stubbendieck, 2003). Artemisia genus belongs to Asteraceae family and includes more than 500 plant species (Bora, 2011). Tarragon found throughout the northern half of the world including Europe, Asia, India and western Americaand also grows in Ukrainian steppe and forest steppe ecoregions (Mohsen, 2008). Tarragon (*Artemisia dracunculus* L.) is a well-known perennial aromatic plant that is consider one of the finest seasoning ingredients similar to Anise (Boiko, 2013). Tarragon whole plant is bald, smooth, and green, and young plants have only occasional branching (Aglarova, 2008). The use of *Artemisia dracunculus* was mentioned in ancient Greece, but some historicans considered that Asia is real tarragon's origin. At present, there are two well-described cultivars (Russian and French). (Abad M. J., 2012). Of *Artemisia dracunculus*, which differ in physiology, botanical features and phytochemical profile (Sutton, 1985). The genus Artemisia is known to contain many bioactive compounds; artemisinin exerts not only antimalarial activity but also profound cytotoxicity against tumor cells(Efferth, 2007) and arglabin is employed for treating certain types of cancer in the former USSR (Wong, 2002). The important groups of the Artemisia dracunculus bioactive secondary metabolites, are essential oil, coumarins, flavonoids and phenolic acids (Sayyah, 2004). It's main source is alluvial valleys and various parts of Russia and Siberia. But nowadays it has become a native to the western regions of North America. Also, it is grown in the most areas of Asia, Iran and has dispersed everywhere (Zargari 1992). The fresh and dried leaves are commonly used in salads and soups. This plant has been used in traditional folk medicine as appetizer, gastric tonic, diuretic, anti-scurvy and antiworm (Zargari 1992). It has been used as a Traditional Chinese drug for the treatment of gynaecepathy, amenerrhea, bruise and rheumatic disease (Kwak, 1997). Artemisia species are popular plants which are used for the treatment of diseases such as hepatitis, cancer, inflammation and infections by fungi, bacteria, and viruses (J. H. Kim,2002). Furthermore, several species of Artemisia are used in folk medicine, has been employed in the treatment of painful menstruation and in the induction of labor or miscarriage (Lee, 1998). Flavonoids, coumarins, phenylpropanoids, terpenes determine antimicrobial, antiviral, antifungal and antioxidant activities of *Artemisia dracunculus*. Such a broad spectrum of biological activities could cause tarragon`s use in pharmaceutical industry for treatment of diseases such as inflammation (Eidi , 2016), hepatitis (Aglarova , 2006) and different kind of infections e.g., bacterial or viral (Mohsenzadeh, 2007,O'Mahony, 2005). Both leaves and stems of Tarragon are can be used, either fresh or dried, as seasoning or as a folk medicine, leaves of *Artemisia dracunculus* accumulate artemisinh up to 0.27% (Mannan, 2010). Recent studies of *Artemisia dracunculus* were devoted to plant micropropagation (Fernández-Lizarazo, 2012), medicine compounds accumulation (Obolskiy , 2011) and artemisinin synthesis in particular (Mannan , 2010).

The aim of this study was to evaluate the active phytochemical compounds of leaves and stems of Tarragon (*Artemisia dracunculus)* grown under the environmental and soil condition of Sulaimani governorate.

MATERIALS AND METHODS

Collection and preparation of plant material

The leaves and stems were collected from farmer's field nearby Sulaimanyia governorate, north of Iraq. After thorough cleaning and removal foreign materials, the leaves with young branches of (*Artemisia dracunculus* L.) were obtained from 15th Mar to 1st July 2016 before blooming. The samples were cleaned in shade condition to prevent hydrolysis of the existing materials and to keep the natural color of the sample fixed. The leaves were dried in the lab temperature and were powdered and kept at appropriate conditions from the viewpoint of temperature and light until the essential oil taking stage. Afterwards, essential oil and Aqueous extract was taken from 100 g of the powdered sample in hydro-distillation method using Clevenger apparatus in 500 ml of distal water, kept at 4 °C until use(Bradley, 1993).

Gas chromatography mass spectrum analysis

The GC-MS instrument model (QP 2010 Plus SHIMADZU) under the computer control at 70 eV, was used to analysis the plant extract. About 1 µl of the essential oils was injected into the GC-MS using a micro syringe and the scanning was done for 20 min. As the compounds were separated, they eluted from the column and entered a detector which was capable of creating an electronic signal whenever a compound was detected. The greater the concentration in the sample, bigger was the signal obtained which was then processed by a computer (Dhia, 2016).

RESULTS AND DISCUSSION

Gas Chromatography and Mass spectroscopy analysis of compounds was carried out in essential oils leaves and stems hydro extract of (*Artemisia dracunculus* L.), shown in Table 1. The GC-MS chromatogram of the 40 peaks of the compounds detected was shown in Figure 1. Chromatogram GC-MS analysis of the essential oils extract of *Artemisia dracunculus* L. showed the presence of ten major peaks and the components corresponding to the peaks were determined as follows. The First set up peak was determined to be α-pinene Figure 2. The second peak indicated to be Eucalyptol. Figure 3. The next peaks considered to be Camphor, Borneol (Bicyclo[2.2.1]heptan-2-ol, 1,7,7-trimethyl-,1S-endo)-) , cis-Verbenone (Bicyclo[3.1.1]hept-3-en-2-one, 4,6,6-trimethyl-) , Camphene (Bicyclo[2.2.1]heptane, 2,2-dimethyl-3-methylene-, (1S)-)) , (3-Octanone) , bornyl ester (1,6-Octadien-3-ol, 3,7-dimethyl- , Acetic acid, 1,7,7-trimethyl-bicyclo[2.2.1]hept-2-yl ester), Linalool (3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, (S)-) , (Borneol), β.-Myrcene (Bicyclo[3.1.1]heptane, 6,6-dimethyl-2-methylene-, (1S)-), 4-Carvomenthenol (Cyclohexanol, 2-methyl-5-(1-methylethenyl)-). L-β-Pinene (Bicyclo[3.1.1]heptane, 6,6-dimethyl-2-methylene-, (1S)-), Borneol, Dihydrocarveol (Cyclohexanol, 2-methyl-5-(1-methylethenyl)-).

The essential oils of *Artemisia dracunculus* L. leaves and stems proved the presence of Alkenes, Aliphatic fluoro compounds, Alcohols, Ethers, Carboxlic acids, Esters, Nitro compounds, Alkanes, Aldehydes, Ketones compounds which shows major peaks at 3.0, 6, 7.5, 7.7, 8, 8.8, …(Figure 1). Among the identified phytocompounds have the property of antioxidant and antimicrobial activities (He, 2010 and Deus-de-Oliveira, 2011). Plant based antimicrobials have enormous therapeutic potential as they can serve the purpose with lesser side effects. Continued further exploration of plant derived antimicrobials is needed today.

Previous papers on the analyses and antifungal activities of essential oils of some species of various genera have shown that they have various degrees of growth inhibition effects against some phytopathogenic fungal species (Cakir, 2004 and Alvarez-Castellanos, 2001). On the basis of the results reported in these papers and unpublished data, it can be concluded that the essential oils rich in Alkenes, Aliphatic fluoro compounds, Alcohols, Ethers, Carboxlic acids, Esters, Nitro compounds, Alkanes, Aldehydes, Ketones compounds and it is one of the important medicinal plants.

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Table (1): peak report TIC of **Artemisia dracunculus** L.

Peak#	R.Time	Area	Area%	Name
1	4.777	17459649	17.00	.alpha α.-Pinene
2	4.981	5394584	5.25	Camphene (Bicyclo[2.2.1]heptane, 2,2-dimethyl-3-methylene-,
3	5.034	401944	0.39	β-Thujene (Bicyclo[3.1.0]hex-2-ene, 4-methylene-1-(1-
4	5.335	1169097	1.14	L-β-Pinene (Bicyclo[3.1.1]heptane, 6,6-dimethyl-2-methylene-,
5	5.436	5186536	5.05	3-Octanone
6	5.491	2655192	2.59	β.-Myrcene
7	5.585	727231	0.71	dl-5-Hydroxylysine, N,N,o-tris(tert-butyldimethylsilyl)-, tert-
8	5.822	478109	0.47	α-Terpinene (1,3-Cyclohexadiene, 1-methyl-4-(1-methylethyl)-
9	5.918	873811	0.85	m-Cymene (Benzene, 1-methyl-3-(1-methylethyl)-)
10	6.014	15872826	15.46	Eucalyptol
11	6.313	665385	0.65	. γ-Terpinene (1,4-Cyclohexadiene, 1-methyl-4-(1-
12	6.457	72004	0.07	cis-Sabinene hydrate (Bicyclo[3.1.0]hexan-2-ol, 2-methyl-5-
13	6.629	844553	0.82	(+)-4-Carene
14	6.675	125541	0.12	β-Methylisoallylbenzene (Benzene, (2-methyl-1-propenyl)-)
15	6.787	4613527	4.49	Linalool (1,6-Octadien-3-ol, 3,7-dimethyl-)
16	7.036	840318	0.82	Chrysanthenone (Bicyclo[3.1.1]hept-2-en-6-one, 2,7,7-
17	7.336	12113458	11.80	Camphor
18	7.418	151903	0.15	Evonine
19	7.525	208640	0.20	Carbamic acid, [2-[[1-(diphenoxyphosphinyl)-2
20	7.609	10330959	10.06	(-)-Borneol (Bicyclo[2.2.1]heptan-2-ol, 1,7,7-trimethyl-, (1S-
21	7.675	1628362	1.59	4-Carvomenthenol –(terpinen-4-ol (3-Cyclohexen-1-ol, 4-
22	7.756	138332	0.13	Phenol, 2-ethyl-4,5-dimethyl-
23	7.833	2782063	2.71	α-Terpineol (3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-
24	7.915	1174977	1.14	Borneol
25	7.977	7130091	6.94	cis-Verbenone (Bicyclo[3.1.1]hept-3-en-2-one, 4,6,6-trimethyl-)
26	8.066	128797	0.13	cis-Carveol (2-Cyclohexen-1-ol, 2-methyl-5-(1-methylethenyl)-
27	8.301	984208	0.96	(-)-cis-Myrtanol
28	8.372	1154160	1.12	Dihydrocarveol (Cyclohexanol, 2-methyl-5-(1-methylethenyl)-)
29	8.425	88776	0.09	p-Benzoquinone, 2-(3-hydroxy-3,7,11,15,19,23,27-heptamethyl
30	8.507	175333	0.17	Methyl nerolate (3,6-Octadienoic acid, 3,7-dimethyl-, methyl
31	8.568	125076	0.12	Isopiperitenone (2-Cyclohexen-1-one, 3-methyl-6-(1-
32	8.696	4606278	4.49	bornyl ester (Acetic acid, 1,7,7-trimethyl-bicyclo[2.2.1]hept-2-yl
33	9.129	99018	0.10	2-Methylbicyclo[4.3.0]non-1(6)-ene
34	9.235	99084	0.10	Piperitenone (2-Cyclohexen-1-one, 3-methyl-6-(1-
35	9.427	126940	0.12	Cyclopentane, 1-acetoxymethyl-3-isopropenyl-2-methyl-
36	9.711	597204	0.58	3,5-Heptadienal, 2-ethylidene-6-methyl-
37	9.973	978686	0.95	Caryophyllene
38	10.284	181427	0.18	1,4,7,-Cycloundecatriene, 1,5,9,9-tetramethyl-, Z,Z,Z-
39	11.353	227628	0.22	Caryophyllene oxide
40	11.925	82690	0.08	1-Oxaspiro[2.5]octane, 5,5-dimethyl-4-(3-methyl-1,3-
		102694397	100.00	

among the forty bioactive detected, only fourteen of them were their concentration exceeded 0.1 which can consider to be effective, namely α-Pinene , Eucalyptol, Camphor, Borneol, cis-Verbenone, Camphene, 3-Octanone , bornyl ester, Linalool, β.-Myrcene, 4-Carvomenthenol, L-β-Pinene, Borneol and Dihydrocarveol.

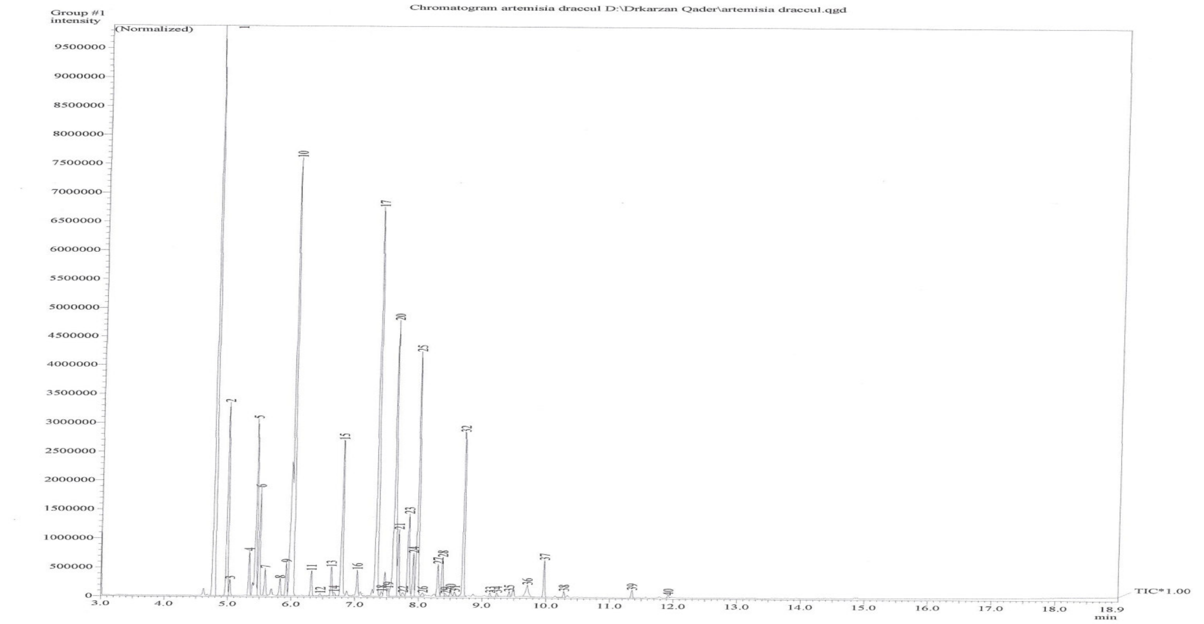

Figure 1. The GC-MS profile of leaves and stems extraction of Artemisia dracunculus L.

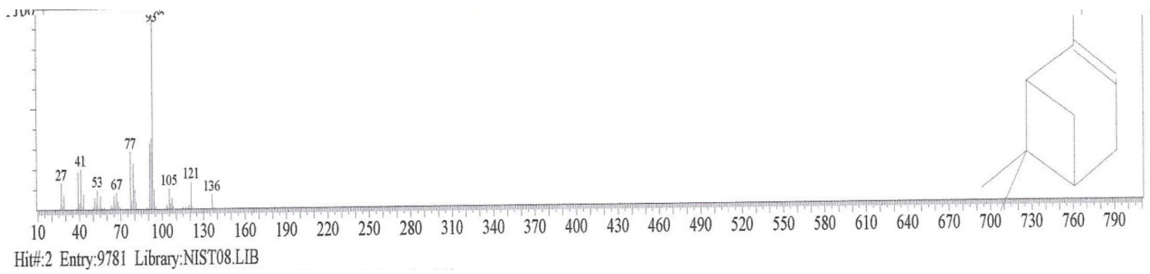

Figure 2. Structure of α-Pinene phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

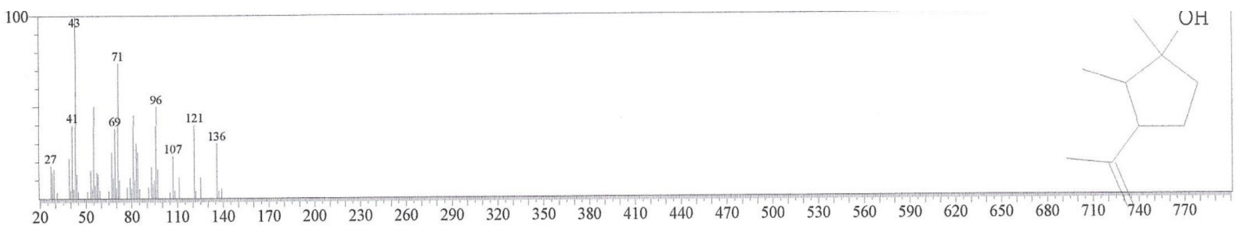

Figure 3. Structure of Eucalyptol phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

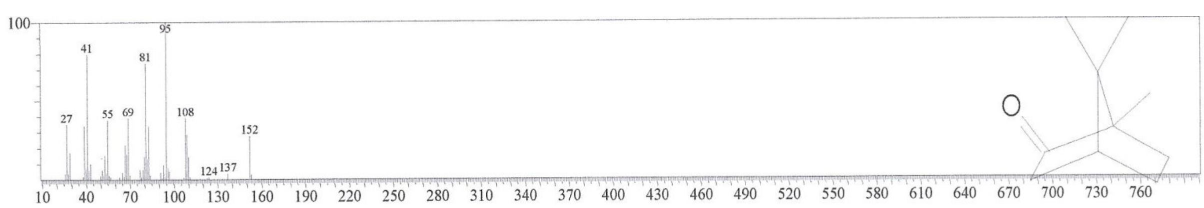

Figure 4. Structure of Camphor phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

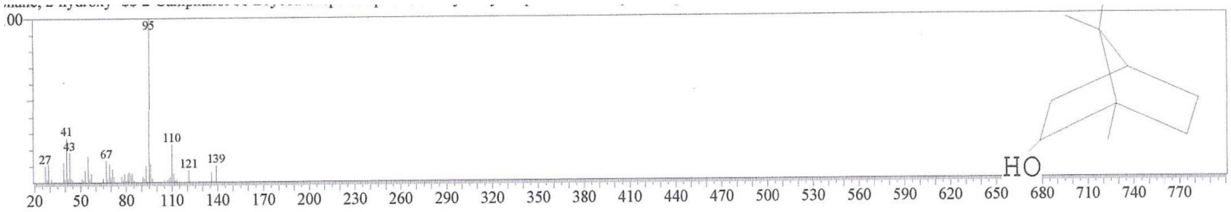

Figure 5. Structure of Borneol phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

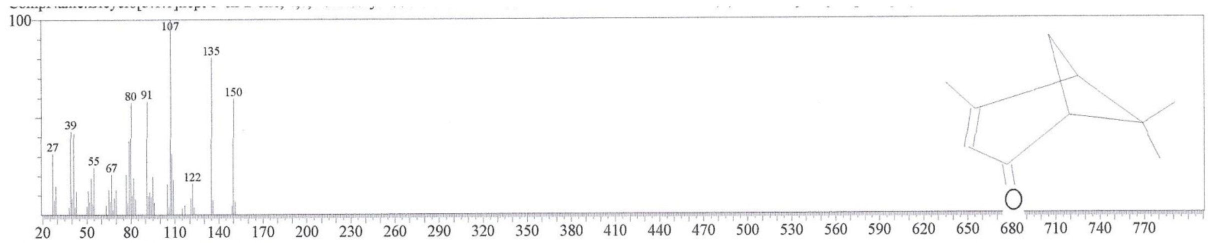

Figure 6. Structure of cis-Verbenone phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

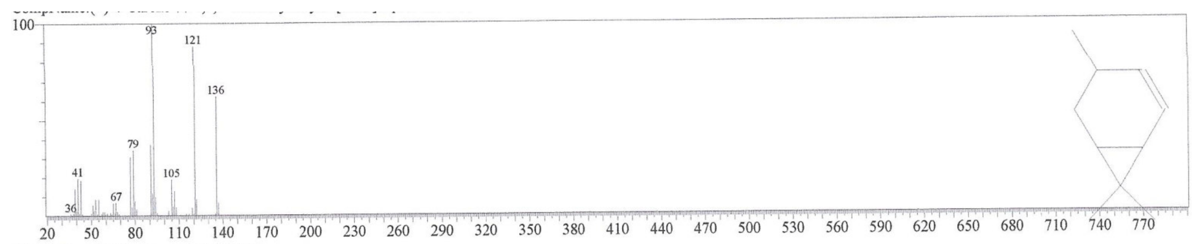

Figure 7. Structure of Camphene phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

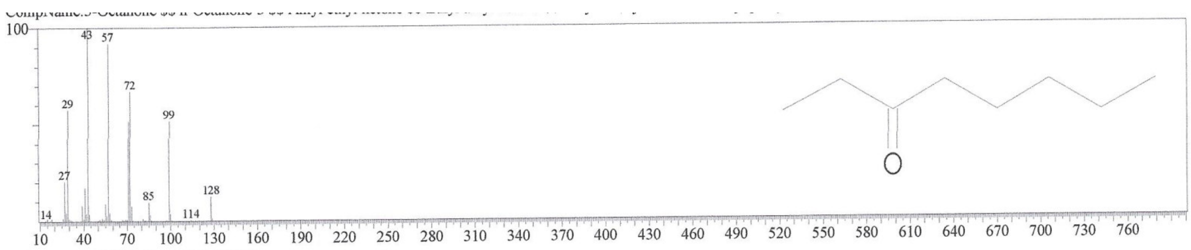

Figure 8. Structure of 3-Octanone phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

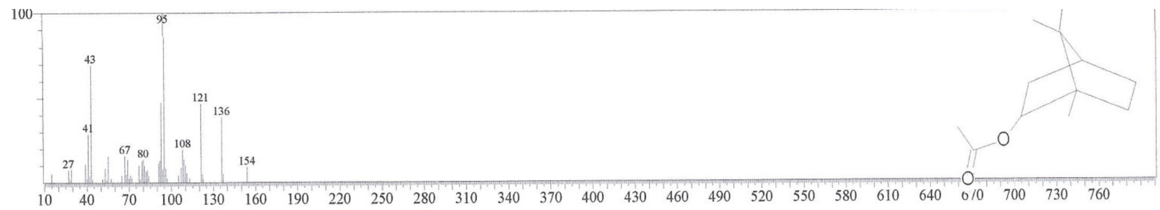

Figure 9. Structure of bornyl ester phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

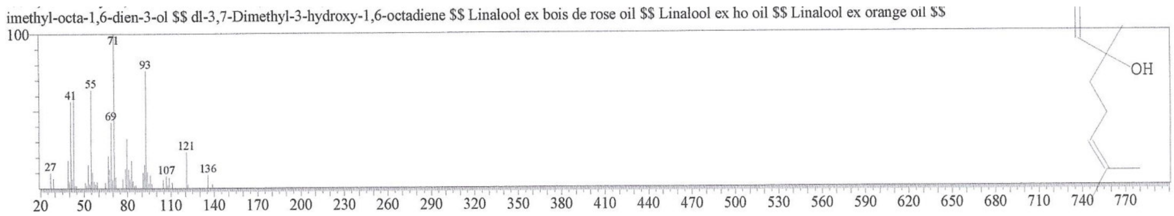

Figure 10. Structure of Linalool phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

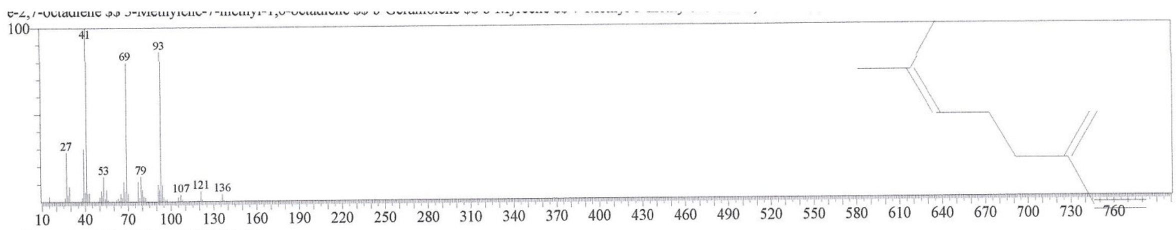

Figure 11. Structure of β.-Myrcene phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

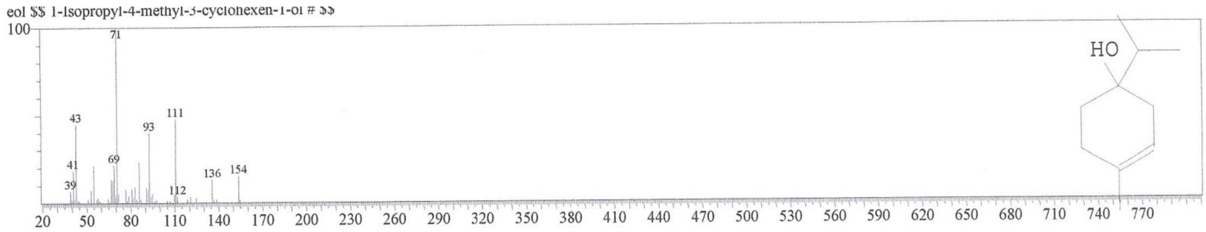

Figure 12. Structure of 4-Carvomenthenol phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

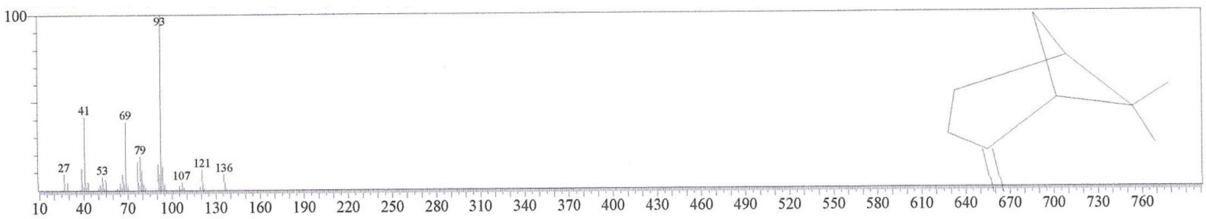

Figure 13. Structure of L-β-Pinene phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

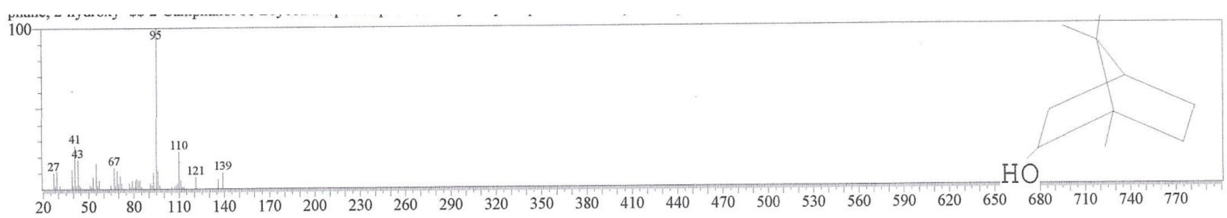

Figure 14. Structure of Borneol phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

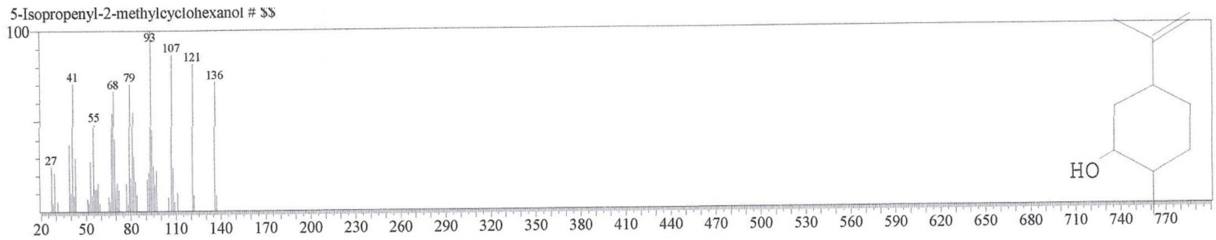

Figure 15. Structure of Dihydrocarveol phytochemical compounds of leaves and stems (Artemisia dracunculus L.) extraction using GC-MS analysis.

Conclusion

Artemisia dracunculus L. is native plant of Iraq, can be successfully cultivated in Sulaimani location. It contains aromatic compounds in the term of essential oil derivatives and other chemical constitutions which may be useful, either seasoning and various herbal formulation as anti-inflammatory, analgesic, antipyretic, cardiac tonic and anti- asthmatic. These results support the possibility that these plants, which are commonly used in the Iraq diet as condiments or decoctions which can show protective effects on human health.

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