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Original Article

Phytochemical Analysis of Essential oil of *Tanacetum parthenium* L. with Hydro-distillation and Steam Distillation

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Abstract

Tanacetum parthenium L. known as feverfew is a medicinal herb which is found in many old gardens. It has been used in folk medicine for reducing fever**.** Feverfew is a member of the daisy family*;* it is used primarily to prevent migraine headaches and to treat rheumatoid arthritis.It hasa colorless essential oil that contains one or more of the sesquiterpene lactones as active principle. *Tanasetum parthenium* cultivated in Iran, were extracted with hydro-distillation and steam distillation and their chemical essential oils composition were investigated by GC/MS. Major components obtained in hydro-distilled method were camphor (36.2%), isoborneol (20.3%), bornyl acetate (14.3%), champhene (8.1%),p-cymene(5.1%) and in steam distilled method were camphor (20.9%), bornyl acetate (14.24%), isobornyl isovalerate (7.1%), bornyl 2-methylbutyrate (5.9%),p-allylanisole (6.3%). The yield of essential oil with hydro-distillation was 0.05% and for steam distillation were 0.12%.

Key words: Essential oils, *Tanacetum parthenium* L, Hydro-distillation, Steam distillation

Introduction

Medicinal plants have been used for centuries to treat diseases [1]. Among the plants that could become a potential source of usable substances is the *Tanacetum* genus comprising about 150 species, about 30 of them have been also practically utilized. Feverfew (*T. parthenium*) is a perennial herbaceous essential oil bearing plant belongs to Asteraceae family. The species of genus *Tanacetum* have been used as medicinal plants for over 2000 years [2]. Interest in the genus hasbeen stimulated by its biological activities, particularly as insect antifeedants, antitumor and antimicrobial activities due to its sesquiterpenoid constituents [3]. This genus has been found in different regions of many countries including Iran, Anatolia, Jordan, Iraq, Turkey, Afghanistan and Pakistan [4]. Feverfew, is an aromatic plant with about 65 cm height, white inflorescence and achene fruit that grows in stony slopes and river beds [5,6].The plant contains a large number of natural products, but the active principle probably include one or more of the sesquiterpen lactones known to be present, including parthenolid [7]. As the content of substances in species of the genus *Tanacetum* depends on many factors, the precise identification of them is difficult [8]. Basing Onseveral studies, the major content of substances of the drug seems to be essential oils, then flavonoids, bitter compounds tannins, and alkaloids. Many studies have been published about the composition of essential oils at this genus [9]. *Tanacetum* is a daisy–like perennial plant found commonly in gardens and along road sides [10]. The roots and rhizomes of this plant have been used in Iranian traditional medicine under the name of Aqhovan, as digestive and stomachic tonic [11]. An important factor in the delivery of quality herbs to the

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consumer is the control of its moisture content. Producers must properly and efficiently harvest, dry and store fever few for commercial purpose [12].The volatile compounds from *T. vulgare* have been examined in detail [13]. In the case of *T. argyrophyllum*, c*is*–thujone, t*rans*–thujoneand 1,8-cineole is reported to predominate in its essential oil [14].The essential oil from aerial part of *T. parthenium* obtained by hydro-distillation was analyzed by GC and GC-MS,Shows about 25 peaks, which constitute 88% , were identified in oil [15]. Composition of the essential oil, which was obtained from the root of *T. parthenium* collected from Karaj city, was determined by gas chromatography in total, 20 components (92% of essential oil) were identified [16]. A comparative study of the essential oil content of the leaves and the flower heads was performed using GC/MS, revealing the presence of 42 and 30 component with the major components camphor and chrysanthenyl acetate in the leaves and the flower heads[17]. However, there is no report available for the chemical component comparative two method of extraction of essential oils; therefor the current study was under taken to elucidate the chemical composition.

Material and Methods

Plant materials

Dry aerial part of plant was collected from Iran national bank of medicinal plants in September of 2013.

Extraction of essential oils

For both methods were used about 80 g herbs of *Ocimum sanctum* L. subjected to hydro-distillation (Clavenger type apparatus)for 2 hours and for steam distillation method also, the essential oil was separated from aqueous layer using a 100 mL capacity separatory funnel, and were dried by filtration over anhydrous sodium sulfate. Essential oils yield for to hydro-distillation (Clavenger type apparatus) were (0.049%) and for steam distillation method were (0.12%).

GC/MS analysis

GC-MS analysis were carried out on a Trace MS fitted with a capillary column (30m×0.25mm); film thickness 0.25 µm. The oven temperature was programmed from 60- 250 °C. Helium was used as carrier gas at a flow rate of 1.1 ml/min. The gas chromatograph was coupled to a quadrupole mass selective detector .The MS operating parameters were ionization voltage, 70 ev; and ion source temperature, 200 °C. Identification of components of the volatile oils were based on retention indices and computer matching with wiley library as well as by comparison percentage of Area.
Identification of components of the volatile oils were based on retention indices on DB5 columnand computer matching with wiley library as well as by comparison percentage of area.

Table 1 Percentage composition of volatile oils of *Tanacetum parthenium*.

S. No	Compound name	RI*	Steam-Distillation	Hydro - Distillation
1	Tricyclene	925	0.2	0.5
2	α-pinene	935	0.2	0.6
3	Champhene	951	4.1	8.1
4	Sabinene	975	0.1	0.1
5	β-pinene	979	0.2	0.5
6	β-myrcene	990	0.1	-
7	Mesitylene	996	0.3	0.6
8	α-terpinene	1016	-	0.2
9	p-cymene	1025	2.9	5.1
10	Limonene	1029	1	1.2
11	(E)-β-ocimene	1046	0.1	-
12	γ-terpinene	1058	0.2	0.8
13	*Cis*- sabinene hydrate	1067	0.1	0.1
14	Camphenilone	1084	-	0.1
15	Terpinolene	1088	-	0.1
16	*Trans*- sabinene hydrate	1101	0.4	0.5
17	1,3,8-p-menthatriene	1105	0.1	0.1
18	Chrysanthenone	1126	0.1	0.6

Table 1 Continue

19	Allo-ocimene	1131	1.1	-
20	Camphore	1151	20.9	36.2
21	Menthone	1154	0.1	-
22	β- pinene oxide	1158	0.2	0.3
23	Isoborneol	1164	0.3	20.3
24	Isomenthone	1168	2.7	2.8
25	Terpin-4-ol	1177	0.4	1.9
26	α-terpineol	1187	-	0.1
27	Dihydrocarveol	1190	-	0.2
28	γ- terpineol	1199	5.3	0.4
29	*Trans*-carveol	1216	-	0.1
30	*Ccis*-sabinene hydrate acetate	1221	-	0.1
31	*Cis*-carveol	1227	0.2	0.3
32	*Trans*-chrysanthenylacetate	1232	-	0.1
33	Cumin aldehyde	1240	0.2	0.3
34	Carvone	1243	0.1	0.1
35	Bornyl acetate	1288	14.2	14.3
36	*Trans*-sabinyl acetate	1292	0.8	-
37	*Trans*- verbenyl acetate	1293	0.5	-
38	Carvacrol	1301	0.2	0.4
39	N-tridecane	1308	0.3	0.2
40	Myrtenyl acetate	1324	0.2	0.2
41	Iiso-dihydrocarveol acetate	1325	0.3	-
42	Eugenol	1354	-	0.2
43	Dihydrocarvyl acetate	1368	1.1	-
44	Isobornylpropanoate	1375	2.2	1.7
45	α- copaene	1379	0.2	0.3
46	β-bourbonene	1385	1.1	0.2
47	β-elemene	1391	0.2	-
48	α-cedrene	1413	3	2.1
49	*Trans*-caryophyllene	1420	1.5	0.1
50	*Trans*-α-bergamotene	1434	1.2	-
51	E-β-farnesene	1453	0.6	-
52	*Cis*-muurola-4(14),5-diene	1464	0.3	-
53	*Trans*-β-ionone	1483	0.4	-
54	β-selinene	1487	0.3	0.4
55	(E,E)- α- farnesene	1508	5.9	3.7
56	Menthylisovalerate	1517	7.1	3.7
57	δ-cadinene	1523	0.2	-
58	Germacrene B	1561	2.0	1.4
59	N-tridecanol	1569	0.2	0.2
60	Spathulenol	1580	0.8	0.3
61	Caryophyllene oxide	1586	2.6	0.6
62	Viridiflorol	1595	0.4	0.2
63	Geranylisovalerate	1602	1.9	0.9
64	Humulene epoxide II	1611	0.7	0.6
65	E- sesquilavandulol	1628	0.3	-
66	Caryophylla-4(14),8(15)-dien-5-α-ol	1639	0.4	0.3
67	Epi- α-muurolol	1642	0.5	-
68	β- eudesmol	1652	0.5	0.4
69	α-cadinol	1658	2.3	1.8
70	N-tetradecanol	1675	0.3	0.2
71	Longiborneol	1688	0.2	0.3
72	Germacrone	1692	0.1	-
73	α-amyl-cinnamyl acetate	1755	0.7	-
74	N-octadecane	1795	0.1	-
75	Iso-longifolol acetate	1821	-	0.2
76	2,7(14)-10-bisabolatrien-1-ol-4-one	1842	0.5	0.2
77	(E)- β-santaol acetate	1865	0.1	-
78	Oplopanonyl acetate	1887	0.9	0.3
79	N-nonadecane	1901	0.3	0.2

RI*: retention indices on DB5 column

Results and Discussion

The genus *Tanacetum* belongs to family Asteraceae or Compositae. The family is distributed throughout the world and most commonin the arid and semi-arid regions of subtropical and lowertemperate latitudes Interest is increasing in species of *Tanacetum* due to its essential oils (cordial, stomachic and used as a foodpreservative), bitter substances and the presence of sesquiterpenelactones, which exhibited biological activities like cytotoxicity,antimicrobial activity, and growth regulating. The essential oils isolated from *Tanacetum* species have variable chemical constituents.

In the present study aerial part of *Tanasetum parthenium* were collected from Iran national medicinal plants bank in September of 2013 and subjected to hydro and steam distillation analyzed for their volatile constituents by GC/MS, the yield of hydro-distilled essential oils was 0.05% and the yield of steam distilled essential oils was 0.12%, their compositions are given in Table 1. About sixty compounds were identified by hydro-distillation method and about seventy compounds in steam distillation method. Majore components obtained in hydro-distilled method were camphor (36.2%), bornyl acetate (14.3%), champhene (8. 07%), p-cymene (5.1%) and in steam distilled method were camphor (20.9%), isoborneol (20.3%), bornyl acetate(14.2%), Isobornylisovalerate (7.1%), bornyl 2-methylbutyrate (5.9%), p-allylanisole (6.3%). The result of table show camphor is major compound in both method of extraction but in hydro distillation is higher than steam distillation, and also isoborneol in hydro distillation are second component which are higher with (20.3%), which in steam distillation are very low (0.3%). Comparison of the numberand amount of essential oil chemical compositions in both methods of extraction samples showed that the geneticconstitution and environmental conditions could affect theyield and composition of volatile oil produced by feverfewplants.Some investigators have shown that the majorconstituents of the essential oils extracted from aerial partsof *T. parthenium* have been camphor (56.9%) followed bycamphene (12.7%) and *p*-cymene (5.2%) [19]. Camphor exists in the aerial parts of *T. aucheranum* (11.6%), *T. hiliophyllum* (28.1%), *T. argenteum* (14%) and *T. Argyrophyllum* (22.3%) [19-21].

Chemical properties of camphor according to literatures are analgesic, anesthetic, antiacne, antiseptic, decongestant, expectorant, stimulant. Prevents/Treats - cysts, neuralgia, itching, flatulence. Stimulates central nervous system, cancer-preventive, relieves irritation, stimulates evacuation of uterus. May Cause - vomiting, eye irritation, reddening of the skin, spasms, warts, vomiting. Convulsant, deliriant, slows or stimulates respiration as needed by body. Also bornyl acetate compound chemical properties are bactericide, expectorant, sedative, capable of killing/preventing virus. Can cause spasms [18]. Camphene chemical properties are antioxidant, capable of producing abnormally low blood cholesterol and spasms, and also p-Cymene chemical properties are analgesic, antiflu, antirheumatalgic, bactericide, capableofkilling/preventingvirus [18]. *Tanacetum* species have been used for centuries as folk remedy because of their diverse biological activities. Furtherstudy should be carried out to isolates the active compounds forpharmaceutical and industrial purposes.

This study demonstrates the occurrence of camphor/camphene chemotype of *T. parthenium* from Iran national medicinal plants bank in September of 2013. Aftercomparison of our date with those reported in literaturewe can conclude that methods of extraction essential oils factorsplay role in determining the composition of essential oil of *Tanacetum parthenium*.

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