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# Chemical composition of the essential oils from the flower of *Tanacetum polycephalum subsp. duderanum* as a herbal plant in Iran

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# Abstract

The chemical composition of the essential oil obtained by hydrodistillation from flower of *Tanacetum polycephalum subsp. Duderanum* was analyzed by GC/MS and 23 compounds constituting 80.41% of the oil were identified. The major components were, cis-Chrysanthenyl acetate(27.18%), Thuj-3-en-10-al(10.70%), Linalool(9.72%), Linalool butyrate(8.80%), Carvacrol(5.64%), Geranyl acetate(5.44%), Menthyl isovalerate(2.94%), 1,8-Cineole(1.93),  $\alpha$ -Pinene(1.61%) and Bornyl acetate(1.27%). The yield of essential oil obtained by hydrodistillation from flower of the dried plant in full flowering stage is 2.74%.

**Keywords:** *Tanacetum polycephalum*, essential oil, hydrodistillation, chemical composition, cis-Chrysanthenyl acetate.

# Introduction

Gas chromatographic (GC) methods have been extensively applied for the determination of individual components of essential oils. Identification of terpenoids can be performed using standard detectors such as GC-FID (flame ionization detection) as well as more sophisticated techniques like GC-MS (mass spectroscopy)[1–3] and GC-FTIR-MS [4]. Alternatively, different vibrational spectroscopic methods were successfully applied for the identification of the main compounds in the isolated essential oil and for the discrimination of different species of various spice plants [5–11].

However, the isolation of essential oil by hydrodistillation or solvent extraction may lead to changes with regard to composition and quality. Therefore, the in situ analysis of essential oils that does not cause artifacts of the analytes is of great interest [12]. In combination with Raman,

mapping techniques are a powerful tool to study the chemical composition of plant samples not only in a single point but also within a larger area [13-16].

The essential oil and various extracts of plants have provoked interest as sources of natural products. They have been screened for their potential uses as alternative remedies for the treatment of many infectious diseases. Particularly, the antimicrobial activities of plants oils and extracts have formed the basis of many applications, including pharmaceuticals and alternative medicine and natural therapies. The present study deals with the analysis, chemical composition of the essential oil from flower of *Tanacetum polycephalum Subsp. Duderanum* grown wild in North- East of Iran. A literature survey revealed that these oils have not been previously studied, so we decided to examine them.

#### **Results and Discussion**

The yield of essential oil obtained by hydrodistillation from flower of the dried plant in full flowering stage is 2.74%. The composition of the essential oil of flower of *Tanacetum Polycephalum Subsp. Duderanum* is listed in Table 1. Twenty three constituents, representing 80.41% of the total components in the oil, have been identified in the essential oil extracted from the flower of this plant. As it is shown in Fig.1. The major compound in the oil of flower of *Tanacetum Polycephalum Subsp. Duderanum* is cis-Chrysanthenyl acetate followed by next nine compounds namely, Thuj-3-en-10-al, Linalool, Linalool butyrate, Carvacrol, Geranyl acetate, Menthyl isovalerate, 1,8-Cineole,  $\alpha$ -Pinene and Bornyl acetate. The comparing of the chemical compounds in the essential oil of *Tanacetum Polycephalum Subsp. Duderanum* flower with other species [17-19] show that most of the compounds in the oils of this flower and others are similar. On the other hand the percent of the chemical compounds are not the same. These behaviors can be related to the type of the plant, aerial or flower parts and also the geographical regions of the plant growing places. The results can help to do more investigation for antibacterial activities of the oil.



Figure 1. The major compounds in the oil of flower of *Tanacetum Polycephalum Subsp. Duderanum* 

No.	Retention	Compound	Retention	Cont%
	time(min)		Index	
1	1.777	α-Thujene	925	0.02
2	1.862	α-Pinene	934	1.61
3	1.990	Camphene	947	0.22
4	2.323	$\beta$ - Pinene	978	0.95
5	2.523	$\beta$ -Myrcene	995	0.27
6	3.175	1,8-Cineole	1036	1.93
7	3.663	γ-Terpinene	1061	0.19
8	4.368	trans -Linalool oxide	1092	0.71
9	5.014	Linalool	1096	9.72
10	5.272	Chrysanthenone	1129	0.29
11	5.694	Camphor	1145	0.45
12	6.207	Pinocarvone	1163	0.17
13	6.890	Thuj-3-en-10-al	1184	10.70
14	7.247	Myrtenal	1195	0.58
15	7.500	$\alpha$ -Terpineol	1199	0.58
16	10.349	cis-Chrysanthenyl acetate	1270	27.18
17	10.796	Bornyl acetate	1290	1.27
18	11.190	Carvacrol	1299	5.64
19	14.83	Geranyl acetate	1391	5.44
20	15.087	Z- Jasmone	1397	0.26
21	16.475	Linalool butyrate	1423	8.80
22	19.933	Menthyl isovalerate	1518	2.94
23	43.133	n-Docosane	2208	0.49
Total				80.41

 Table 1. Percentage composition of essential oil of the flower of Tanacetum Polycephalum

 Subsp. Duderanum

#### Experimental

#### Plant material

The flower of *Tanacetum polycephalum Subsp. Duderanum* were collected (May, 2008) from Arzane waterfall of bakharz town, Khorasan Razavi province, Iran at altitude of 1700m. Voucher specimens were deposited in the Herbarium of Ferdowsi University of Mashhad (FUMH) with Herbarium number 39340. Fig. 2, shows the plant photo that is taken from the mentioned region of Iran.



Figure 2. The photo of Tanacetum polycephalum Subsp. Duderanum

#### Oil isolation

The air-dried flower of specimens (50g) were then subjected to hydrodistillation using Cleavenger-type apparatus for 4 h subsequent to collecting and drying over anhydrous sodium sulfate. The corresponding oils were isolated in yield of 2.74% (w/w).

#### Analysis

The essential oil was analyzed by gas chromatography mass spectroscopy (GC/MS). The GC/MS analysis was carried out on a Shimadzu GC/MS model QP 5050. The capillary column was BD– $5(30 \times 0.2 \text{ mm}, \text{ film thickness } 0.32 \,\mu\text{m})$ . The operating conditions were as following; carrier gas, helium with a flow rate of 1.7 ml/min; injector and detector temperatures, were both at 280°C; volume injected 0.1  $\mu$ l of the essential oil and ionization potential 70 ev. The initial temperature of column was 60°C (held 1 min) and then heated to 200°C with a 3°C/min rate and then heated to 250°C and kept constant for 2 min. The same condition of temperature programming used for n-alkans mixture to calculate the retention index(RI). Identification of components in the oil was based on the retention index (RI), Wiley computer library and literature survey [17-19]. The relative percentage of the oil constituent was calculated.

## Conclusion

It is found in this research that the essential oil of *Tanacetum polycephalum Subsp. Duderanum* have at least 23 compounds. The major component was cis-Chrysanthenyl acetate with 27.18% of the oil components. Also, it is found that in the full flowering stage the flowers of the plant have about 2.74% oil.

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