

Analysis of the essential oil extract from the aerial parts of southernwood herb (*Artemisia abrotanum* L.) that grown in Iraq by GC/MS

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Abstract:

Objective: this research is to identify the chemical composition of essential oil of the aerial parts of *A.abrotanum* L. that grown in Iraq and used recently only for decorative purpose.

Method: After collection of the aerial parts the essential oil extracted by hydro-distillation using Clevenger apparatus, then the oil are analyzed by GC/MS.

Result: The obtained results show the presence of 14 compounds. The most important constituents are: Eucalyptol (1, 8-cineole), O-cymene, Camphor, Terpeneol, Borneol, Longipinocarvone, Limonene, and Aromadendrene.

Conclusion: This study analyzes the chemical constituents of the essential oil of *A.abrotanum*. The essential oil extracted by hydrodistillation then analyzed by GC/MS. 14 Compounds were identified. Due to good result obtained from the essential oil from this plant so further studies chemically and clinically of the active compounds is required.

Key words: Southernwood; *Artemisia abrotanum*; Gas Chromatography/Mass Spectrometer; Volatile Oils.

تحليل الزيت الطيار المستخلص من الاجزاء الهوائية لنبات *Artemisia abrotanum* L. النامي في العراق باستخدام GC/MS

الخلاصة:

الهدف: هذا البحث لمعرفة التركيب الكيميائي للزيت الطيار المستخلص من الاجزاء الهوائية لنبات *A.abrotanum* L. النامي في العراق والمستخدم مؤخرًا فقط لغرض الزينة .

طريقة العمل: بعد تجميع الاجزاء الهوائية للنبات، الزيت الطيار يستخلص بطريقة التقطير المائي باستخدام جهاز Clevenger وتحليل مكونات الزيت الطيار بواسطة الـ GC/MS.

النتائج: النتائج التي تم الحصول عليها تبين وجود 14 مركب كيميائي. اكثر المكونات المهمة-8، Eucalyptol (1، cineole)، O-cymene، Camphor، Terpeneol، Borneol، Longipinocarvone، Limonene، and Aromadendrene.

الاستنتاج: هذه الدراسة لتحليل المركبات الكيميائية للزيت الطيار المستخلص. الزيت الطيار استخلص بواسطة التقطير المائي وتم تحليله باستخدام الـ GC/MS 14 مركب كيميائي تم التعرف اليها نتيجة للنتائج الجيدة التي تم الحصول عليها من استخلاص الزيت الطيار ، وبالتالي يجب عمل دراسات كيميائية وسريريه اضافيه عن المركبات الكيميائية لهذا النبات.

Introduction:

Medicinal plants are nature's gift to human beings to make healthy life free from diseases, and play an important role to maintain our health. They are considered to be much safer and proven cure in the treatment of various conditions [1]. Essential oils play an important role in the biological activity of plant; they were mostly composed of terpenes and are obtained by means of steam distillation,

hydrodistillation or solvent extraction of different parts of the aromatic plants [2]

The genus *Artemisia* (wormwood) consists of about 500 species throughout the world. *Artemisia* is the genus of small herb of the family Asteraceae (Compositae) family [3]. *A.abrotanum* (southernwood) is a shrubby perennial plant, the height and width 3-5feet, it consist of yellowish-white flowers, has fragrance similar to cola or tangerine [4]. It's native to eastern is the half of the

united state, Africa, and Eurasia (in the southern Europe and in different areas of Asia), as well as in Silesia, and eastern Anatolia [5].

A.abrotanum was traditionally used as an antiseptic, Astringent, emmenagogue, antidiabetic, expectorant, febrifuge, stomachic, antimalarial, anti-inflammatory, vermifuge, spasmolytic and used for treating upper respiratory tract disease, antibacterial, antifungal, cancer, cough, and fever [6]. In Iraq ;there is no study about *A.abrotanum* essential oil active constituents and its parameters because this plant was introduced recently to Iraq for a decorative purposes; therefore this study done to conduct the active constituents of the essential oil of *A.abrotanum* and its parameters.

Essential oils are chemically classified into [7]:

1-Terpenes: the carbon skeleton of terpenes are built up by the union of two or more isoprene unit (C₅H₈) and classified into:

- | | | |
|---------------------------|-----|--|
| Terpene →
acyclic | } → | monoterpene (alcohol):
linalool |
| | | diterpene → (alcohol):
phytol |
| | | triterpene → (hydrocarbon):
squalene |
| Terpenes →
*monocyclic | } → | Hydrocarbon → limonene |
| | | Alcohol → terpinol, Thymol,
carvacrol |

- Ketone → menthone,
- Carvomenthone, carvone
- Oxide → cineole

- | | | |
|---------------------|-----|--|
| Terpene → *bicyclic | } → | Hydrocarbon →
α-thujone, β-thujone,
α-Pinene |
| | | Oxygenated → verbenone |
| | | Ketone → camphor |
| | | Peroxide → ascaridole |

- | | | |
|--------------------------|-----|--|
| Terpene → *sesquiterpene | } → | Hydrocarbon → aroma
dendrene, β-
caryophyllene |
| | | Alcohol → α-bisabolol |

Beside to terpenes the essential oil might contain oxygenated compound like phenol also aldehyde, ketone, ester, lactone, coumarin, and ether.

Materials and methods:

Plant collection

The plant aerial parts of *A.abrotanum* were collected from Iraq at August from the botanical garden in College of Pharmacy at Almustansiriyah University. The plant was authenticated by National Iraqi Herbarium, Botany Directorate at Abu-Ghraib. The aerial parts of the plant were dried in the shade at room temperature for (7 days) until crisp and then were grinded by mechanical mills and weighed (Figure 1).



Figure 1: Iraqi *A.abrotanum*

Determination of the essential oil content

The essential oil content of *A.abrotanum* was extracted by hydro distillation method by the use Clevenger apparatus, (100 gm) of the plant material were hydrodistilled by adding (500 ml.) of distilled water in round flask bottom, the plant was left boiling for three hours; the volatile oil was collected after observing that there is no increase in volatile oil was achieved. Anhydrous sodium sulphate was added to the essential oil in the cylinder to remove any water left. The volume of the collected oil was calculated using graduated cylinder, then it was kept into tightly closed, dark, small, glass containers and kept into the refrigerator and stored at (40C) until analysis by GC-MS. The average percentage of volatile oil content of the plant sample was calculated by (V/W) of dried plant material [8].

Gas chromatography/mass spectroscopy (GC/MS)

This technique is done at College of Science Chemistry Department, Mustansiriyah University, the GC/MS condition was: Stationary phase: modified phase silica DB5, Column: 30m X 0.25mm Internal Diameter (I.D). Mobile phase (Carrier gas):

Helium split ratio (1:15)

Injection volume: 0.5, Column oven temperature: 70.0 0C, Injection temperature: 240.00 0C, Injection mode: Splitless, Sampling time: 1.00 min., Flow control mode: pressure, Pressure: 100.0KPa, Total flow rate: 19.9 mL/min Column flow: 1.53 mL/min, Temperature program: from 70Co (3 min) to 240 Co (8 min).

Essential oil parameters

Determine the essential oil (extract of *A.abrotanum*) density, specific gravity, Refractive index by using Anton paar DMA 4200M, and by Refractometer RFM870 done at Midland Refineries company-Daura Refinery.

Result and Discussion:

This study shows that the percentage of essential oil extracted from this plant was 0.5%. Table 1 represents the GC/MS analysis of the essential oil from *A.abrotanum* which shows the presence of 14 compounds, the density of the essential oil equal to 0.935 g/cm³, the specific gravity equal to 0.938, and the refractive index equal to 1.470 at 20 0C.

Table -1: GC/MS of Iraqi *A.abrotanum*

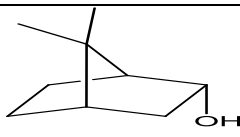
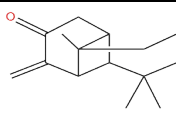
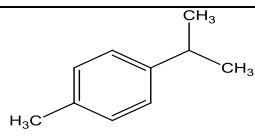
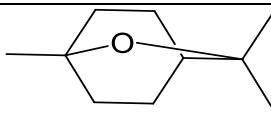
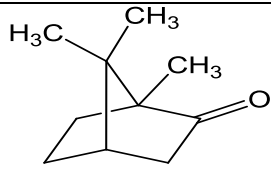
Name	Peak	Time	Area%	Height%	Mass Peak
Eucalyptol(1,8-cineole) ^(10,11,12,13)	1	4.92	1.12	2.61	358
Cymene ⁽¹¹⁾	3	5.52	3.60	4.27	349
Camphor ⁽¹⁰⁾	5	9.43	0.09	0.17	304
Terpineol	6	10.45	0.02	0.04	315
Borneol ^(10,11,12)	7	11.95	8.38	12.24	354
Aromadendrene	8	12.25	1.67	5.11	358
Longipinene	9	12.32	0.02	0.06	360
Patchoulane	12	15.65	0.39	0.37	368
Longipinocarvone	14	16.66	8.60	17.59	403
5.alpha.-Hydroxy-4.alpha.-,8,10,11-tetramethyl tricycle [6.3.0.0(2,4)] undec-10-ene	15	17.05	4.66	12.77	396

Limonene	17	17.34	0.11	0.42	347
Mayurone	18	17.56	2.09	6.64	385

The constituents of the essential oil and their percentage vary from region to region and vary according to the season of collection. The major constituents of the essential oil are Longipinocarvone (8.60%), Borneol (8.38%), 5.alpha.-Hydroxy-4.alpha., 8, 10, 11- tetramethyl-tricyclo [6.3.0.0(2, 4)] undec-10-ene (4.66%), Trans-2-alpha.-Bisabolene

epoxide (4.97%), cymene (3.60%), Aromadendrene (1.67%), then followed by Eucalyptol represents about (1.12%), while the minor constituents are Patchoulane (0.39%), Limonene (0.11%), Camphor (0.09%), Terpeneol and Longipinene have the minimum percentage from the rest of the constituents which represent about (0.02%).

Table-2: The chemical structures of some chemical compounds

Name	Chemical structure
Borneol	
Longipinocarvone	
Cymene	
Cineole	
Camphor	

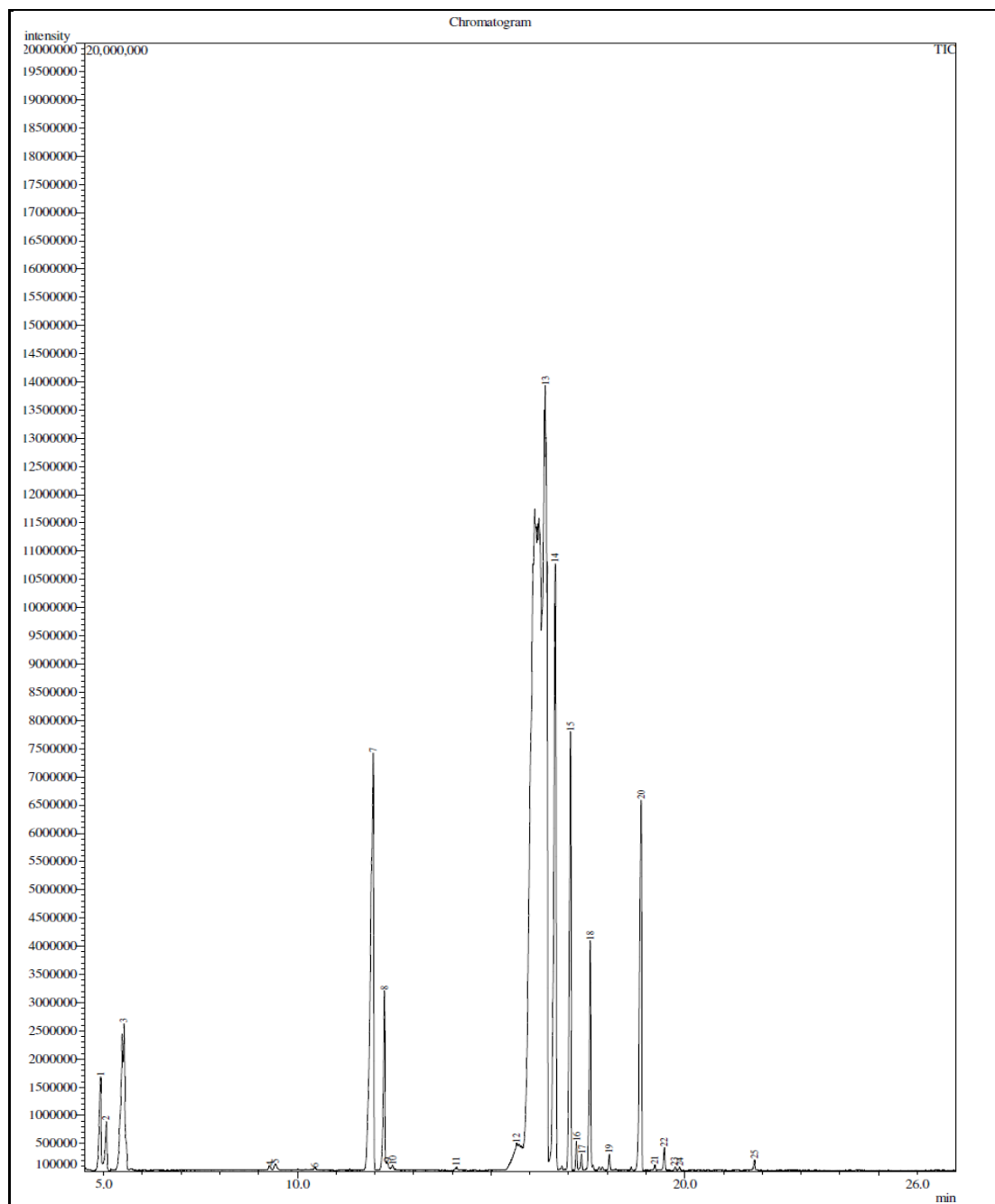


Figure-2: The graphical results of the GC/ MS analysis for the essential oil extract of A.abrotanum

The amount of essential oil and constituents of *A.abrotanum* in this study that collected from Iraq differ when compared to other region. Essential oil of southernwood from Turkey (10) contains Borneol (13.5%), 1, 8-cineole (32.6%), camphene (2.7%), Camphor (3.5%), germacrene (3.4%). Essential oil from Romania (11) rich in Eucalyptol (17.59%), terpinene (13.55%), Borneol (13.24 %), cymene (11.30 %).

Oil isolated from Serbia (12) is high in Silphiperfol-5-en-3-one A (14.6 %), ascaridole (13.1 %), 1, 8-cineole (10.5 %), bisabolol oxide A acetate (8.7%), germacrene D (6.5 %), Borneol (6.0 %). In Poland (13) Piperitone (17.51%), davanone (16.75%), 1, 8 -cineole (12.54%), silphiperfol-5-en-3-ol A (6.28%), germacrene D (5.87%) are the main components.

Conclusion:

The essential oil of *A.abrotanum* that recently grows in Iraq extracted by hydrodistillation then analyzed by GC/MS. 14 Components were identified. The major compounds are Methandrostenolone (63.02%), Longipinocarvone (8.60%), Borneol (8.38%), 5.alpha.-Hydroxy-4.alpha., 8, 10, 11- tetramethyltricyclo [6.3.0.0(2, 4)] undec-10-ene (4.66%), Trans-2-alpha.-Bisabolene epoxide (4.97%), cymene (3.60%), Aromadendrene (1.67%), then followed by Eucalyptol represents about (1.12%), while the minor constituents are Patchoulane (0.39%), Limonene (0.11%), Camphor (0.09%), Terpeneol and Longipinene have the minimum percentage from the rest of the constituents which represent about (0.02%).

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