**Study of the chemical content of extracted essential oil from the plant *Arbutus* *andrachne* L. using GC/MS in Syrian coast, tartous Governorate**

 **ABSTRACT**

The essential oil was extracted from the leaves of the plant *Arbutus* *andrachne* Lwhich were collected in Baniyas location in Tartous in syria by steam distillaton using clevenger apparatus.

The chemical composition of the essential oil was determined by gas chromatography mass spectrometry GC/MS

*Arbutus andrachne* L. is among the two species of *Arbutus* genus which belongs to the family Ericaceae.

*Arbutus* *andrachne* L. is a plant that grows naturally in Syria, this species has medical, environmental, nutritional and ornamental importance.

The analysis results showed that the essential oil contains 61compounds, the com pounds in the essential oil extracted from the leaves of this plant vary between hydrocarbon, oxygen, nitrogenous compounds and other chemical compounds.

chemical compounds were identified, representing 99.7% of the total essential oil of the leaves sample, The main compounds and their respective percentages were as follows:

Phytol (19.9%), Decane, 5,6-bis (2,2-dimethylpropylidene)-, (E,Z)-(13,6%), 1,2-Benzenedicarboxylic acid, butyl octyl ester (6.8%), and Heptacosane (5.3%).

while the percentages of compounds ranged from (0.1% to 4.8%)

The difference between the results of our study and previous studies is attributed tothe difference in geographical characteristics and climatic conditions.

This is first research in Syria on extracting essential oil from the leaves of the plant *Arbutus* *andrachne* L.

K**ey words: Arbutus *andrachne* L, Essential oil , Clevenger, GC/MS .**

**1. Introduction**

*Arbutus andrachne* L. (Greek or Eastern strawberry tree) is among the two species of *Arbutus* genus which belongs to the family Ericaceae (Serçe *et al*., 2010). It is an evergreen small tree which is native to the Mediterranean region and southwestern Asia (Markovski, 2017; Bertsouklis and Papafotiou, 2013; Dönmez *et al*., 2016).

*Arbutus* species are utilized in traditional medicine for various purposes. For instance, the leaves of *Arbutus* *unedo* L. are traditionallyused for their diuretic, urinary antiseptic, antidiarrheal, astringent, depurative, and antihypertensive properties (Bessah and Benyoussef, 2012).

The red coloured edible berries of *Arbutus* L*.* have traditionally been used for human consumption in many countries (Molina *et al*., 2011; Tardío *et al.*, 2006; Çavuşoğlu *et* *al.*, 2015).

Many food products can be prepared from berries in a wide range including alcoholic beverages, jam, fruit jelly and marmalades (Ayaz *et al*., 2000; Pallauf *et al*., 2008; Oliveira *et al*., 2009).

Fruits are collected from nature and consumed as fresh fruit *Arbutu unedo* L. and *Arbutus* *Andrachne* L. fruits are consumed in an immature manner and have a satisfying effect and have antioxidant compounds such as C, vitamin E and carotenoids, niacin, polyphenolic (Ruiz-Rodriguez *et al*., 2011).

Sandal is used as a handicraft material because of the hardness of wood tissue, as it does not work in wood, in fireplaces or in undesirable places to do work (Dingil 1990).

Indeed, the composition and potent antioxidant activity of the extracts of *Arbutus* *andrachne* L. fruits and leaves has been verified in the preliminary studies (Serçe *et* *al*., 2010; Şeker and Toplu, 2010).

Screening natural plants based essential oils and extracts for biological activity has been a historically significant research field that has resulted in the development of several phytopharmaceuticals, perfumes and natural antioxidant and antibacterial agents in food industry (Abu-rish *et al*., 2016; Djouahri *et al*., 2015; Sıcak *et al.*, 2017)*.*

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| AGeneral shape of the plant *Arbutus* *andrachne*L  | B*Arbutus* *andrachne*L.flowers | C *Arbutus* *andrachne*L.fruits |
| **Figure 1 : *Arbutus* *andrachne* L.** |

**-The importance of research:**

*Arbutus* *andrachne* L. is a plant that grows naturally in Syria, this species has medical, environmental, nutritional and ornamental importance.

But it has not received enough attention from researchers in fact, there is no similar work published on the chemical content of the oil extracted from the leaves of this plant in Syria.

**-Research objective:**

1-extraction of essential oil from the leaves of *Arbutus* *andrachne* L. using a Clevenger apparatus.

2-determination of the chemical composition of oil by GC/MS.

**Materials and methods:-**

**-Equipment and tools used:**

 Clevenger device -

-Chromatography combined with mass spectrometry type CHROMATEC 9000 –Mass Spectrometric Detector.

-sensitive balance from the company (Sartorius, Germany).

-chloroform from the company (Honey ell, Germany).

-electric spherical heater from the company. (ittmann Heraeus, Germany).

- anhydrous sodium sulfate from the company (LTD.Titan Biotech, India).

 (type ZELPA (Belgium, hatman no.1 -filter paper from the company

-glass laboratory instruments from the company (Isolab, Germany).

**Materials and Methods:**

**Sample collection and preparation for extraction-**

**Study site:-**

A village called Bablota in the Baniyas district of Tartous Governorate in Syria.

This village is 350 meters above sea level.

**Plant material:**

leaves were collected from *Arbutus* *andrachne* L. shrubson 30/5/2024

it was thoroughly cleaned of dust and impurities then dried in well ventilated, shaded place at room temperature (20-250c) for a bout a month.

Then they were ground using an electric grinder until they reache the required degree of fineness, stored in tightly sealed nylon bags, ready for use in proper time.

**-Essential oil extraction:**

The essential oil was extracted from the leaves sample by hydro distillation for four hours using a Clevenger apparatus (100g of sample in 600ml distilled water), the essential oil was then separated using 30 ml of chloroform in a separating funnel in three batches.

and dried using unhydrous sodium sulfate, after filtration, the chloroform was evaporated by passing a light stream of nitrogen over it, then store oil in a glass tube at 4 0c until analysis. The study was conducted in the organic chemistry research laboratory 2 faculty of science, lattaakia university in Syria.

**GC-MS analysis of essential oil:-**

the analysis was completed in the laboratories of the higher atomic energy commission- Damascus.

Through injection1 μl from the essential oil sample in the device GC – MS of a kind CHROMATEC 9000 –Mass Spectrometric Detector using a poetic column of the type BP5MS with dimensions of (Length 30m , I.D 0.25 mm, thickness 0.25$ μm)$ helium is an inert gas with a purity of 99.9% at flow rate 30cm/min then set the injector temperature at 300 0c the ionization source temperature is 280 0c, the heating program started at 50 0c, this temperature was maintained for (5.5 min),then it was raised to 3000c at a rate of 100c per minute, this temperature was maintained for 5 minutes, the analysis took 35.5 minutes

The chemical compounds of the essential oil sample were identified by comparing the resulting mass spectra for each peak with the mass spectra of compounds in the instrument libraries

**-Results and Discussion:**

**-Results of analysis of essential oil extracted from the leaves of the plant *Arbutus* *andrachne* L.:**

after analyzing the essential oil extracted from the leaves sample using a device GC/MS, 61 compounds were identified representing a percentage of (99.2%) of the total essential oil, through the chromatogram of the essential oil shown in figure(2), table (1) shows the main compounds, Fig (2) shows the chemical formulas of the main compounds found in the essential oil extracted from the leaves of the plant *Arbutus* *andrachne* L., while table (2) shows the identity of these compounds and their percentages ,



 **Figure 2 : GC/MS chromatogram of essential oil *Arbutus* *andrachne* L. leaves**

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| **Table 1: the main compounds in the essential oil extracted from the leaves of the *Arbutus* *andrachne* L.** |
| **Area (%)** | **Compounds** | **No**  |
| 19.9 | Phytol | 1 |
| 13.6 | Decane, 5,6-bis(2,2-dimethylpropylidene)-, (E,Z)- | 2 |
| 6.8 | 1,2-Benzenedicarboxylic acid, butyl octyl Ester | 3 |
| 5.3 | Heptacosane | 4 |

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| **Table 2: components of the essential oil extracted from the leaves of the *Arbutus* *andrachne* L.** |
| **Area (%)** | **M.W(g/mol)** | **M.F.** | **Compounds** | **RI** | **No** |
| 0.1 | 214.39 g/mol | [C14H30O](https://pubchem.ncbi.nlm.nih.gov/#query=C14H30O) | Hexyl octyl ether | 12.39 | 1 |
| 0.1 | 170.25 g/mol | C10H18O2 | 2H-Pyran-3-ol, 6-ethenyltetrahydro-2,2,6- trimethyl- | 14.49 | 2 |
| 0.2 | 240.42g/mol | C16H32O | Oxirane, tetradecyl- | 14.56 | 3 |
| 0.5 | 154.25 g/mol | C10H18O | α-Terpineol | 14.85 | 4 |
| 0.1 | 207.15g/mol | C9H19Br | 2-Bromononane | 16.01 | 5 |
| 0.1 | 884.1 g/mol | C45H73NO16 | Solasonine | 16.57 | 6 |
| 0.3 | 157.21 g/mol | C8H15NO2 | 1-Piperazinecarboxylic acid, ethyl ester | 16.86 | 7 |
| 0.8 | 206.24 g/mol | C12H14O3 | Phenol, 2-methoxy-4-(1-propenyl)- | 17.24 | 8 |
| 0.3 | 178.27 g/mol | C12H18O | 2-Propenal, 3-(2,6,6-trimethyl-1- cyclohexen-1-yl)- | 17.82 | 9 |
| 0.4 | 190.28 g/mol | C13H18O | Oxacyclotetradeca-4,11-diyne | 18.19 | 10 |
| 0.4 | 196.29 g/mol | C12H20O2 | Cyclohexanol, 2-methyl-3-(1- methylethenyl)-, (1α,2α,3α)- | 18.35 | 11 |
| 0.3 | 196.29 g/mol | C12H20O2 | Cyclohexanecarboxaldehyde, 3,3- dimethyl-5-oxo- | 18.46 | 12 |
| 1.2 | 249.35 g/mol | C14H23N3O | 3-Buten-2-one, 4-(2,6,6-trimethyl-1- cyclohexen-1-yl)- | 18.87 | 13 |
| 0.1 | 286.05 g/mol | C9H18Br2 | 1-Bromo-3-(2-bromoethyl)heptane | 18.94 | 14 |
| 0.3 | 166.22 g/mol | C10H14O2 | 7-Oxabicyclo[4.1.0]heptane, 1-methyl-4-(2-methyloxiranyl)- | 19.08 | 15 |
| 1.3 | 206.32 g/mol | C14H22O | 2,4-Di-tert-butylphenol | 19.15 | 16 |
| 0.7 | 296.5 g/mol | C19H36O2 | 11-Octadecynoic acid, methyl ester | 19.36 | 17 |
| 0.2 | 166.22 g/mol | C10H14O2 | 3H-Naphth[1,8a-b]oxiren-2(1aH)-one, hexahydro- | 19.60 | 18 |
| 0.2 | 220.35 g/mol | C15H24O | Caryophyllene oxide | 19.79 | 19 |
| 0.1 | 220.35 g/mol | C15H24O | Lanceol, cis | 19.99 | 20 |
| 0.5 | 446.7 g/mol | C28H46O4 | Didodecyl phthalate | 20.09 | 21 |
| 0.2 | 268.5 g/mol | C19H40 | Octadecane, 6-methyl- | 20.18 | 22 |
| 0.3 | 284.4 g/mol | C20H28O | Retinal | 20.35 | 23 |
| 3.5 | 222.37 g/mol | C15H26O | Ledol | 20.44 | 24 |
| 2.2 | 222.37 g/mol | C15H26O | (1S,3aS,4S,5S,7aR,8R)-5-Isopropyl-1,7a- dimethyloctahydro-1H-1,4-methanoinden-8-ol | 20.60 | 25 |
| 4.8 | 222.36g/mol | C15H26O | 2-Naphthalenemethanol, 1,2,3,4,4a,5,6,7- octahydro-α,α,4a,8-tetramethyl-, (2R-cis)- | 20.83 | 26 |
| 0.7 | 222.37 g/mol | C15H26O | .tau.-Muurolol | 20.94 | 27 |
| 0.1 | 537.0 g/mol | C37H76O | 1-Heptatriacotanol | 21.04 | 28 |
| 3.6 | 222.37 g/mol | C15H26O | 2-Naphthalenemethanol, decahydro- α,α,4a-trimethyl-8-methylene-, [2R- (2α,4aα,8aβ)]- | 21.12 | 29 |
| 0.2 | 254.41 g/mol | C116H30O2 | cis-7-Hexadecenoic acid | 21.20 | 30 |
| 0.6 | 220.35 g/mol | C15H24O | trans-Z-α-Bisabolene epoxide | 21.31 | 31 |
| 0.1 | 288.9 g/mol | C18H37Cl | Octadecane, 1-chloro- | 21.36 | 32 |
| 0.3 | 222.37 g/mol | C15H26O | 1H-Cycloprop[e]azulen-4-ol, decahydro-1,1,4,7-tetramethyl-, [1aR- (1aα,4β,4aβ,7α,7aβ,7bα)]- | 21.61 | 33 |
| 0.3 | 294.5 g/mol | C19H34O2 | 2,5-Octadecadiynoic acid, methyl ester | 21.78 | 34 |
| 0.8 | 224.42g/mol | C16H32 | Cetene | 22.31 | 35 |
| 1.4 | 198.34g/mol | C13H26O | 2-Undecanone, 6,10-dimethyl- | 22.83 | 36 |
| 6.8 | 334.44g/mol | C20H30O4 | 1,2-Benzenedicarboxylic acid, butyl octyl Ester | 23.04 | 37 |
| 0.7 | 272.9 g/mol | C17H33Cl | 7-Heptadecene, 17-chloro | 23.24 | 38 |
| 0.4 | 256.46g/mol | C17H36O | 1-Hexadecanol, 2-methyl- | 23.41 | 39 |
| 1.5 | 268.4 g/mol | C17H32O2 | Cyclopentaneundecanoic acid, methyl ester | 23.63 | 40 |
| 0.4 | 150.21g/mol | C10H14O | Benzenebutanal | 23.76 | 41 |
| 0.7 | 296.5 g/mol | C20H40O | Isophytol | 23.87 | 42 |
| 0.5 | 266.38 g/mol | C16H26O3 | 2-Dodecen-1-yl(-)succinic anhydride | 23.93 | 43 |
| 2.0 | 334.4 g/mol | C20H30O4 | 1,2-Benzenedicarboxylic acid, butyl 2- ethylhexyl ester | 24.02 | 44 |
| 0.7 | 284.47g/mol | C18H36O2 | Hexadecanoic acid, ethyl ester | 24.28 | 45 |
| 2.2 | 186.33g/mol | C12H26O | 1-Octanol, 2-butyl- | 24.31 | 46 |
| 1.2 | 232.83g/mol | C14H29Cl | Tetradecane, 1-chloro- | 24.38 | 47 |
| 13.6 | 278.5 g/mol | C20H38 | Decane, 5,6-bis(2,2-dimethylpropylidene)-, (E,Z)- | 24.77 | 48 |
| 0.8 | 172.31 g/mol | C11H24O | 1-Undecanol | 25.19 | 49 |
| 19.9 | 296.5 g/mol | C20H40O | Phytol | 25.44 | 50 |
| 1.1 | 282.5 g/mol | C18H34O2 | Oleic Acid | 25.89 | 51 |
| 2.7 | 281.47g/mol | C18H35NO | 9-Octadecenamide, (Z)- | 27.65 | 52 |
| 2.1 | 296.53g/mol | C20H40O | Octadecane, 1-(ethenyloxy)- | 27.85 | 53 |
| 0.7 | 226.44 g/mol | C16H34 | Hexadecane | 28.62 | 54 |
| 1.8 | 390.6 g/mol | C24H38O4 | Bis(2-ethylhexyl) phthalate | 28.96 | 55 |
| 2.4 | 308.6 g/mol | C22H44 | 1-Docosene | 29.33 | 56 |
| 2.3 | 268.5 g/mol | C19H40 | Nonadecane | 29.36 | 57 |
| 0.6 | 362.5 g/mol | C21H30O3S | 2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl- | 30.98 | 58 |
| 1.5 | 326.60g/mol | C22H46O | Behenic alcohol | 32.40 | 59 |
| 5.3 | 380.7 g/mol | C27H56 | Heptacosane | 33.37 | 60 |
| 0.5 | 258.5 g/mol | C16H34S | tert-Hexadecanethiol | 34.51 | 61 |

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| **Fig 2 :the chemical formulas of the main compounds found in the essential oil extracted from the leaves of the plant *Arbutus* *andrachne* L.** |
| Phytol | Decane, 5,6-bis(2,2-dimethylpropylidene)-, (E,Z)- |
| 1,2-Benzenedicarboxylic acid, butyl octyl Ester | Heptacosane |

In contrast, our analysis of the leaves essential oil revealed Phytol (19.9%), Decane, 5,6-bis (2,2-dimethylpropylidene)-, (E,Z)-(13,6%), 1,2-Benzenedicarboxylic acid, butyl octyl Ester (6.8%), and Heptacosane(5.3%). highlighting a different chemical

profile.

**Comparison of the result with the studies men tioned:-**

The comparison between the essential oils derived from the leaves of *Arbutus* *andrachne* L. in our study and those obtained from the wood as reported in turkey

 provides significant insights into the plant's chemical diversity.

The study in Turky on *Arbutus* *andrachne* L. wood identified 25 compounds making up (80.5%) of the oil, with cinnamyl alcohol (21.97%), 4-tert-butylcyclohexyl acetate

(16.59%), and isobornyl acetate (15.37%) as the primary constituents (Sıcak and Eliuz, 2019).

Kivcak *et al*., (2001) identified (37) compounds from leaves of *Arbutus* *unedo* L. of Turkish in their study and determined the most active compounds as E-2-decenal (12%), α-terpineol (8,8 %), hexadecanoic acid (%5,1) and (e) -2- undecenal (4.8%).

Kahriman *et al*., (2010) identified 49 components in the flowers and fruits of *Arbutus* *unedo* L. and the most active components were α-terpineol (%16,3) in the oil of the flower and hexadecanoic acid (21.7%) in the essential oil of the fruit

In the study conducted by Bessah and ben youssef (2010) on the Composition of the essential oil of  *Arbutus* *unedo* L. leaves found in Algeria, palmitic acid (35.2%), linoleic (18.8%) p-cresol, 2,6-di-tert-butyl- (%6.2).

In Jordon a study was conducted and aresult result revealed that the essential oil of the fruits comprises 35 different components. The main ingredient in a *Arbutus* *andrachne* L. fruits is pentadecanoic acid, 14-methyl-, methyl ester (19.87%), (Shaheen *et al*., 2024).

This distinct chemical profile contrasts with our finding, highlighting the diversity within the *Arbutus* ssp. and prompting further exploration into the factors shaping such differences.

The difference between the results of our study and previous studies is attributed tothe difference in geographical characteristics and climatic conditions (Baydar, 2000).

**Conclusion**

1-many of the key compounds have medical and pharmaceutical importance.

2-the com pounds in the essential oil extracted from the leaves of this plant vary between hydrocarbon, oxygen, nitrogenous compounds and other chemical compounds.

**Suggestions**

1-study of the biological effectiveness of the essential oil in view of the medical importance of this plant..

2-working on extracting essential oil from different parts of the plant (fruits, Flowers, wood).

3- depending on different locations because the main resulted compounds differ according to different location.

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