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**Research Article**

# Chemical Composition of the Essential Oil Extracted from the Aerial parts of Sage (*Salvia Officinalis* Collected from North East of Algeria.

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**Abstract:** The purpose of this study was to investigate the chemical composition of the essential oil from *salvia officinalis* collected from north east of Algeria. The oil was isolated by hydrodistillation in a Clevenger-type apparatus and analyzed by GC/MS. The yield of the essential oil was 1.48% (v/w) and thirty seven constituents were identified according to their chromatographic retention times and mass spectra, corresponding to 100% of the compounds present. The major constituents of the oil were caryophyllene (25.87%), 1-alpha- Terpineol (16.85%), (+)-Ledene (10.05%) and Allo-aromadendrene (6.99%). The essential oil studied was not similar to those found in the literature; however, the main compounds of this oil present several interesting biological activities.
**Keywords:** medicinal plants**,** *salvia officinalis*, essential oil, hydrodistillation, chemical composition, GC/MS

## INTRODUCTION

The exploration of traditional knowledge for cure to common diseases is attractive since antiquity. The medicinal plants are responsible for the most of the medicine and food used in modern society. It is estimated that an amount of 20,000 species from several families are useful for these purposes [1, 2].

Aromatic plants have been used for centuries as spices and condiments to confer aroma and flavor to food and beverages. Additionally, due to their constituents, medicinal and aromatic plants can act as stabilizer agents, playing an important role in the shelf-life of foods and beverages [3], but only in the last decade scientific research have focused its interest on their essential oils (EOs) and extracts as natural sources of antimicrobial and antioxidant compounds [4].

Essential oils occur in edible, medicinal and herbal plants, which minimize questions regarding their safe use in food products. Essential oils and their constituents have been widely used as flavouring agents in foods since the earliest recorded history and it is well established that many have wide spectra of antimicrobial action [5, 6]. The composition, structure as well as functional groups of the oils play an important role in determining their antimicrobial activity [7].

The genus *Salvia* with its nearly 1000 species [8] represents a huge and important taxonomic unit of the tribe Menthae, Lamiaceae Subfam. Nepetoideae [9].

*Salvia officinalis* L., popularly known as salvia or sage, is an aromatic plant widely distributed in the world. Common sage, since ancient times, has been an ingredient in perfumes, a flavoring in a variety of food preparations, and a medicinal plant used in the healthy Mediterranean diet [10, 11].

The essential oil of sage is added to meat, sausage, poultry stuffings, fish, soups, canned foods and other food products. Sage essential oil protected liver patés from oxidation processes and could be used as alternative option to synthetic antioxidants such BHT and was used in dry fermented buffalo sausage too [12].

Sage essential oil is also exhibit anti-inflammatory, antispasmodic, antimicrobial and stimulant properties [13].

Many studies have focused on the chemical composition of *S. officinalis* and large variations have been reported from different countries [14].

The variability in the composition of the essential oil depends on genetic (species, chemical plant variety) and environmental factors (climate, insolation, altitude) [15].

The purpose of this paper was to examine the composition of the essential oil of *Salvia officinalis* collected from north east of Algeria by GC/SM.

## MATERIALS AND METHODS

### Plant material

The aerial parts of wild growing plant materials of *salvia officinalis* were available in the local markets from Algeria (exactly from Annaba). The collected samples were washed clearly by water to remove dust materials. Then they were dried.

### Isolation of the essential oil

Air-drying of the plant was performed in a shady place at room temperature for 10 days. Dried aerial parts (100 g) of plants were cut and subjected to the hydro-distillation for 2 h, using Clevenger type apparatus. The resulting essential oils were dried over anhydrous sodium sulfate and stored at 4°C until analyzed.

### Gas chromatography/Mass spectrometry (GC/MS) analysis

Analyses were realized in the university Ouled Aissa (Jijel). The GC-MS used was a Shimudzu GCMS-QP 2010 Plus system (Shimudzu, Kyoto, Japan). The column was a 30 m × 0.25 mm DB-5 MS capillary with 0.25µm film thickness. The carrier gas was helium at a flow rate of 2.0 ml min-1. Samples were injected by placing the SPMe fiber in the GC inlet for 2 min. The starting temperature was 40°C for 10 min, then raised to 200°C at a rate of 5°C min-1 and held at 220°C for 5 min. The mass spec- trometer was operated in the electron impact mode with ion source temperature of 250°C, using an ionization voltage of 70 eV. The mass range was 40-450 amu.

The components were identified by computerized bank ESO 2000 database, library NIST 05.

## RESULTS AND DISCUSSION

The hydrodistillation of sage purchased from local markets yielded 1.48% (v/w). This is in accordance with others values found in literature, which reported yields of 1.1 to 2.8% (v/w) [16-12].

**Table.1** shows the qualitative and average quantitative composition of the main constituents in the oil sample of sage. Chemical analysis of the EO revealed the presence of 35 components making up to 100 % of the total material.

**Table-1: Chemical composition (%) of the essential oils isolated from aerial parts of *S. officinalis L.***

| N° | Compounds | RT | Composition (%) |
|---|---|---|---|
| **1** | **1-alpha- Terpineol** | **3.843** | **16.85** |
| 2 | γ-Terpinene | 4.016 | 1.36 |
| 3 | L-4-Terpinolene | 5.364 | 1.11 |
| 4 | Terpinolene | 5.826 | 0.59 |
| 5 | β-Thujone | 6.105 | 1.83 |
| 6 | Linalool | 6.588 | 0.36 |
| 7 | Myrtenol | 6.965 | 0.51 |
| **8** | **D-camphor** | **7.937** | **8.54** |
| 9 | trans-3-pinanone | 8.959 | 0.85 |
| 10 | 3-pinanone-cis | 9.650 | 0.23 |
| 11 | L-4-Terpineol | 10.550 | 0.95 |
| 12 | Estragole | 11.511 | 0.16 |
| 13 | Anethol | 13.989 | 2.55 |
| 14 | Bornyl acetate | 16.283 | 0.78 |
| 15 | Carvacrol | 17.394 | 0.26 |
| 16 | α-Terpinyl acetate | 18.426 | 2.24 |
| **17** | **Caryophyllene** | **21.957** | **25.87** |
| **18** | ***Allo*-aromadendrene** | **22.296** | **6.99** |
| 19 | β-Gurjunene | 23.089 | 0.96 |
| 20 | (-)-α-Panasinsen | 23.185 | 0.72 |
| **21** | **Isocaryophillene** | **23.413** | **5.88** |
| 22 | γ-Gurjunene | 23.520 | 1.60 |
| 23 | α-caryophyllene | 23.928 | 2.72 |
| 24 | Espatulenol | 24.201 | 1.17 |
| 25 | δ-Guaiene | 24.996 | 0.84 |
| **26** | **(+)-Ledene** | **25.436** | **10.05** |
| 27 | β-Cadinene | 27.217 | 0.24 |
| 28 | Cyclopentane, 4-methylene- 1-methyl-2-(2-methyl-1-propen-1-yl)-1-vinyl- | 27.868 | 0.22 |
| 29 | 9β-Acetoxy-3,5,8-trimethyltricyclo[6.3.1.0 (1,5)]dodec-2-ene | 29.682 | 0.24 |
| 30 | caryophyllene oxide | 32.256 | 0.39 |
| 31 | Tetracyclo[6.3.2.0(2,5).0(1,8)]tridecan-9-ol, 4,4-dimethyl- | 32.416 | 0.24 |
| 32 | 4,8, 13-Cyclotetradecatriene-1,3-diol, 1,5,9- trimethyl-12-(1-methylethyl)- | 33.418 | 0.78 |
| 33 | Androstan-17-one, 3-ethyl-3-hydroxy-,(5α)- | 33.936 | 0.28 |
| 34 | Sclarene | 40.838 | 1.49 |
| 35 | Trachylobane | 42.680 | 1.04 |

The major components were caryophyllene (25.87%), 1-alpha- Terpineol (16.85%), (+)-Ledene (10.05%), D-camphor (8.45%) and *Allo*-aromadendrene (6.99%).

The results of GC/MS analysis show that the presence and quantity of dominant compounds in the essential oil of investigated population of *salvia officinalis* significantly differ from the results published earlier (Table 2).

**Table-2: Major components (%) of some essential oil of *Salvia officinalis* in literature data.**

| Authors | Country | Major components |
|---|---|---|
| Soković *et al.*, [21] | The Netherlands | Camphor (16.7%) and α-thujone (31.7%) |
| Arraiza M.P. *et al.* [16] | Spain | α-thujone (40.1 - 46.5%), β pinene (2.6 - 4.5%), cineole (3.5 - 8.7%), β thujone (4.1 - 5.6%), camphor (4.1 - 8.0%), borneol (1.3 - 3.7%), α humulene (3.8 - 7.3%), viridiflorol (3.4-12.6%) and manool (0.1-4.5%). |
| Kabouche Z *et al.*, [22] | Algeria | α-thujone (24.52%), camphor (16.86%), 1,8-cineole (15.92%), β-thujone (6.50%) and veridiflorol (6.35%) |
| Porte A *et al.*, [12] | Brazil | α-thujone (40.90 %), camphor (26.12 %), α-pinene (5.85 %) and β-thujone (5.62 %) |

The greatest difference in essential oil composition could be arise from several environmental (climatical, seasonal) and genetic differences [15].

It also might be correlated to the geographic origin of the populations and ecological conditions [17].

Furthermore, the essential oil studied could have good antimicrobial properties because of its high content of 1-alpha- Terpineol. This components was proved as an efficient agent against Gram + and Gram – bacteria [18], in association with terpinene-4-ol and alpha-pinene, it can be efficient against *Propionibacterium acnes* [19].

The study realized by Hammer el al. [20], indicate that 1-alpha- Terpineol exert antifungal actions by altering membrane properties and compromising membrane-associated functions.

## Conclusions

The chemical composition of the aerial parts of *Salvia officinalis* collected from the north east of Algeria was investigated. Essential oil was obtained from hydrodistillation method, and its chemical composition was determined b GC-MS.

The findings indicated that the essential oil contained the largest amount of caryophyllene (25.87%) in comparison with previously investigated corresponding oils in different countries.

Our study show clear qualitative and quantitative differences and the oil composition did not match the requirement of ISO 9909, Furthermore, the main compounds of this oil present several interesting biological activities.

The next step will be to isolate some major components of *Salvia officinalis* and then to evaluate their antimicrobial and antioxidant activities.

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