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Chemical Composition of the Essential Oil of *stachys lavandulifolia(*after flowering) Growing wild in Darkesh Protected Area(North Khorassan Province Iran)

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ABSTRACT

The essential oil of Stachys lavandulifolia Vahl (Lamiaceae) was isolated by hydrodistillation of the aerial parts of the plant after flowering, with a yield of 0.15%. The chemical composition of volatile oil was analyzed by GC/ MS. The main components were bis (2-ethylhexyl)phthalate(58.39%),decane(25.46%), p-Xylene (4.2%) ,dodecane(3.85%)and α-pinene (3.29%).

Keywords: *Stachys lavandulifolia*; Lamiaceae; essential oil; GC-MS.

INTRODUCTION

In the flora of Iranica genus, *Stachys* is represented by thirthy-one species. *Stachys lavandulifolia* is grown in many parts of Iran, Iraq and Anatolia [1]. The plant is known as Chaye-kuhi (Fig1) in Iran and its' english name is Betony. It is used as the herbal tea in gastrointestinal disorders [2]. Hydroalcoholic extract of the aerial parts of *S. inflata* shows potent anti-inflammatory activity in rat. The methanolic extract of the tuber of *S. sieboldii* has anti-anoxia action in mice [3, 4]. Ramezani et al. reported spathulenol and caryophyllene oxide as the main constituents of *S. lavandulifolia* [5]. In the present study a sample of *S. lavandulifolia* with different chemical composition has been reported.

Plant material

Aerial parts of *S. lavandulifolia* were collected at the after flowering stage from the Darkesh Protected Area, Bojnourd (North Khorassan Province Iran) In Jun 2010,and identified at the Research center for plant of Department of environment of North Khorassan,Iran. A voucher specimen has been deposited in the Herbarium of research center for plant .

Isolation of the essential oil

were air-dried for 4 days before isolation of essential oil. The plant material (100gr) was cut into small pieces and The essential oil was obtained by the hydrodistillation method, using a Clevenger apparatus. The temperature and pressure of hydrodistillation were 120ºC and 560 mmHg respectively. The distillation time was six hours. The resulting pale yellow oil was then dried over anhydrous sodium sulphate and 30 µL were solubilized in 1 mL of dichloromethane before the GC injection. 1 µL of this solution was directly used for analysis.

Fig1:Photo from *S. lavandulifolia*

MATERIALS AND METHODS

Gas chromatography and mass spectrometry

Gas chromatographic analysis was performed on an Hewlett-Packard(HP)6890A instrument equipped with a flame ionization detector and Rtx-5MS (15 m × 0.25 mm × 0.25 µm) capillary column, while the essential oil components were identified on an Agilent Technologies 5973N mass spectrometer. The GC settings were as follows: the initial oven temperature was held at 35 ºC for 6 min and ramped at 5 ºC min^{-1} to 150 ºC for 0 min, and then ramped at 10 ºC min^{-1} to 280 ºC for 3 min. The injector temperature was maintained at 250 ºC. The samples (1 µL) were injected neat, with a split ratio of 1:10. The carrier gas was helium at flow rate of 1.0 mL min^{-1}. Spectra were scanned from 20 to 550 m/z at 2 scans s^{-1}. Most constituents were identified by gas chromatography by comparison of their retention indices with those of the literature or with those of authentic compounds available in our laboratories. The retention indices were determined in relation to a homologous series of *n*-alkanes under the same operating onditions. Further identification was made by comparison of their mass spectra on both columns with those stored in NIST 05 and Wiley 275 libraries or with mass spectra from literature[6-11]. Component relative percentages were calculated based on GC peak areas without using correction factors.

RESULTS AND DISCUSSION

The average yield of essential oil obtained after hydrodistillation of the aerial parts of *stachys lavandulifolia* was about 0.15%. Table 1 reports the chemical composition of the essential oil under study. nine components were identified ,accounting for %100 of the total oil.The various compounds were identified by comparison of their Kováts retention indexes, determined utilizing a non-logarithmic scale on non-polar (Rtx-5MS) columns(Fig2), and by comparison of the mass

spectra of each GC component with those of standards and with reported data(12).High resolution gas chromatography-mass spectrometric (HP GC-MS) analysis and Kováts Index values showed that its principal components are the (2-ethylhexyl) phthalate(58.39%), decane(25.46%), p-Xylene (4.2%) and α-pinene (3.29%).

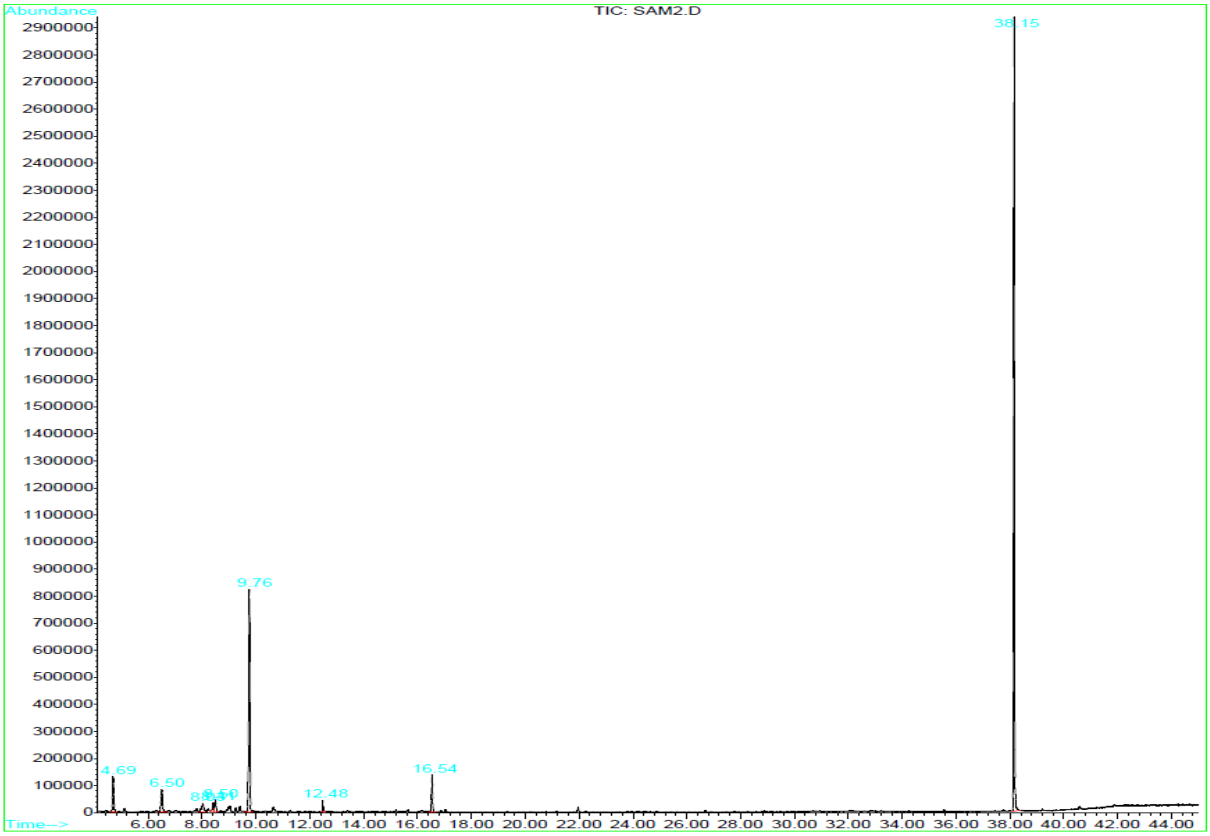

Fig2: TIC Spectra of *Stachys lavandulifolia*

Table 1. Percentage composition of the essential oil isolated from aerial parts of *Stachys lavandulifolia*

NO	compound	Experimentally determined KI[a]	HP GC-MS Peak area [%]	Method of identification
1	p-xylene	888	**4.20**	GC-MS,Ms
2	Decane Alpha-pinene	935	**3.29**	GC-MS,Ms
3	3-ethyl-2,4-dimethylpentane	945	1.66	GC-MS,Ms
4	Beta-pinene	970	1.19	GC-MS,Ms
5	3-methylnonane	978	1.44	GC-MS,Ms
6	Decane	998	**25.46**	GC-MS,Ms
7	oxirane	1165	0.52	Ms
8	Dodecane	1187	**3.85**	GC-MS,Ms
9	Bis(2-ethylhexyl)phthalate	2526	**58.39**	GC-MS,Ms

a: Retention Indices on RTX-5MS

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