

## CHEMICAL COMPOSITION OF THE ESSENTIAL OILS OF *ANETHUM GRAVEOLENS* L.

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*Key words: Anethum graveolens, Chemical composition, Essential oils*

### Abstract

The volatile constituents of the leaves of *Anethum graveolens* L., growing wild in Iran, were investigated by GC/MS,  $\alpha$ -Phellandrene (29.12%), limonene (26.34%), dill ether (15.23%),  $\alpha$ -pinene (2%), *n*-tetracosane (1.54%), sabinene (1.34%), neophytadiene (1.43%), *n*-docosane (1.04), *n*-tricosane (1%), *n*-nonadecane (1%), *n*-eicosane (0.78%), *n*-heneicosane (0.67%),  $\beta$ -myrcene (0.23%) and  $\alpha$ -tujene (0.21%) were found to be the major constituents of the oil.

*Anethum graveolens* L. (Fam.: Umbelliferae) commonly known as Dill, is an annual medicinal plant with tiny yellow flowers. *A. graveolens* seeds are widely used in food and pharmaceutical industries. In traditional medicine, Dill seeds are used against gastrointestinal problems and rheumatism (Grosso *et al.* 2008). On the other hand, seed augments the appetite and strengthen the stomach (Zargari 1996). The major part (90%) of the dill fruit's oil consists of d-carvone, d-limonene, and  $\alpha$ -phellandrene. The remaining include: dillanoside, kaempferol and 3-glucuronide compound, vicenin, myristicin and other flavonoids, phenolic acids, proteins and fats (Zargari 1990, Valady *et al.* 2010). The present work was undertaken to determine the chemical composition of essential oils from *A. graveolens* wild growing in several locations of Ilam, Iran.

*A. graveolens* leaves were ground and the resulting powder was subjected to hydrodistillation for 3 hrs in an all glass Clevenger-type apparatus according to the method recommended by the European Pharmacopoeia (1975). The obtained essential oils were dried over anhydrous sodium sulphate and after filtration, stored at +4°C until analysed.

The GC/MS analyses were executed on a Hewlett-Packard 5973N gas chromatograph equipped with a column HP-5MS (30 m length  $\times$  0.25 mm i.d., film thickness 0.25  $\mu$ m) coupled with a Hewlett-Packard 5973N mass spectrometer. The column temperature was programmed at 50°C as an initial temperature, holding for 6 min, with 3°C increase per minute up to the temperature of 240°C, followed by a temperature enhancement of 15°C per min up to 300°C, holding at the mentioned temperature for 3 min. Injector port temperature was 290°C and helium was used as carrier gas at a flow rate 1.5 ml/min. Ionization voltage of mass spectrometer in the EI-mode was equal to 70 eV and ionization source temperature was 250°C. Linear retention indices for all components were determined by coinjection of the samples with a solution containing homologous series of C<sub>8</sub> - C<sub>22</sub> *n*-alkanes and comparing them and their mass spectra was compared with those of authentic samples or with available library data of the GC/MS system (WILEY 2001 data software) and Adams libraries spectra (2001).

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The essential oil was extracted from the leaves of *A. graveolens* L. by hydrodistillation with a yield of 1.05%. GC/MS analyses of the oil led to the identification of 14 different components, representing 81.93% of the total oil. The identified compounds are listed in Table 1 according to their retention index relative to *n*-alkanes. Monoterpenic hydrocarbons were found predominant in the leaf oil. The major components in the oil detected were  $\alpha$ -phellandrene (29.12%), limonene

**Table 1. Chemical composition of essential oil from leaves of *A. graveolens*.**

Compounds	Percentage	Kovats retention indices
$\alpha$ -Tujene	0.21	920
$\alpha$ -Pinene	2.00	932
Sabinene	1.34	970
$\beta$ -Myrcene	0.23	990
$\alpha$ -Phellandrene	29.12	1002
Limonene	26.34	1017
Dill ether	15.23	1180
Neophytadiene	1.43	1799
<i>n</i> -Nonadecane	1.00	1900
<i>n</i> -Eicosane	0.78	2001
<i>n</i> -Heneicosane	0.67	2054
<i>n</i> -Docosane	1.04	2118
<i>n</i> -Tricosane	1.00	2227
<i>n</i> -Tetracosane	1.54	2387
Total	81.93	

(26.34%), dill ether (15.23%),  $\alpha$ -pinene (2%), *n*-tetracosane (1.54%), sabinene (1.34%), neophytadiene (1.43%), *n*-docosane (1.04), *n*-tricosane (1%), *n*-nonadecane (1%), *n*-eicosane (0.78%), *n*-heneicosane (0.67%),  $\beta$ -myrcene (0.23%) and  $\alpha$ -tujene (0.21%).  $\alpha$ -Phellandrene and dill ether are the compounds, which form the important odor of Dill herb (Blank and Grosch 1991). Ashraf *et al.* (1997) analyzed the Dill seed essential oil by GLC and found the oil to be rich in carvone (52.25%), Dill apiole (28.28%) and limonene (9.34%). Singh *et al.* (2005) reported carvone (55.2%), camphor (11.44%), limonene (16.6%) and Dill apiole (14.4%) to be the key components present in the essential oil extracted from the seeds of *A. graveolens*. However, there were significant differences among the rates of those reported components.

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*(Manuscript received on 22 July, 2014; revised on 21 August, 2014)*