

Characterisation of bioactive compounds in organic dill (*Anethum graveolens* L.) stems processed by freeze-drying

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INTRODUCTION

- Dill (*Anethum graveolens* L.) is an annual plant native to the Mediterranean region, cultivated all over the world, including south of Europe, Iran, Egypt, USA and China. One of the main constituents of the dill volatile oil is α -phellandrene, with a great contribution to the sensory traits of dill, which can be greatly influenced by conventional drying. The aim of this paper is to characterise the chemical composition of dill stems before and after they were processed by drying, using freeze-drying technologies, at a temperature of -55 °C, and further milled in order to obtain a fine powder, which can successfully be used as food additives.

MATERIALS AND METHODS



Anethum graveolens L. stems



Freeze-dried powdered stems

- **Moisture determination**
 - 0.5 g of fresh sample was dried until constant mass in a Sartorius thermobalance at 105 °C.
- **Essential oil extraction and GC-MS analysis**
 - hydro-distillation for 3 h in a Clevenger-type apparatus.
 - analyzed by GC-MS) by using a Agilent 6890 GC coupled with a 5973 Network single quadrupole mass spectrophotometer detector in Electron Ionization (EI) mode and 7673 injector on a HP-5MS capillary column (30 m × 0.25 mm id, 0.25 μm film thicknesses).
- **Total phenolic content (TPC) by Folin-Ciocalteu method**
 - methanolic (70%, v/v) extracts
 - absorbance measured at 760 nm
 - Specord 210 Plus UV/VIS spectrophotometer
- **DPPH radical scavenging activity (AA)**
 - methanolic (70%, v/v) extracts
 - absorbance measured at 515 nm
 - Specord 210 Plus UV/VIS spectrophotometer

CONCLUSIONS

- The changes in volatile oil constituents during freeze-drying vary due to the different boiling points of the compounds. Although freeze drying is one of the most recommended techniques for herbs drying, significant changes can occur in the chemical composition of the essential oil of *Anethum graveolens* L..
- Given the high content of phenolic compounds and antioxidant activity of dried stems, the freeze-drying is a sustainable processing technique for preservation of phenolic compounds and antioxidant activity.

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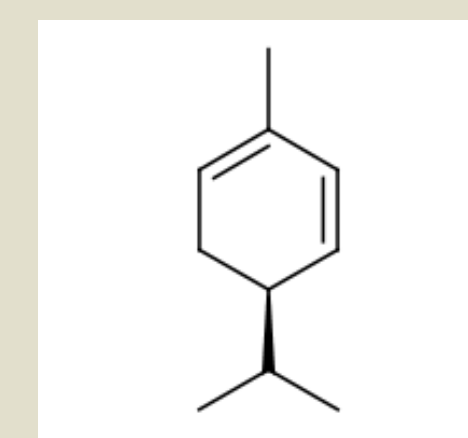
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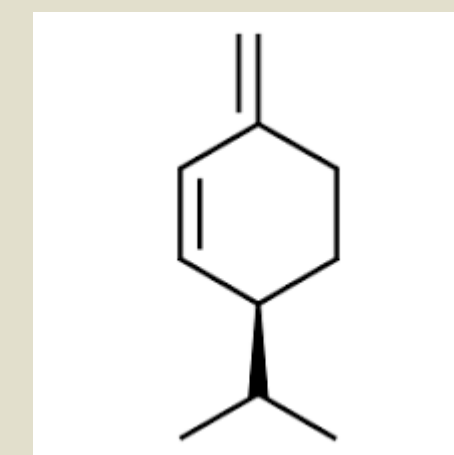
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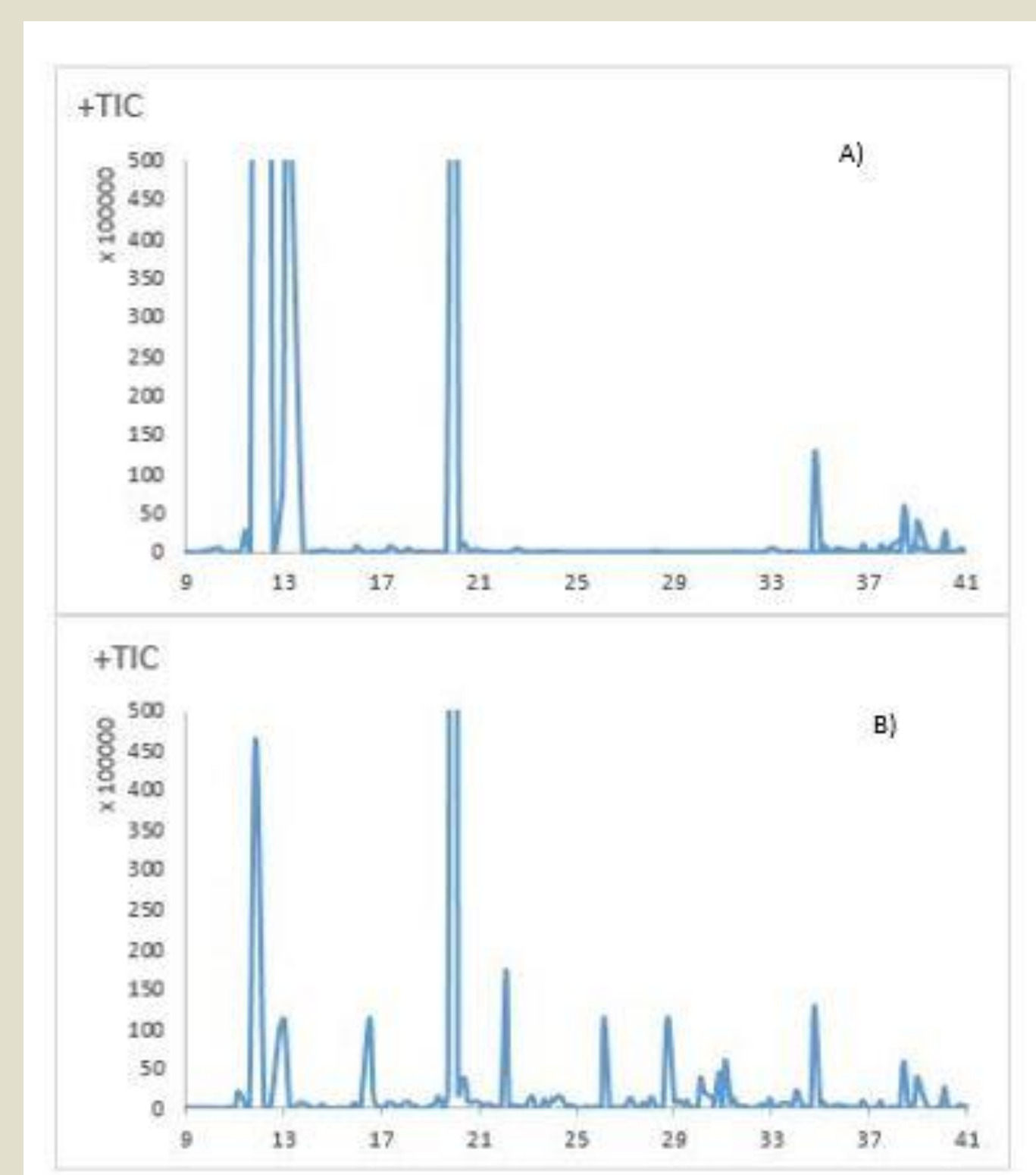
RESULTS AND DISCUSSIONS



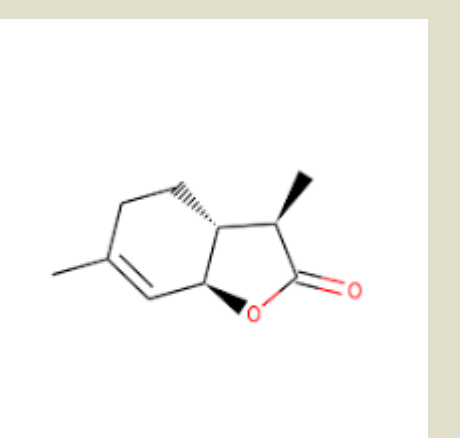
α -phellandrene



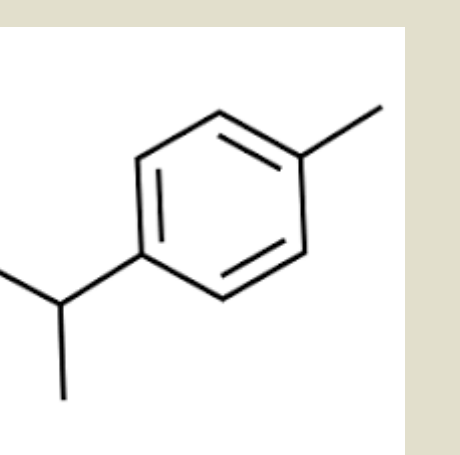
β -phellandrene



Chromatographic profile of A) fresh dill stems; B) freeze-dried dill stems



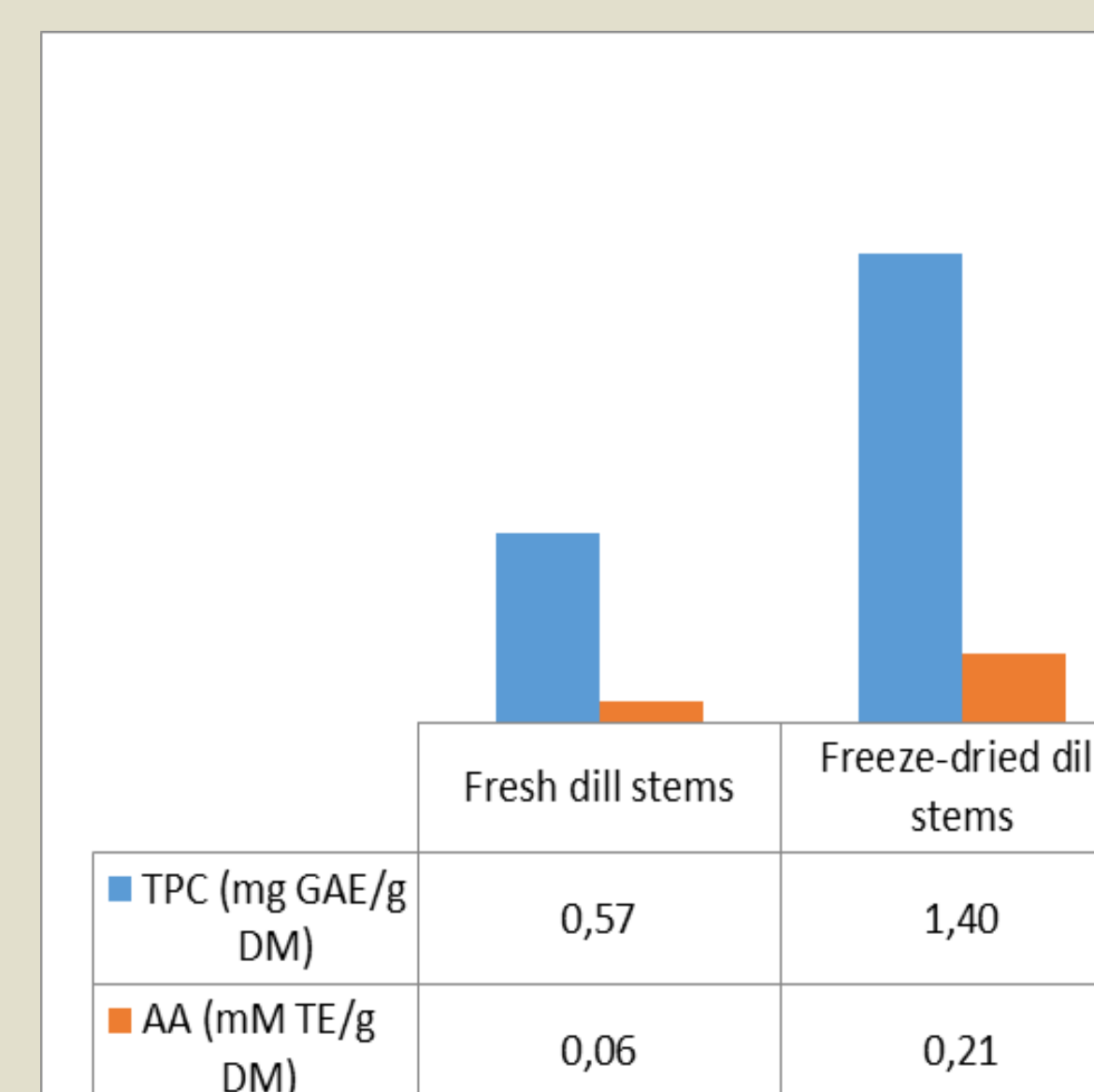
Dill ether



p-cymene

- After freeze-drying the samples reached a 71 % loss from the fresh weight, with a final dry matter content of 98.14 % for dried stems.
- The extraction ratio for stem volatile oil was 0.067% w/w for fresh stems and 0.158% w/w for dried powdered stems.
- The main volatile oil constituents identified in both fresh stems and freeze-dried stem powder were: α -phellandrene, β -phellandrene, and dill ether.
- Over 95% of the chemical composition of fresh dill stems was constituted of α -Phellandrene 65,23%, β -Phellandrene 11,36%, dill-ether 19,944% și p-Cymene 1,46%.
- *Anethum graveolens* L. processed by freeze-drying shows a decrease of monoterpene hydrocarbons of 84%.

Variation of TPC and AA of dill stems



- The highest TPC was found for freeze-dried stems (1.40 mg GAE/g DM) compared to only 0.57 mg GAE/g DM for fresh stems.
- In the case of the antioxidant activity, the trends are similar to the one observed for the total phenolic content. Freeze dried stems remains the samples which display higher antioxidant activity (0.21 mM TE/g DM) compared to fresh stems (0.06 mM TE/ g DM).