

Assessing indoor air quality in the olive mills

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Introduction:

- During the olive oil production process various Volatile Organic Compounds (VOCs) are generated.
- The chemical composition of the indoor air in olive mills includes pleasant VOCs derived from the aroma of olive oil and other VOCs release from human activities and the industrial processes (Fig. 1).¹
- Also, most olive mills in Cyprus usually store their olive mill waste products (OMW) in open reservoirs for later potential reuse, so odorous VOCs are released as they naturally degrade under ambient conditions.
- VOCs can be identified in the indoor air of olive mill and most of them, especially the unpleasant VOCs have negative impact on the aroma of olive oil, reducing its quality and adverse effects both on the environment and human health.
- By reducing the VOCs related to the negative impacts, the quality of life will be improved.
- Therefore, the main objectives of the study were to:
 - Identify the VOCs composition of indoor air samples from two different olive mills in Cyprus during the olive oil extraction process.
 - Distinguish the origin of the VOCs, by comparing the VOCs released from the aroma of olive oil and the respective indoor emissions.

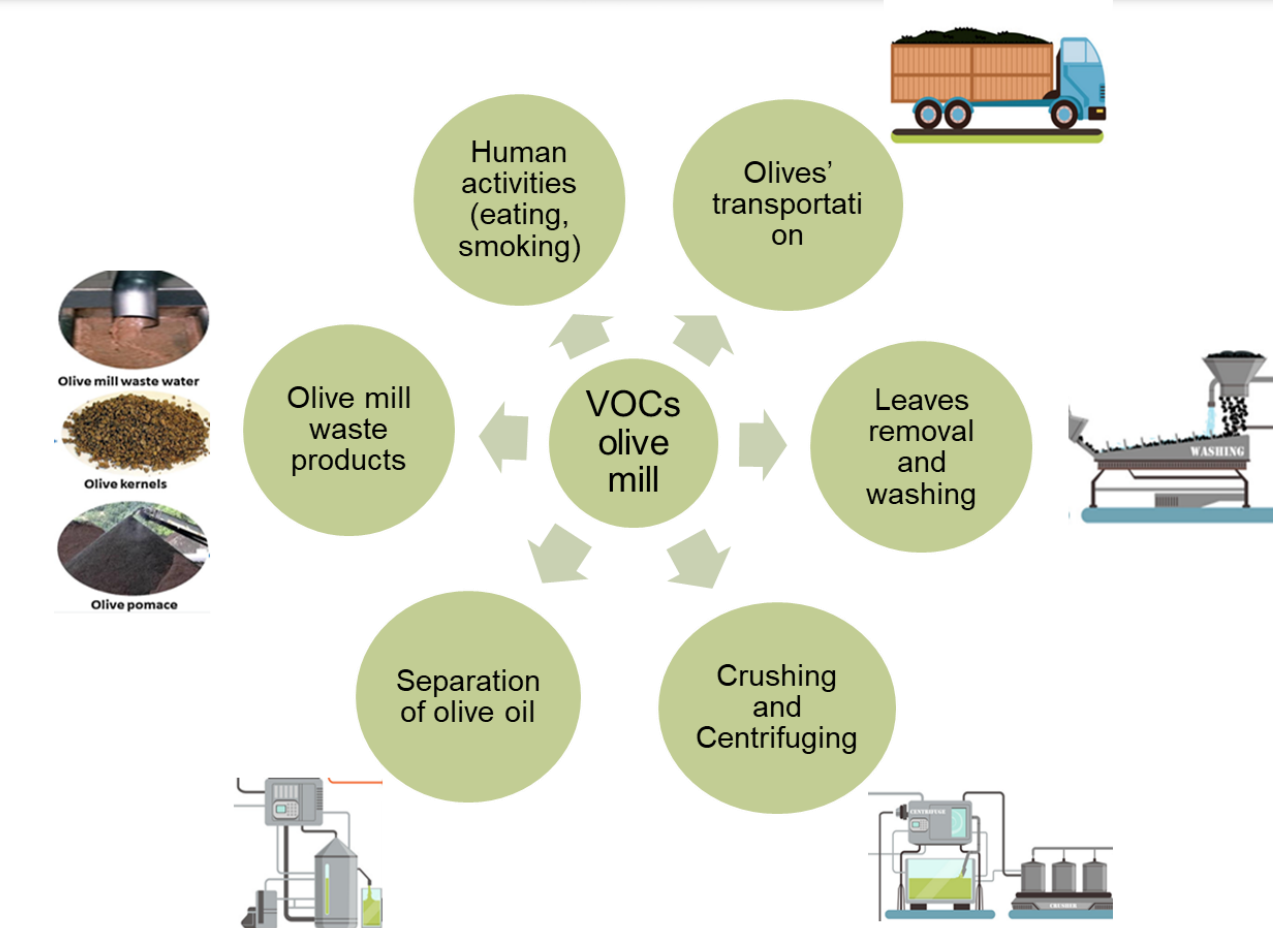


Figure 1. Sources of VOCs in the indoor air of an olive mill.

Material and methods:

Air Sampling:

- Air samples were collected from the ambient air of two different olive mills during the olive oil extraction process. Olive oil samples were collected, too.
- 1 L of air was sampled onto sorbent tubes with different packing materials; Tenax and a combination of Carboxgraph and Tenax (biomonitoring) using a portable pump (Fig. 2).
- The sorbent tubes were conditioned and then sealed with caps, until the sampling. Also, the pump adjusted to a standard flow rate of 100 mL/min.²
- Just before the sampling process, the sealed ends of the sorbent tubes were removed to allow air enter into the media and the sorbent tube was connected to the sampling pump. The sampling process lasted 10 min. When the sampling process completed, the ends of sorbent tubes were sealed and stored in low temperature until their analysis.
- The analytical system used for the sorbent tubes analysis comprised of a Thermal Desorption unit coupled to a Gas Chromatography/Mass Spectrometry (TD-GC/MS).

Olive Oil Analysis:

- To extract the aroma (VOCs) of olive oil, HiSorb probes (Polydimethylsiloxane) were used in the headspace of a vial and then analysed by TD-GC/MS (Figs. 3, 4).



Figure 2. Active air sampling pump (Active-VOC, Markes, UK).

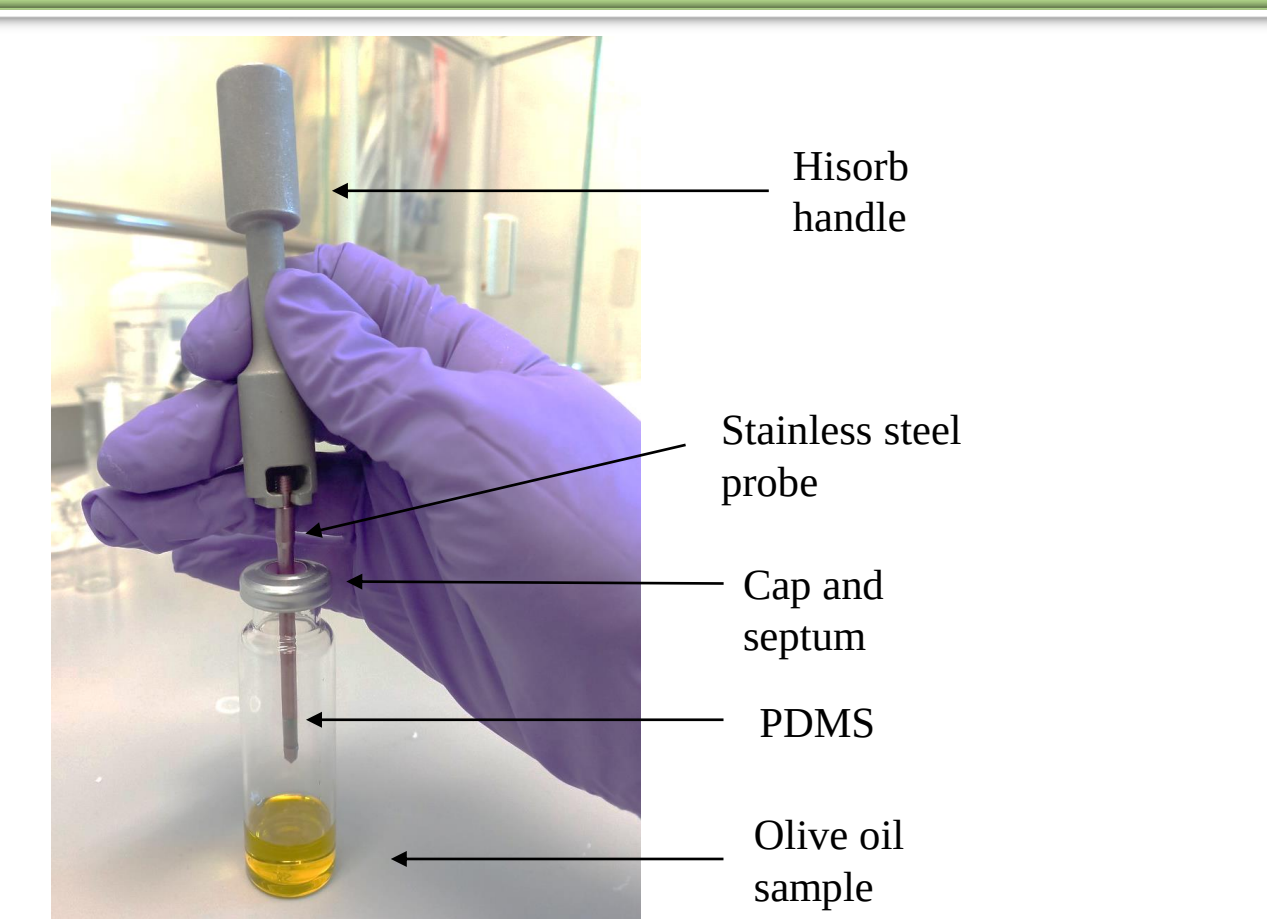


Figure 3. Sampling set up for headspace sorptive extraction using HiSorb™ probe.

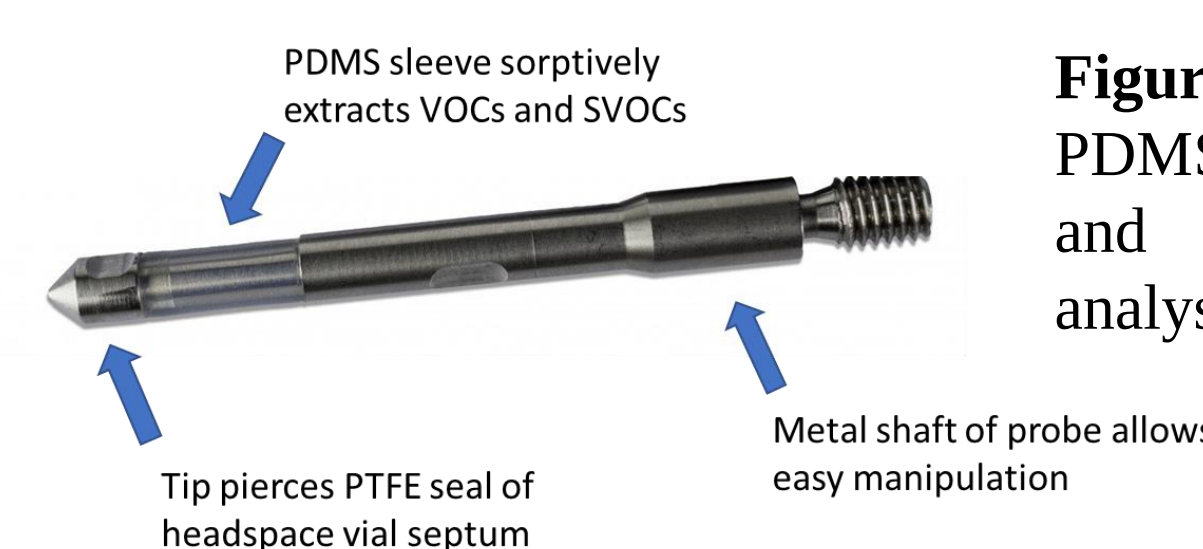


Figure 4. HiSorb™ probe is a high capacity PDMS sorbent, that sorptively extract volatile and semi-volatile organic compounds for analysis by TD-GC/MS.

Results:

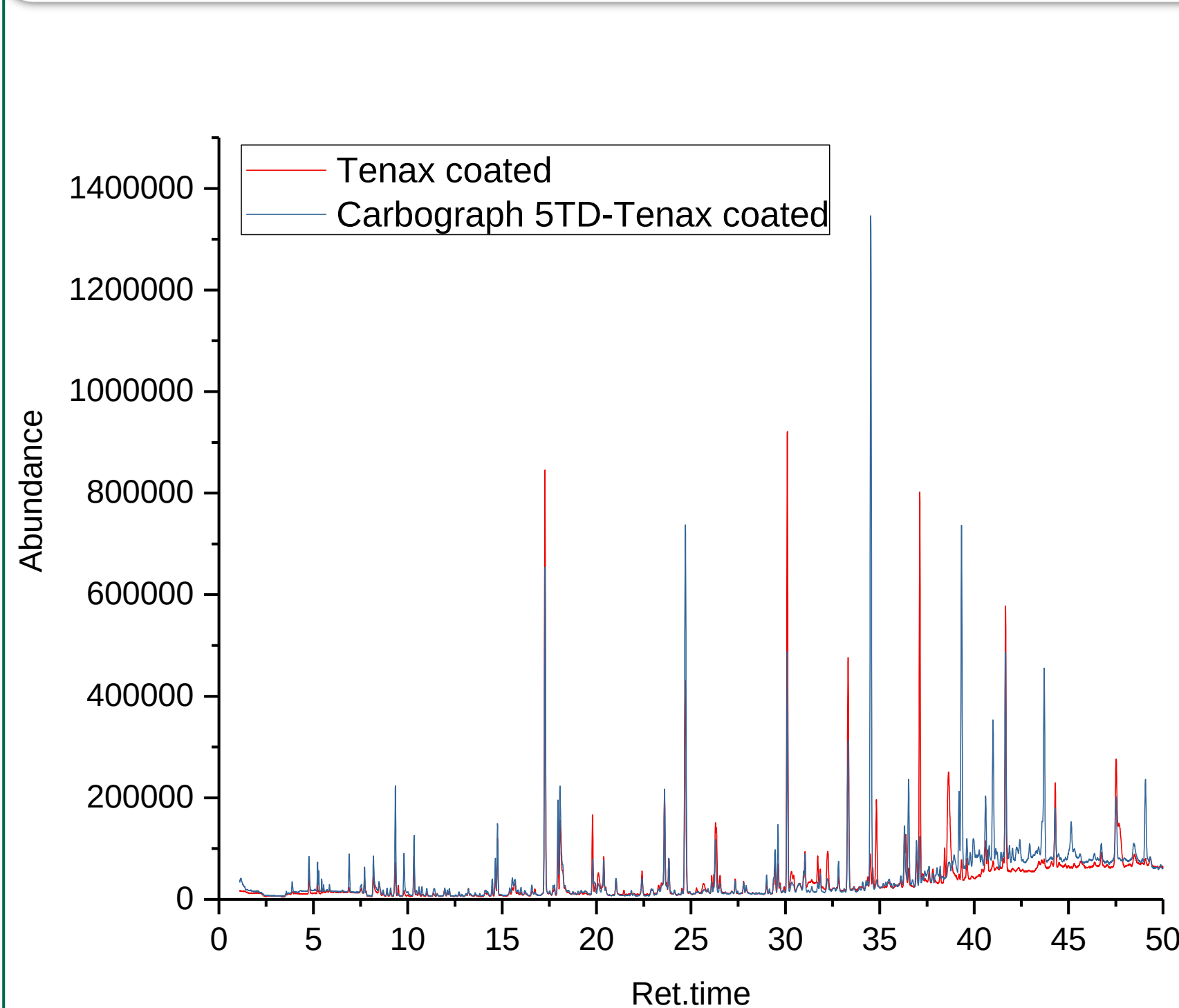


Figure 5. Chromatograms of air samples with Tenax coated sorbent tube (red) and Carboxgraph 5TD-Tenax coated sorbent tube (blue).

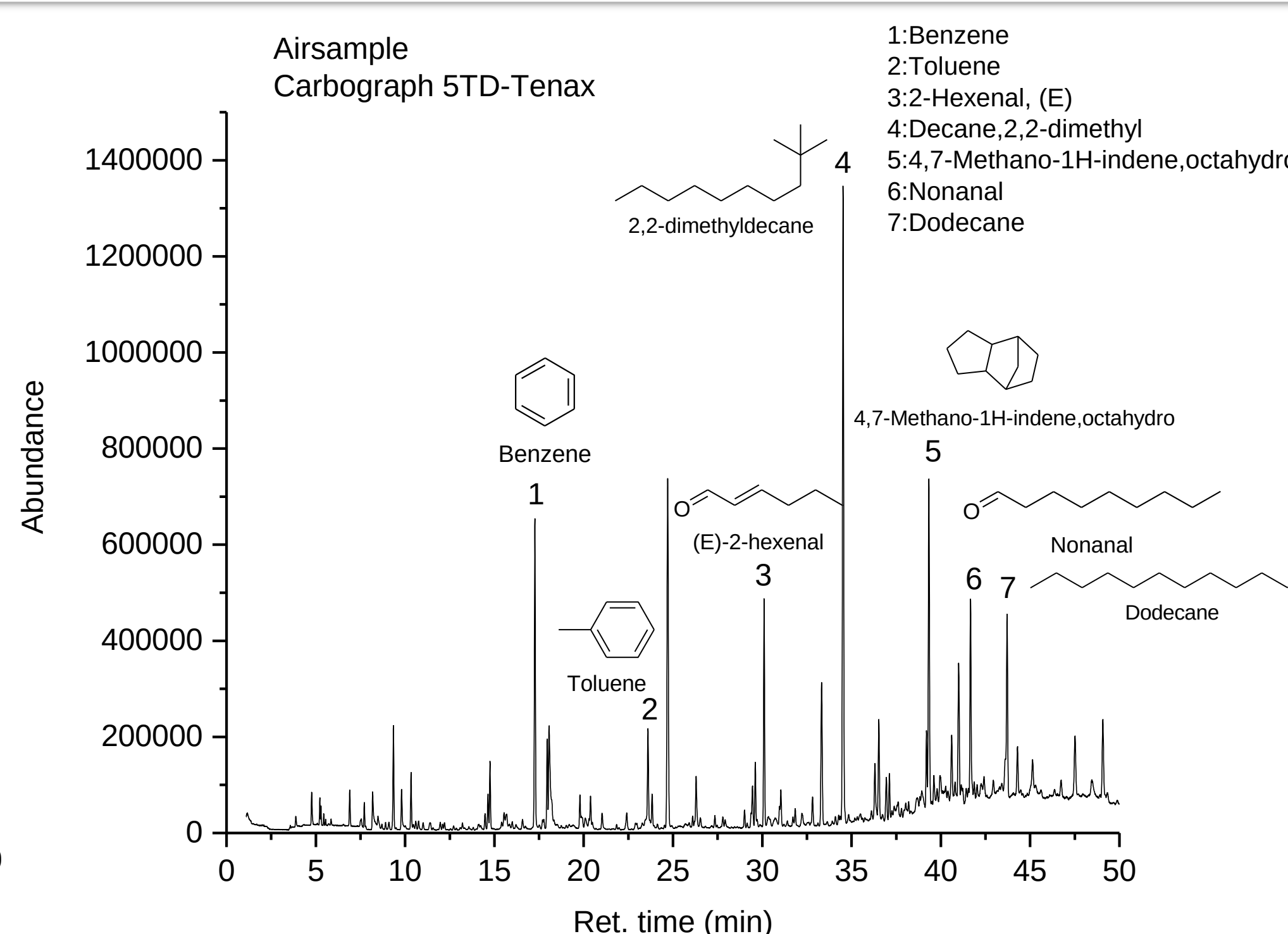


Figure 6. VOCs in the indoor air of an olive mill during the olive oil production using a Carboxgraph 5TD-Tenax coated sorbent tube for active sampling.

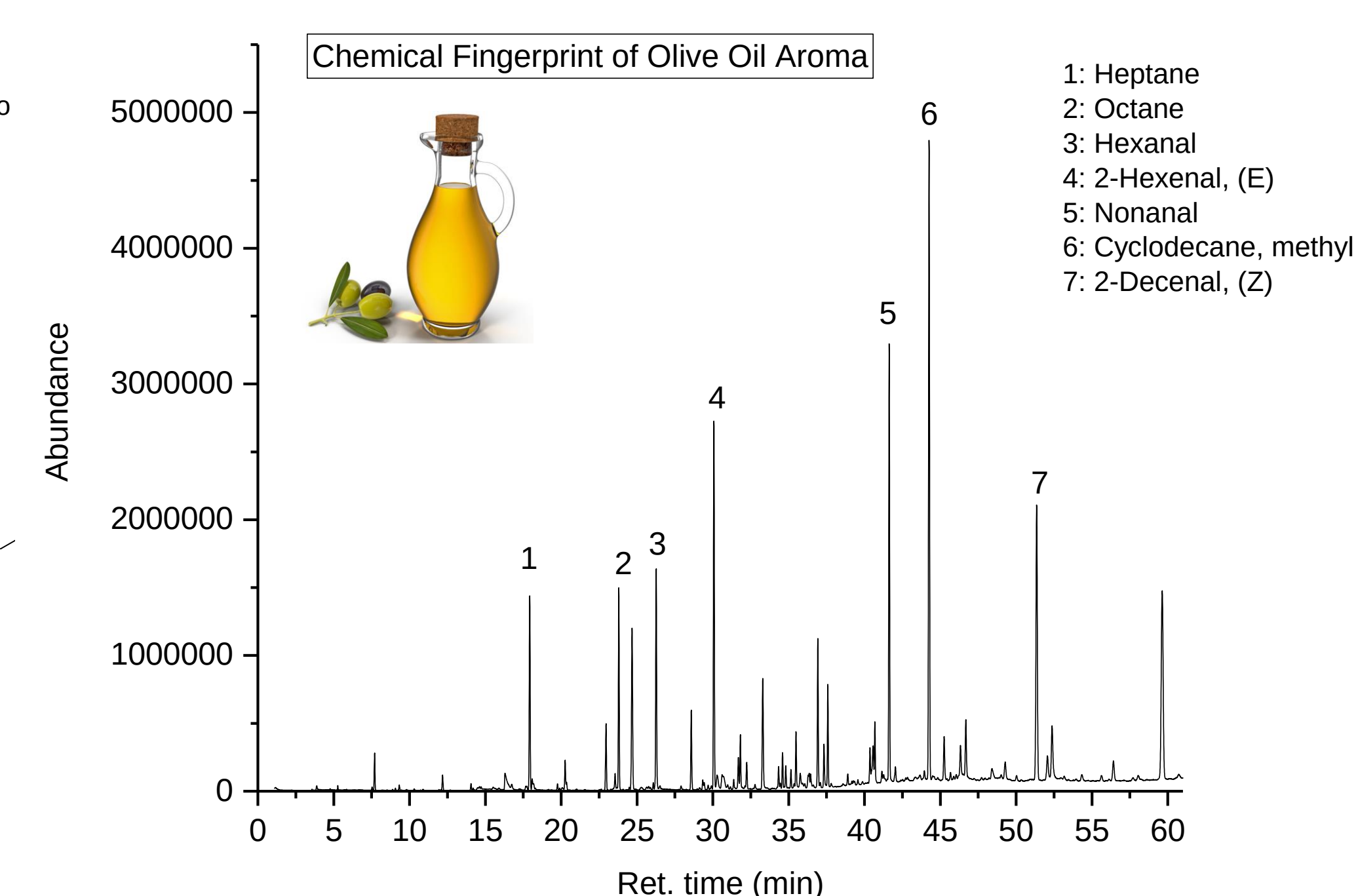


Figure 7. Indicative chromatogram of olive oil chemical fingerprint, using the HiSorb sorptive extraction process.

Conclusions:

- The Carboxgraph 5TD - Tenax coated sorbent tube is the best sampling material for monitoring the VOCs emitted from indoor air in the olive mills. Eluted chromatograms are apparently better than those given by the Tenax coated tube (Fig. 5).
- When compared the chromatograms of the indoor air in olive mills (Fig. 6) and the chromatograms of the VOCs in olive oil (Fig. 7), indoor air pollutants such as benzene, toluene and 1,3,5-trifluorobenzene were noticed that were not presented in the aroma of olive oil.
- HiSorb sorptive extraction process is an innovative, simple and quick technique to characterize the aroma of olive oil.

References:

- [1] Baysal, E.; Uzun, U. C.; Ertaş, F. N.; Goksel, O.; Pelit, L. Development of a New Needle Trap-Based Method for the Determination of Some Volatile Organic Compounds in the Indoor Environment. *Chemosphere*. 2021, 277, 1-7.
 [2] Quinteros-lama, H.; Tenreiro, C.; Gabriel, D. Assessing Concentration Changes of Odorant Compounds in the Thermal-Mechanical Drying Phase of Sediment-Like Wastes from Olive Oil Extraction. *Appl. Sci.* 2019, 9, 1-13.