Composition of volatile organic compounds (VOCs) emitted from coffee residues

M.A. Stylianou[1,2], I. Erotokritou[1], A. Agapiou[*1]

[1]Department of Chemistry, University of Cyprus, P.O. Box 20537, 1678 Nicosia, Cyprus

[2]Civil & Environmental Engineering, Subsurface Research Laboratory, Nireas-IWRC, University of Cyprus, P.O.Box 20537, 1678 Nicosia, Cyprus

*corresponding author:

e-mail: agapiou.agapios@ucy.ac.cy

Abstract

The global production of coffee has been increased because of higher consumption (ICO 2016), leading to high generation of solid residues that are produced during the preparation process of coffee beverages or through the manufacturing of coffee products. Companies no longer consider residues as waste, but as raw materials for other processes.

Targeting the field of agriculture and food industry, coffee waste attracted the attention of many researchers as a promising substrate for various processes enabling the conversion of the waste into value-added products, that can fit into the waste hierarchy, either as a product to be reused for feeding people or livestock, or for recovering valuable compounds able produce energy or other products such as fuels, materials, chemicals and energy. Furthermore, researchers are trying to develop methods, which will enhance the isolation of particularly useful compounds for the industry, such as the isolation of bioactive compounds: phenolic compounds, flavonoids, chlorogenic acid, and protocatechuic acid (Bravo et al. 2012; Ballesteros et al. 2014).

In the coffee industry, except from valuable compounds, products include various chemicals which can be considered as pollutants under a specific limit (*e.g.* caffeine). The present study aims to characterize these valuable compounds and examine potential air pollution issues related to waste from the coffee industry, through the analysis of volatile organic compounds (VOCs) (Oliveira et al. 2014).

Untreated green coffee seeds, roasted coffee beans, silver skin (the thin outer layer of the green coffee bean obtained as a by-product during the roasting process), and traditional Cyprus coffee (mixture of *Arabica* and *Robusta* coffee varieties) samples were collected from a local coffee industry. Headspace solid-phase micro-extraction gas chromatography-mass spectrometry (HS-SPME-GC/MS) analyses of the samples were performed (figure 1) and the emitted VOCs were identified. Results showed that the emitted VOCs are grouped in various classes such as furans, phenolic compounds, pyrazines, pyridines, aldehydes and pyrroles.
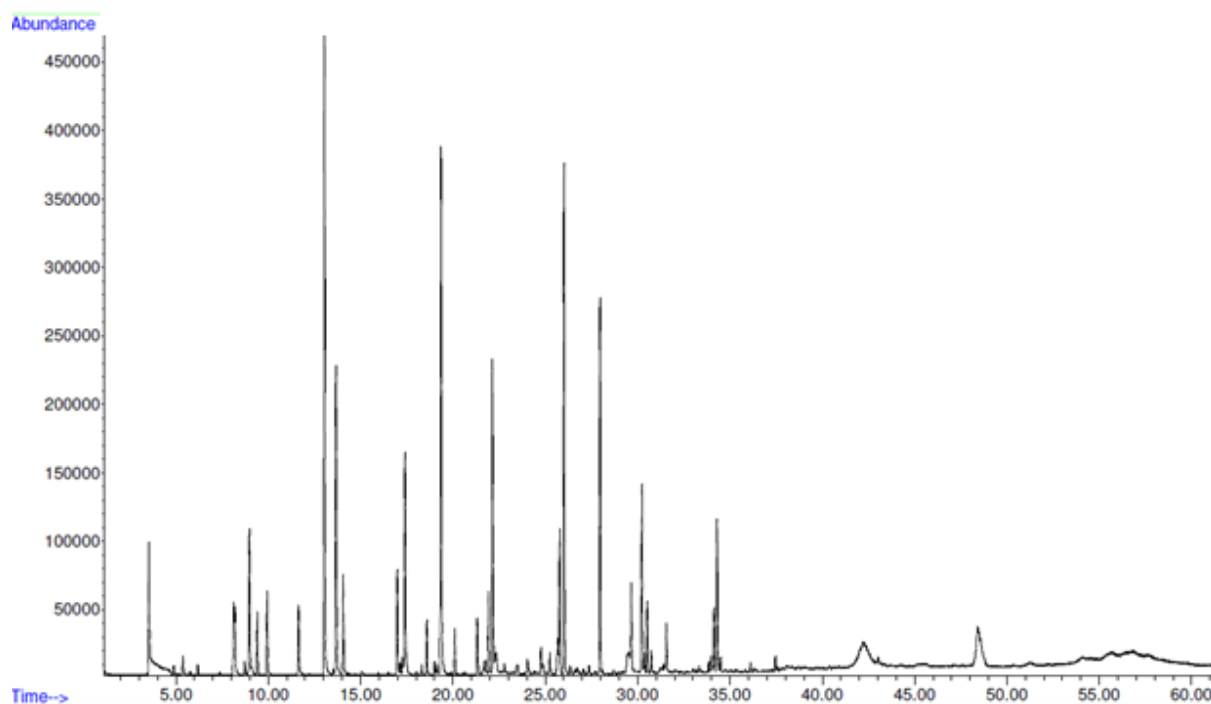
Figure 1. GC-MS analysis of coffee beads

References

Ballesteros LF, Teixeira JA, Mussatto SI (2014) Chemical, Functional, and Structural Properties of Spent Coffee Grounds and Coffee Silverskin. Food Bioprocess Technol 7:3493–3503 . doi: 10.1007/s11947-014-1349-z

Bravo J, Juániz I, Monente C, et al (2012) Evaluation of Spent Coffee Obtained from the Most Common Coffeemakers as a Source of Hydrophilic Bioactive Compounds. J Agric Food Chem 60:12565–12573 . doi: 10.1021/jf3040594

ICO ICO (2016) Total production by all exporting countries. In: http://www.ico.org/. http://www.ico.org/prices/po-production.pdf. Accessed 4 Nov 2016

Oliveira A, Cabral LMC, Bizzo H, et al (2014) Identification and Recovery of Volatiles Organic Compounds (VOCs) in the Coffee-Producing Wastewater. J Water Resour Prot 6:375–380 . doi: 10.4236/jwarp.2014.64039