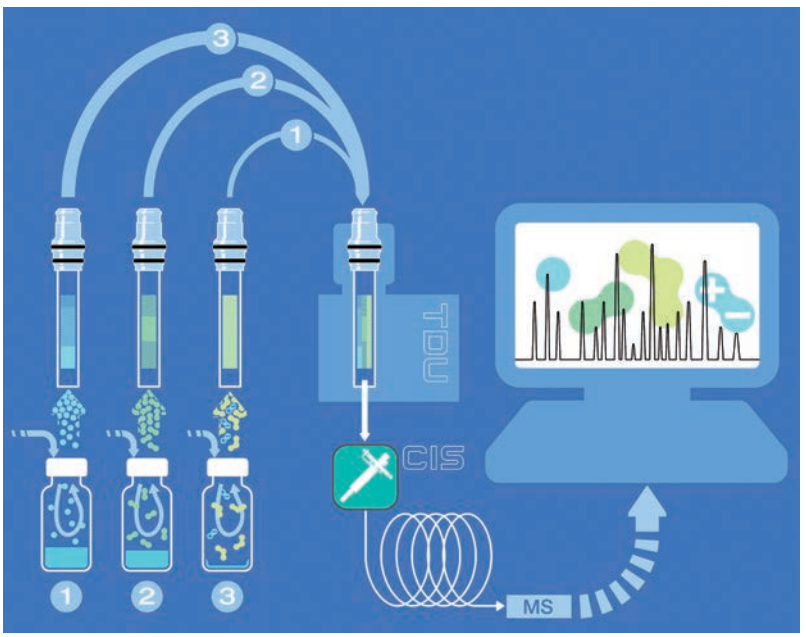
Flavor Analysis

Tracking the Whole Range of Flavor Compounds

Sequential dynamic headspace sampling of brewed coffee and other beverages provides more information in a single GC/MS run.

Aroma profiles of brewed coffee and other beverages are composed of a wide range of compounds, representing a multitude of compound classes. These span not only a wide volatility range, but also a wide solubility range in aqueous solution. Until now, it has been extremely difficult to combine and determine all these compounds in a single GC/MS run with adequate recoveries and useful results for all compound classes. In the following, an overview is given of the Multi-Volatile Method (MVM), developed by GERSTEL application experts, which relies on a new analyte concentration technique and automated sample preparation to overcome the problems of determining all compounds from beverages in a single GC/MS run.



Flavor analytes are extracted from the sample in three separate DHS steps and the analytes concentrated on three separate TDU liners packed with different adsorbents. The three TDU liners are desorbed separately and the analytes are concentrated in the CIS inlet. When the CIS is heated, the analytes are transferred simultaneously to the GC/MS and determined in one run.

Headspace gas chromatography (HS GC) is frequently used for flavor analysis due to the volatility of flavor compounds. Several established HS techniques are available, for example, static headspace (SHS), dynamic headspace (DHS), and headspace using solid phase microextraction (HS-SPME). However, in terms of analyte recovery, these techniques tend to discriminate in favor of more volatile and/or hydrophobic compounds. Recently, a full evaporation DHS (FEDHS) method, based on a classical full evaporation technique (FET) was demonstrated for uniform enrichment of aroma compounds from several sample types [1]. FEDHS of 10-100 µL of sample at 80 °C using a valve-less short-path DHS system, enables near complete vaporization and uniform recovery of aroma compounds, while largely eliminating non-volatile matrix. However, the FEDHS method often requires a large purge volume in order to remove water from the adsorbent trap. This can lead to loss of volatile compounds due to breakthrough in the adsorbent trap during the purge step. The loss of volatile compounds can be overcome by using replaceable adsorbent traps for analyte concentration, enabling sequential sampling from the same HS vial under different trapping conditions. This method is made practical through the use of a completely automated GERSTEL DHS system mounted on a GC/MS system using a highly flexible MultiPurpose Sampler (MPS). The flexibility of the system allows different adsorbent traps to be used. This enables the extraction and trapping of more volatile compounds in a traditional DHS step prior to the FEDHS extraction step. A novel multi-volatile method (MVM) was developed based on sequential DHS sampling (and desorption) using a variety of trapping conditions for the determination of a wide range of aroma compounds in aqueous samples. The MVM method consists of three different DHS sampling steps including a final FEDHS step. The DHS parameters were examined with the model aroma compounds spiked in 100 µL of water. Feasibility and benefits of using the MVM method is demonstrated through the determination of key odor compounds in brewed coffee [2].

For more information

[1] Flavor and Fragrance Analysis of Consumer Products – Dynamic Headspace Compared to Some Traditional Analysis Approaches, GERSTEL AppNote 06/2012: www.gerstel.com/pdf/p-gc-an-2012-06.pdf

[2] Multi-volatile method (MVM) for aroma analysis using sequential dynamic headspace sampling with an application to brewed coffee, Jun Tsunokawa, Nobuo Ochiai, Kikuo Sasamoto, Andreas Hoffmann. Journal of Chromatography A, 1371 (2014) 65–73. Free Download: www.sciencedirect.com/science/article/pii/S0021967314016859