

Course Topics

Day 1 – Morning

- Introduction section
 - a. Description of different types of headspace sampling
 - b. Comparison of static versus purge and trap headspace methods
 - c. Different types of analytes and matrices that are typical subjects of headspace analysis
 - d. Typical sensitivities for different analytes in different matrices

- Theory in Action
 - a. Definition and basic equations
 - b. Headspace as an extraction technique
 - c. Matrix effects in GC and Headspace

- Examples and Explanation of Matrix Effects
 - a. Effect of temperature
 - b. Effect of salinity
 - c. Presence of solids
 - d. Effect of different type of solvents
 - e. Effect of pH
 - f. Maximizing sensitivity using all these effects

Day 1- Afternoon

- Calibration and Quantification in Headspace Analysis
 - a. Calibration of gaseous phase for quantification of odors, explosion and health hazard limits
 - b. Determination of partial vapor pressures
 - c. Calibration approaches for analysis of condensed matrices

- Description and Practical use of Matrix Independent Techniques
 - a. MSA- method of Standard Additions
 - b. MHE- Multiple Headspace Extraction
 - c. VPT- Variable Phase Ratio or Variable Volume technique
 - d. FET – Full Evaporation Technique

- Practicum
 - a. Calculation of expected sensitivity for several chemicals in different matrices
 - b. Calculation of concentrations of chemicals from chromatograms provided
 - c. Increasing the sensitivity using approaches learned in the earlier sections

Day 2 – Morning

- General Principles and Specifics of Instrumentation for Headspace Analysis
 - a. Syringe based system (Gerstel, LEAP)
 - b. Volume controlled injection (Agilent, Tekmar, EST-9000, etc.)
 - c. Time controlled injection systems (Perkin-Elmer, EST-9000)
 - d. Dual needle sampling (EST-9000, Tekmar MP3)
 - e. Some special injection devices
 - Selection of Instrumental Parameters
 - a. Temperature zones
 - b. Speed and time of pressurization
 - c. Vial pressure
 - d. Time and rate of de-pressurization (loop fill)
 - e. Injection times
- Validation of Headspace GC Methods

Day 2 – Afternoon

- Specific Applications
 - a. Environmental analysis
 - b. Pharmaceuticals
 - c. Food, Flavors, and Fragrances
 - d. Biological and Forensic Samples
 - e. Paints and Latexes
 - f. Analysis of polymers below and above their glass transition points
- Special and Unusual Applications
 - a. Derivatization techniques
 - b. Determination of solubility limits
 - c. Determination of activity coefficients, enthalpies, free energy, and partial vapor pressure over complex matrices
 - d. Determination of Partition Coefficients in multi-component solutions
- Optional topics
 - a. Combination of headspace sampling with non-chromatographic analyzers (Electronic Nose, Mercury Analyzer, Infrared, etc.)
 - b. Process headspace analysis