B134 Forensic Applications of Headspace Single-Drop Microextraction

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After attending this presentation, attendees will have a better appreciation of the various headspace single-drop microextraction (HS- SDME) methods. These methods are relatively new and involve simple sample preparation. They have been used with gas and liquid chromatography to sample volatiles in a variety of matrices.

This presentation will impact the forensic science community by serving as a key aspect in describing several HS-SDME methods which offer the forensic scientist simple, effective and non-invasive sampling methods for chromatographic analysis of various forensic samples.

The sample preparation step in an analytical procedure generally involves an extraction of the analyte. This extraction typically results in isolation and enrichment of target compounds from a sample matrix with generally good recovery. Extraction processes have been developed that reduce the amount of extraction solvent, and incorporate automation and miniaturization. In 1990, solid-phase microextraction (SPME) was developed as a fast, simple, and solvent-free sampling technique. Consequently, SPME has found application in many fields including forensic science.

Headspace gas chromatography (HSGC) has been commonly used to analyze samples containing volatile compounds from various matrices. Over the last few years a very, simple sampling technique called single-drop microextraction, SDME, has been combined with headspace sampling. The first SDME publication appeared in 1996 and the first application to headspace analysis was published in 2001. The technique is simple, does not require sophisticated equipment, and like HSGC, eliminates much interference from the sample matrix.

Several different types of SDME have been described including variations of headspace methods. SDME has also been described in the literature by other names including liquid-phase microextraction (LPME). Static headspace SDME (HS-SDME) is a technique in which a single drop of solvent is suspended at the tip of a microsyringe needle and exposed to the headspace of the sample solution. Another technique has been described as “exposed” dynamic HS-SDME. This technique exposes a single drop of solvent to the headspace of the sample solution similar to HS-SDME, however after the drop is withdrawn back into the syringe barrel, the procedure is repeated several times. A third type of SDME is called “unexposed” dynamic HS-SDME where the extraction solvent is withdrawn into the syringe barrel and a gaseous sample is withdrawn into the syringe barrel, similar to normal static headspace sampling, and allowed to be exposed to the solvent within the syringe.

Various sampling parameters will affect the recovery and precision of HS-SDME methods. These parameters include the solvent, size of drop, shape of the needle tip, temperature of the sampling, equilibration time and temperature, extraction (sampling) time, effect of stirring, ionic strength of the sample solution, and ratio of headspace volume to sample volume. Good precision and linearity have been reported with several types of methods. Automated methods have been reported as well. This presentation will discuss the different types of HS-SDME including the effect of sampling parameters, and other aspects of the techniques. Forensic Science applications of HS-SDME will be illustrated.

Headspace, Single-Drop Microextraction, Gas Chromatography

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