Contemporary Sample Preparation Methods for the Detection of Ignitable Liquids in Suspect Arson Cases

REFERENCE: Bertsch W, Ren Q: Contemporary sample preparation methods for the detection of ignitable liquids in suspect arson cases; *Forensic Sci Rev* 11:141–156; 1999.

ABSTRACT: The isolation of ignitable liquid components, usually petroleum-based distillates from fire debris, is an important step in deciding whether a fire is of natural or incendiary origin. Steady progress has been made to develop sample preparation methods capable of enriching target analytes in high yield and within a short period of time. Heated headspace enrichment methods are currently most widely used. There are several variations of this basic technique. Carbon-based adsorbents are most popular. They come in different forms and shapes, including a flat sheet of polymer, impregnated with carbon particles. The analyst cuts a small strip from this sheet and suspends it in the heated headspace above the debris sample. The volatiles adsorb onto the carbon surface, eventually reaching an equilibrium condition. The process is usually carried out in an oven. This convenient method, called the static method, has largely replaced the dynamic method, which uses a granular charcoal adsorbent. In the latter, the heated headspace is drawn over a short trap packed with charcoal, using a source of vacuum such as a pump or pushed along using pressurized nitrogen. The headspace volatiles in both the static and dynamic method are recovered by elution with a solvent, usually carbon disulfide. Recently, a promising variation of the static headspace method has been introduced. It is based on the use of a tiny amount of a polysiloxane polymer which has been coated onto the tip of a thin silica fiber. The fiber can be retracted into a syringe-type needle and the adsorbed headspace vapor can be conveniently introduced into the heated injector port of a gas chromatograph. No solvent is required. This technique, abbreviated SPME (for solid-phase microextraction) has many attractive advantages but it is not without some problems. Low boiling range accelerants, including water-soluble polar substances such as ethanol, are poorly retained on methylsiloxane type polymers. The recent introduction of hybrid fibers containing a combination of carbon and a methylpolysiloxane polymer has extended the usefulness of SPME toward the high volatility end. With judicious optimization of experimental conditions, it is now possible to obtain an adequately representative sample of the headspace above the fire debris sample. It is thus possible to characterize the full spectrum of potential liquid accelerants, ranging from alcohols and similar water-soluble substances to high boiling range fuel oils.

KEY WORDS: Criminalistics, fire debris, arson, ignitable fluids, accelerants, sample preparation, solid-phase microextraction.