

Modular Quantitative Air Sampling for Field Analysis using Person-Portable GC-MS

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Thermal desorption is well suited for the introduction of analytes trapped on sorbent for quantitative analysis using gas chromatography-mass spectrometry (GC-MS). A traditional approach for thermal desorption with laboratory GC-MS analysis involves heating a packed tube containing several hundred milligrams of sorbent, and requires primary desorption flow much greater than that of carrier gas through a capillary GC column. Preconcentration on a very small volume of sorbent is thus required before the desorbed analytes may be introduced into the GC inlet to match the flow through the GC column, and heated transfer lines and bulky thermal desorption equipment are typically used. We report the use of a small diameter needle packed with sorbent as a preconcentrator to accept analytes from a traditional thermal desorption tube using a compact transfer heater separate from the analytical instrument. Controlled carrier gas flow through the needle trap that matches the GC column requirements, and simultaneous heating in the small GC injector of the person-portable GC-MS instrument used allowed quantitative analyte introduction without the need for split injection. Analytes ranging from toluene to tributyl phosphate produced a linear response from the instrument's toroidal ion trap mass spectrometric detector when about 10 to 100 ng of each was desorbed from a large sorbent tube onto the needle trap for introduction into the person-portable instrument. This corresponded to airborne concentrations in the single digit ppb range with a five minute sample time at an air sampling rate of 100 mL/minute through the large sorbent tube. A combined sampling and analysis time of 15 minutes is possible using this approach, without the need to alter the person-portable GC-MS instrument or to reduce the ability to move the instrument that would result from the use of a typical thermal desorption apparatus.