

IN A GREEN WORLD, SHOULDN'T ALL ANALYSES BE MICRO?

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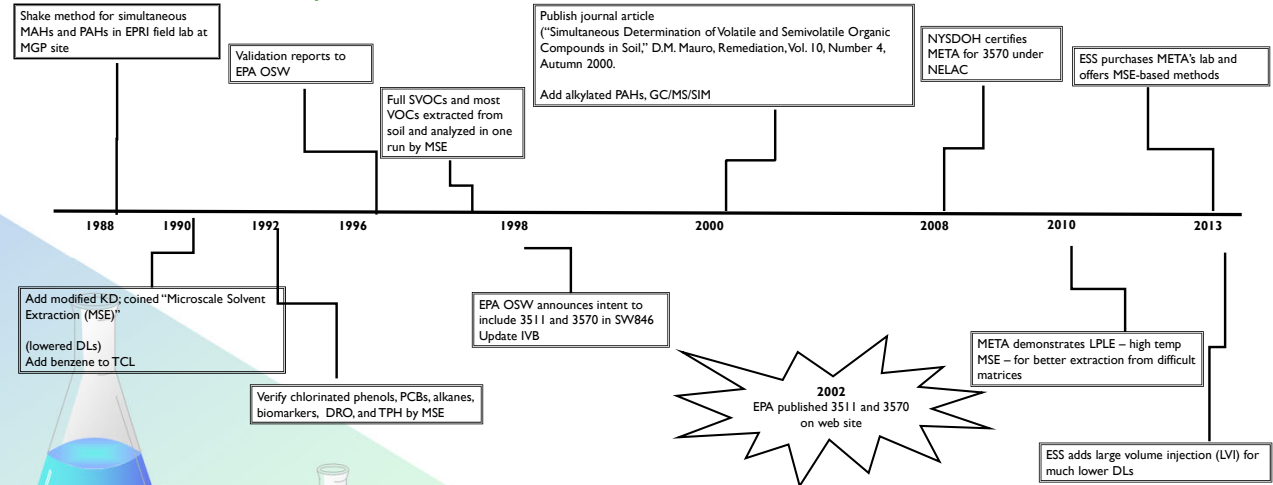
ABSTRACT

Most methods for the analysis of organic compounds in water, soil or other solids rely on an extraction step where the sample is treated with solvents to collect and concentrate trace constituents. This step can be labor intensive and costly, as well as generate substantial volumes of potentially hazardous solvents as wastes. In addition, large quantities of soil and water, which may contain hazardous chemicals, are collected but never analyzed, and must also be handled as waste. For several years, microextraction methods have been promoted by a relatively small group of advocates for reducing the labor needed and minimizing the amount of waste generated in the laboratory over existing methods.

One such approach was developed at META Environmental, Inc. in the early 1990s with support of EPRI and its member utilities. Two microscale solvent extraction (MSE) methods for the simultaneous extraction and analysis of volatile and semivolatile organic compounds in soil or water were developed. Validation reports were sent to EPA's Office of Solid Waste on September 27, 1996 and on April 11, 1997. The methods were reviewed by the SW-846 Organic Methods Workgroup and, after several rounds of review and comment, EPA published Methods 3511 and 3570 on their web site as part of the SW-846 Update IVB in November 2002.

Recently, META has teamed up with ESS Laboratories to offer EPA Methods 3511 and 3570 to a wider market. ESS conducts the methods and certification is either in hand or pending. ESS also is using large volume injection (LVI); one of the recent enhancements to the microextraction approach.

Brief History of EPA Methods 3511 and 3570



Advantages of EPA Method 3511 (per sample) - WATER

Parameter	EPA 3511	EPA 8260/8270 (Sep Funnel)	Savings or Waste Reduction
Sample volume collected	2.40 mL vials	2.40 mL vials 2.1 liter bottles	96% by vol.
Solvent used per sample	2 mL	180 mL	99% by vol. or \$\$
Waste sample generated	80 mL	2,080 mL	96%

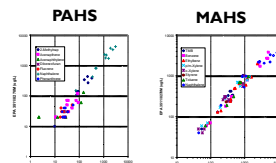
Advantages of EPA Method 3570 (per sample) - SOIL/SED

Parameter	EPA 3570	EPA 8260/8270 (Soxhlet)	Savings or Waste Reduction
Sample volume collected	2 oz soil jar	2.40 mL vials 4 - 8 oz soil jar	50 - 75%
Solvent used per sample (as stated in method)	25 mL	300 mL	90% by vol. or \$\$
Waste sample generated (150 samples)	20 lbs	45 lbs	50 - 75%

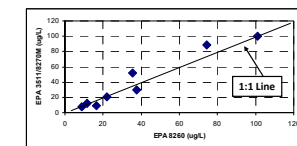
- Other savings:**
 - Sampling time and costs
 - Sampling supplies costs
 - Shipping costs
- Other Advantages:**
 - Less lab space, storage space needed
 - Less solid waste (sample jars, etc.)
 - Energy savings
 - Lower greenhouse gas emissions

Analyses by GC/MS or GC/MS/SIM

META has developed a modified EPA 8270 GC/MS method that includes 52 VOCs and 65 SVOCs for use with MSE prep methods. Also, the 34 NOAA PAHs and alkylated PAHs are measurable, as well as several other compounds of environmental forensic value. Because Methods 3511 and 3570 do not rely on purge and trap instrumentation, laboratories can analyze more concentrated samples. Also, low levels of some compounds can be measured in the presence of high levels of a few compounds in the same sample without instrument problems. This is particularly important at MGP, creosote, and petroleum release sites where samples are often diluted because of high concentrations of naphthalene or other compounds.



EPA 3511/8270 and 8260 are Equivalent for Benzene at Low Levels in Water

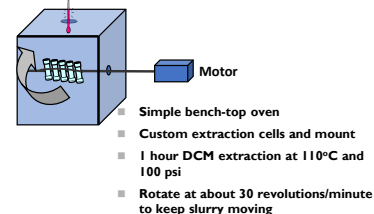


Similar comparability is obtained for many other VOCs

Low Pressure Liquid Extraction (LPLE) for Improved 3570 Extraction Efficiency

Recently, META developed a heated Extractor for EPA Method 3570. The combination of heat, pressure (heated solvent), and kinetic energy (rotation) better penetrate soil or sediment pore spaces and promote more efficient extraction. META constructed custom extraction cells for no loss of volatiles.

META LPLE Extractor



Conclusions

- 3511 & 3570 are EPA-approved, demonstrated-effective micro sample preparation/analysis methods with over 20 years of application
- Continuing instrument improvements allow for smaller samples with better DLs
 - For most investigations, a few grams or a few milliliters is enough
- 3511/3570 equivalent to other EPA sample prep methods
 - New heated extraction for improved HPAH recovery
- MSE-type solvent extraction recovers more VOCs from difficult matrices than purge & trap
- There can be substantial reductions in sample mass needed, solvent and disposables used, waste generated, and costs
 - Substantial savings in time and supplies in the field
 - Using EPA 3511 can save 25% or more on analytical costs for groundwater monitoring programs.
- Use of EPA 3511 (aqueous) is Rapidly Growing
 - Several laboratories are now offering "small sample size" microextraction analyses based on EPA 3511 for PAHs, DRO, and other compounds.
- Use of EPA 3570 also increasing
- NELAC certification is available