Pyrolysis used to Study Soils

Application Note
Environment

Author:

K. Sam

Natural organic matter (NOM) is from decaying plant and animal material, and it serves an important role in soils and sediments. It can help plants grow by improving uptake of nutrients and minerals, and improve the environment for microorganisms integral to plant growth. Its structure can determine the fate of toxic chemicals. A good understanding of the structure and components of organic matter may help us understand its properties.

Thermal desorption and pyrolysis is a good way to analyze both semivolatile and nonvolatile components of NOM. In pyrolysis, macromolecules normally unavailable for analysis by gas chromatography, are broken apart into smaller, more volatile components amenable to GC, producing information that can be used to characterize and help us understand NOM structure and origin.

Four sources of NOM were studied. Dry soil was added to a quartz sample tube so that it was about 3/4 full, anchored between quartz wool. Each sample was heated to 2 separate temperatures; 300 and 500°C. Two sources were commercial soils: spent mushroom compost and potting soil. The other two sources were household compost and soil from a wooded county park. Resulting chromatograms are shown in Figures 1 and 2. Phenols and methoxyphenols associated with lignin were seen at 300°C.

Also, acetic acid, furans, and furaldehydes associated with cellulose and polysaccharides were seen at 300°C. More phenol and methoxyphenols were present, but the larger methoxyphenols were absent at 500°C, and nitrogen-containing compounds like pyrrole, and indolizine, usually associated with proteins, emerged at 500°C.

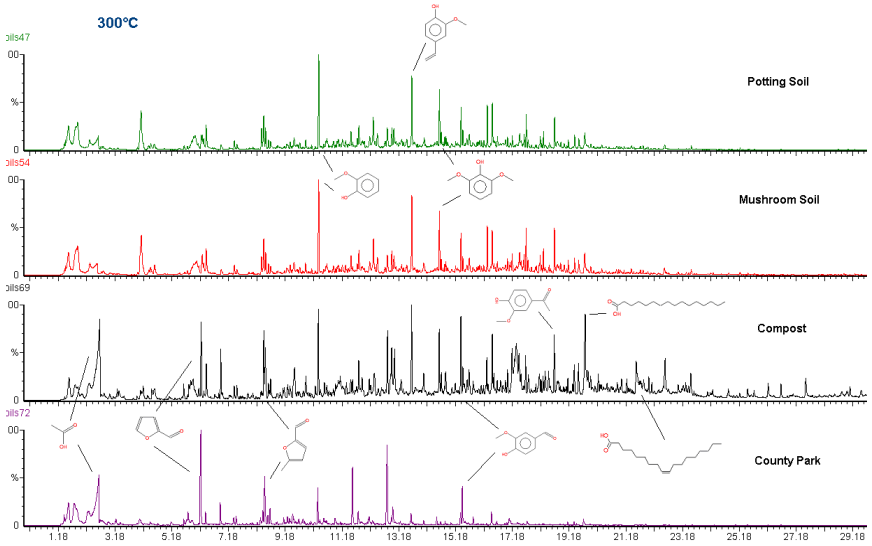

Figure 1. Soil heated to 300°C.

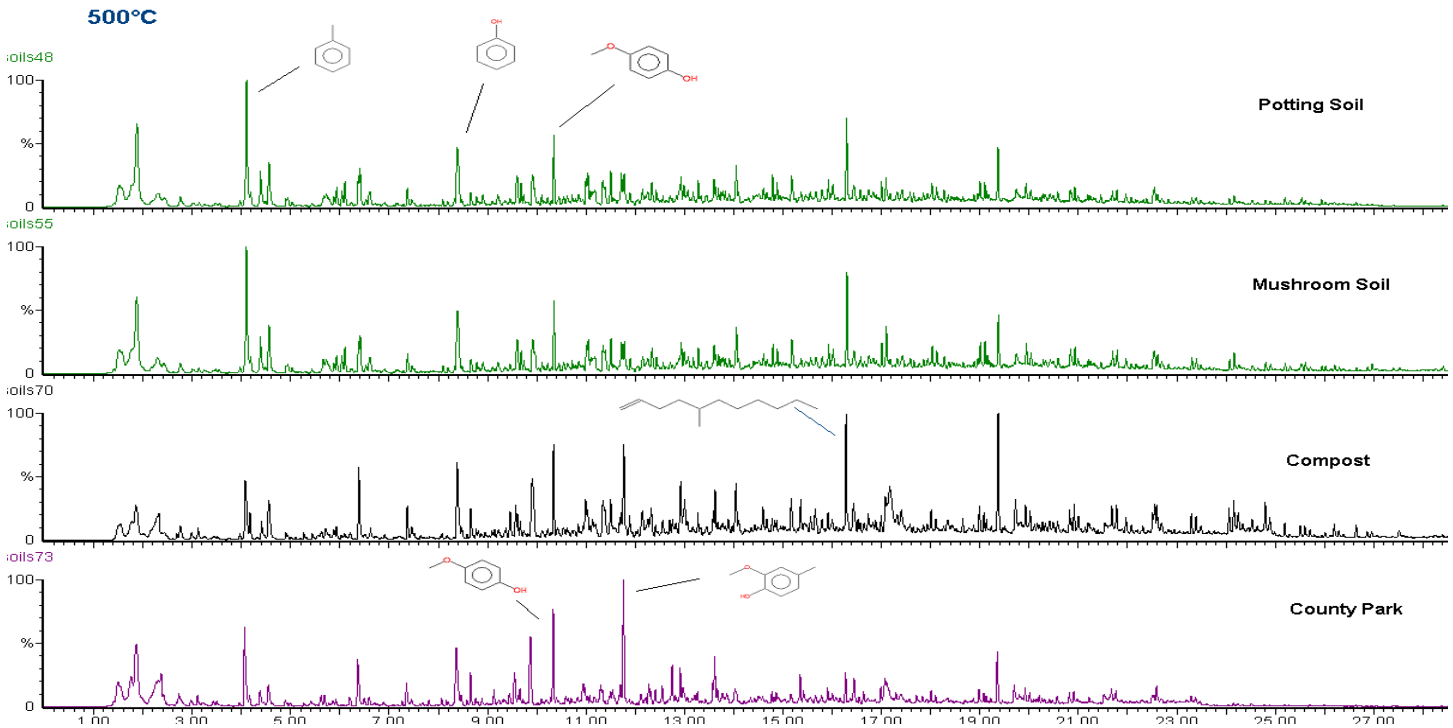

Figure 2. Soil heated to 500°C (after 300°C).

Instrument Conditions

Pyroprobe

Sample:	In quartz tube, 3/4 full
Pyrolysis:	300°C and 500°C 30 seconds
Interface:	300°C for 3 minutes
Carrier:	He, 30ml/min
Trap Initial:	VoCarb, 50°C
Trap Desorb:	300°C for 5 minutes
Valve Oven:	325°C
Transfer Line:	325°C

GC/MS

Column:	35% phenyl (30m x 0.25mm x 0.25μm)
Carrier:	Helium, 50:1 split
Injector:	350°C
Oven:	40°C for 2 minutes
	10°C/min to 300°C hold 9.5 min
Mass Range:	35-600 amu

FOR MORE INFORMATION
CONCERNING THIS APPLICATION, WE RECOMMEND THE
FOLLOWING READING:

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