

[Development and Application of Pyrolysis Gas Chromatography/Mass Spectrometry for the Analysis of Bound Trinitrotoluene Residues in Soil](#)

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Abstract:

TNT (trinitrotoluene) is a contaminant of global environmental significance, yet determining its environmental fate has posed longstanding challenges. To date, only differential extraction-based approaches have been able to determine the presence of covalently bound, reduced forms of TNT in field soils. Here, we employed thermal elution, pyrolysis, and gas chromatography/mass spectrometry (GC/MS) to distinguish between covalently bound and noncovalently bound reduced forms of TNT in soil. Model soil organic matter-based matrixes were used to develop an assay in which noncovalently bound (monomeric) aminodinitrotoluene (ADNT) and diaminodinitrotoluene (DANT) were desorbed from the matrix and analyzed at a lower temperature than covalently bound forms of these same compounds. A thermal desorption technique, evolved gas analysis, was initially employed to differentiate between covalently bound and added  $^{15}\text{N}$ -labeled monomeric compounds. A refined thermal elution procedure, termed "double-shot analysis" (DSA), allowed a sample to be sequentially analyzed in two phases. In phase 1, all of an added  $^{15}\text{N}$ -labeled monomeric contaminant was eluted from the sample at relatively low temperature. In phase 2 during high-temperature pyrolysis, the remaining covalently bound contaminants were detected. DSA analysis of soil from the Louisiana Army Ammunition Plant (LAAP; ~5000 ppm TNT) revealed the presence of DANT, ADNT, and TNT. After scrutinizing the DSA data and comparing them to results from solvent-extracted and base/acid-hydrolyzed LAAP soil, we concluded that the TNT was a noncovalently bound "carryover" from phase 1. Thus, the pyrolysis-GC/MS technique successfully defined covalently bound pools of ADNT and DANT in the field soil sample.

\* Excerpted from online journal website (Click the title)

Frontier Labs Products used:

Multi-functional Pyrolyzer (2020iD)