

Development in the Detection and Identification of Explosive Residues

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ABSTRACT: In the past 2 decades, developments in the sensitivity and selectivity of instrument detectors have significantly improved the detection limits for explosives, particularly nitrated organic compounds. Significant improvements have also been made in clean up and recovery procedures for explosive residues. Methods which also have met the criterion of proven effectiveness in identifying explosive components in "real-world" residues from test explosions have been incorporated into systematic analysis protocols for explosive residues. This article first reviews developments in the application of both traditional and novel methods to analysis of unreacted explosives and explosive residues. Compounds used to formulate commercial, military, and "homemade" explosives are then cross-referenced to the analytical methods that have been specifically applied to them, both as pure chemicals and in explosive mixtures. The subsequent focus is on the combinations of methods used to systematically analyze and positively identify residues from improvised explosive devices, from handswabs derived from persons suspected of handling explosives, and from organic gunshot residue. Technology is available to positively identify virtually any unreacted explosive in residue, but no one method can detect all components of all explosives. Investigators and the courts are best served by well-equipped forensic science laboratories staffed with scientists who have gained experience by the successful analysis of post-blast residues from an explosives range and have comprehensive reference collections of physical material, analytical data, and literature. The greatest progress has been made with respect to nitrated organic compounds, but the new generation of commercial explosive slurries and emulsions which are primarily formulated with inorganic salts and non-nitrated organic compounds offer an ongoing challenge.

KEY WORDS: Analysis, capillary zone electrophoresis, color tests, detection, dynamite, elemental analysis, emulsion, explosive, explosive residue, gas chromatography, handswab, high-performance liquid chromatography, identification, immunoassay, improvised explosive device, infrared spectroscopy, ion chromatography, mass spectrometry, nitramine, nitrate ester, nuclear magnetic resonance spectrometry, organic gunshot residue, plastic explosive, propellant powder, organic nitro compounds, size exclusion chromatography, slurry, supercritical fluid chromatography, thermal energy analysis, water gel, X-ray powder diffraction.
