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Home » Latest News » Sensing Peroxide Explosives

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Sensing Peroxide Explosives

Antiterrorism: Sensor array detects triacetone triperoxide at part-per -billion levels

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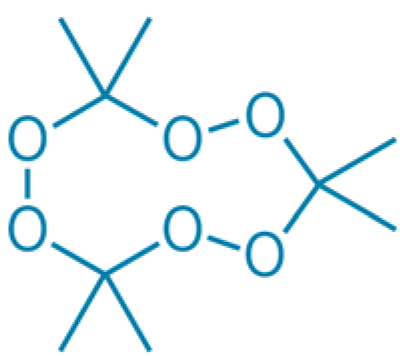

TATP

A handheld device capable of detecting low levels of triacetone triperoxide (TATP) has been developed by chemists at the University of Illinois, Urbana-Champaign (*J. Am. Chem. Soc.*, DOI: 10.1021/ja107419t). The inexpensive instrument could be used to screen travelers and cargo for the dangerous explosive, thereby thwarting terrorist attacks.

Because TATP is easy to make and tough to detect—it doesn't fluoresce, absorb ultraviolet light, or readily ionize—it has become popular among terrorists. Richard Reid, the so-called shoe bomber, tried to ignite the compound during a trans-Atlantic flight in 2001 as part of bombs hidden in the soles of his shoes.

Until now, methods for detecting TATP required expensive instrumentation, needed extensive sample preparation, or weren't capable of detecting the compound in the gas phase. Chemistry professor Kenneth S. Suslick has spent the past decade developing colorimetric sensor arrays that detect dangerous industrial gases. Working with postdoctoral researcher Hengwei Lin, Suslick discovered a way to modify the technology so that it senses TATP.

"The twist here is that there is a solid-acid catalyst to convert the TATP to more responsive analytes—hydrogen peroxide and acetone," Suslick explains. TATP vapor is decomposed by passing it through a tube outfitted with a solid-acid catalyst. The resulting hydrogen peroxide and acetone vapors then pass over an array of redox-sensitive dyes that produce a distinct color signature in the presence of those compounds.

The device is capable of detecting TATP at levels as low as 2 ppb, Suslick says, and there is no interference from food or personal care products.

"This is a remarkable piece of work in several respects," comments chemistry professor Nathaniel Finney of the University of Zurich. "In practical terms, it provides a rapid visual assay for a frightening explosive, with a very low limit of detection. It also illustrates the power of using arrays of molecules—rather than individual molecules or reagents—coupled with computational pattern recognition for highly selective analyses. Most broadly, it represents a beautiful example of addressing complexity at the interface of classical chemistry and functional application."

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