Portable NIST kit can recover traces of chemical evidence

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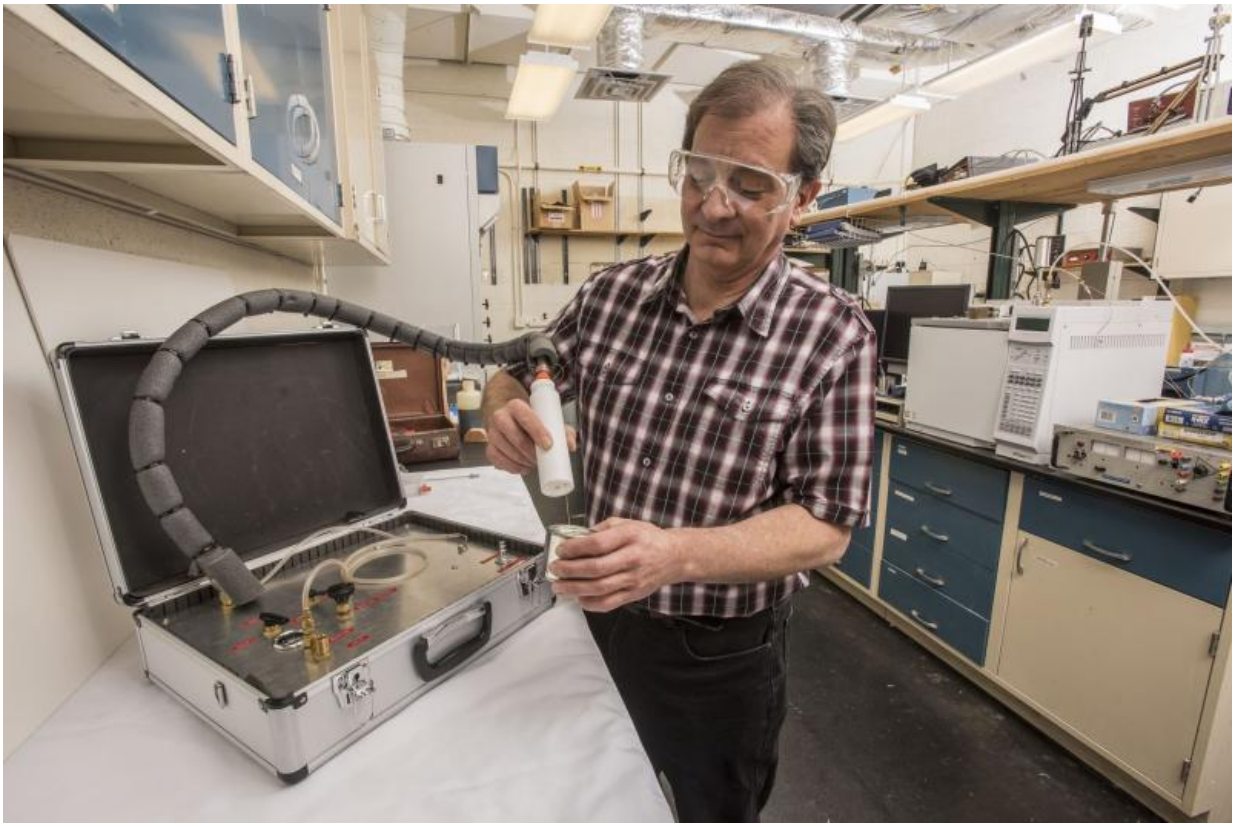

NIST chemist Tom Bruno, who invented a method for recovering trace chemicals such as environmental pollutants and forensic evidence, uses a portable version of the instrument to sample vapor inside an old paint can. The underlying technique is called PLOT-cryoadsorption, or PLOT-cryo - short for porous layer open tubular cryogenic adsorption. Credit: NIST/ Photo by Dave Neligh

A chemist at the National Institute of Standards and Technology (NIST) has developed a portable version of his method for recovering trace chemicals such as environmental pollutants and forensic evidence including secret graves and arson fire debris.

If successfully commercialized by industry, the briefcase-sized kit could enable detectives, field inspectors and others to carry with them a convenient version of NIST's "headspace analysis" technique, which identifies solid or liquid compounds based on the makeup of vapors released into nearby air.

The underlying technique is PLOT-cryoadsorption, or PLOT-cryo—short for porous layer open tubular cryogenic adsorption. PLOT-cryo is sensitive, quantitative and more broadly useful than many competing techniques. It can identify compounds that don't readily evaporate and is not limited to samples dissolved in water, for example. The method recovers vapors by suction or by sweeping a gas across the air above a sample of interest. The laboratory version of the technique has been used to find traces of explosives, spoiled food, residues in arson debris and gravesoil.

The new portable kit collects trace chemicals while analysis is performed with other instruments such as gas chromatography and mass spectrometry, which can also be made portable. In initial demonstrations of the kit in the lab, chemist Tom Bruno recovered and reliably identified substances such as the chemical compound coumarin, the explosive TNT, and diesel fuel. Collection times as fast as 3 seconds produced definitive results. The kit detected diesel fuel—a concern with respect to illegal dumping and leaking tanks—with a sensitivity better than one part per million.

There is no other portable instrument that can detect traces of as wide a range of these types of compounds, Bruno says.

The NIST kit is powered by compressed air, which enables operation without electrical power and ensures safety in potentially flammable and explosive environments. Compressed air is available on many emergency response vehicles. A key component of the kit is a vortex tube, which—without any moving parts—rotates compressed air to make hot or cold air streams.

Vapors are collected in sturdy, inexpensive tubes embedded in an epoxy wafer. The wafer can be used inside either an insulated handpiece for manual sampling or a longer probe for remote sampling of soil and spaces under buildings or in luggage or other containers. With either the handpiece or probe, the wafer can be chilled to collect vapors, and then heated to help remove them.

For now, the portable kit is less sensitive than the lab version of the method, but research continues to improve performance. Bruno has fielded interest in the basic technique from an instrument company, detectives, and film producers looking for a missing explorer.

More information: Companies interested in commercialization should contact the NIST Technology Partnerships Office at nisttech@nist.gov.

Provided by National Institute of Standards and Technology

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