New analytical tool developed for liquid explosives detection

The thwarted 2006 London airline bomb plot not only heightened summer travel fears and created new passenger screening inconveniences, but also greatly underscored the urgent need for improved national security measures.

Now, professor Joe Wang, director of the Center for Biosensors and Bioelectronics at the Biodesign Institute at Arizona State University, has developed a highly sensitive technology to rapidly detect liquid peroxide explosives in as little as 15 seconds. The results are published as a research communication online in this week's edition of the leading international analytical journal, *The Analyst*.

"Previously, there have been no effective sensing technologies that can detect these compounds in a rapid and sensitive manner, so this is an important first step in trying to stay ahead of the terrorists who are becoming increasingly sophisticated in their methods," said Wang, who serves as a faculty member with joint appointments in the Departments of Chemical Engineering in the Ira A. Fulton School of Engineering and Chemistry and Biochemistry in the College of Liberal Arts and Sciences.

In the past few years, terrorists have turned from high-grade commercial explosives toward improvised, homemade explosives that can be made from off-the-shelf products. Though prevented from use by the unraveling of the 2006 air travel plot, such devices were employed in the Madrid and London train bombings of 2004 and 2005, respectively.

Ironically, it was Wang's research to benefit diabetes management and improve human health that led to his breakthrough in explosives detection. Wang has over 20 years experience in designing tiny sensors for commercial products to aid diabetics. This detection technology relies on an enzymatic test where blood glucose is converted to a hydrogen peroxide byproduct and measured by an electrochemical sensor.

"We took our expertise with blood glucose detection and our vision was to make something like a hand-held glucose meter, but toward the screening and detection of peroxide explosives" said Wang.

The highly sensitive assay Wang has developed can rapidly detect the two most common peroxide-based explosives, triacetone triperoxide (TATP) and hexamethylene triperoxide diamine (HMTD), in trace amounts down to the part per billion level.

The approach, which is safe, irradiates these explosives with ultraviolet light, converting the TATP and HMTD into hydrogen peroxide. While a UV lamp system provides results in five minutes, the higher intensity laser irradiation greatly reduces the time down to 15 seconds.

The key to the technical innovation was employing what Wang describes as an 'artificial peroxidase' system, namely, a novel electrocatalyst that accelerates the electrochemical reaction of the liberated hydrogen peroxide.

"We can get very fast detection and now the goal is to integrate this into a high-performance, portable self-contained, easy-to-use device," said Wang.

Though the final product may be down the road, Wang is actively working with the commercialization arm of ASU, Arizona Technology Enterprises (AzTE) to engage government and commercial partners to further develop the technology.

Source: Arizona State University