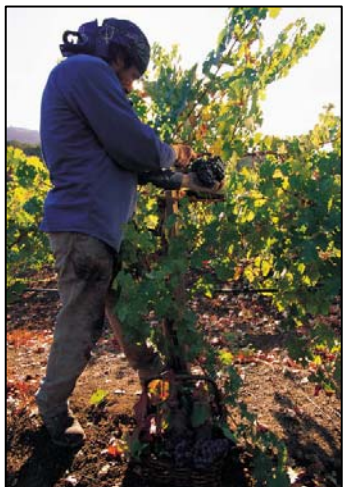
Science opens door for rapid diagnosis of exposure

Studies describe detectors for organophosphates in humans, PCBs in environment

Accurate, portable sensors that detect human and environmental poisons are a major step closer, thanks to developmental work performed using resources at the Department of Energy's Environmental Molecular Sciences Laboratory. Using innovative approaches, the sensors are highly selective and highly sensitive, allowing users to determine exposure to poisons in the field, in minutes instead of days. One example is a carbon nanotubes-based sensor that detects the neuroenzyme cholinesterase in saliva. Low levels of cholinesterase correspond to exposure to organophosphates, the neurotoxin in pesticides and nerve gases. Recent tests on this portable sensor system, developed by researchers from Pacific Northwest National Laboratory, showed it has a higher sample-throughput and comparable sensitivity compared to lab-based colorimetric methods.

A sensor was also developed to detect PCBs, a highly toxic, slowly decomposing chemical found at industrial sites. The sensor, developed by researchers from PNNL, the University of Idaho, and North Dakota State University, uses a competitive immunoassay approach to detect PCBs in river water and other complex environmental samples. This sensor can provide results using small samples and has a detection limit of 10 pg/mL, which is 50-fold lower than the commercial PCB test kit.



Informing workers of pesticide exposure in minutes instead of days is a step closer to reality.

Scientific and technological impact: The sensors use scientific concepts to create new highly selective technologies that will impact environmental research related to transport of contaminants and improve monitoring for personal safety. These technologies are examples of EMSL capability developments that involve making real-time measurements in natural environments.

Societal impact: Rapid, at-site, sensitive diagnostics of exposure to hazardous chemicals offers worried patients answers in minutes instead of days. For the environment, new sensors offer great promise for decentralized environmental application and trace toxic chemical monitoring.

For more information, contact EMSL Communications Manager Mary Ann Showalter (509-371-6017).

Citations: Lin YY, G Liu, CM Wai, and Y Lin. 2008. "Bioelectrochemical Immunoassay of Polychlorinated Biphenyl." *Analytica Chimica Acta* **612**:23-28. Wang J, C Timchalk, and Y Lin. 2008. "Carbon Nanotube-Based Electrochemical Sensor for Assay of Salivary Cholinesterase Enzyme Activity: An Exposure Biomarker of Organophosphate Pesticides and Nerve Agents." *Environmental Science & Technology* **42**(7):2688-2693.

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