Silicone wristbands facilitate exposome study

By Sara Mishamandani

As the environmental health science field strives to better understand the complexity of personal chemical exposures, NIEHS-funded researchers at the Oregon State University (OSU) Superfund Research Program (SRP) *(http://superfund.oregonstate.edu/)* led by Kim Anderson, Ph.D., have developed a simple wristband and extraction method that can test exposure to 1,200 chemicals.

While a person wears the silicone wristband, it absorbs chemicals from the air, water, and even the skin. The chemicals remain in the silicone, mimicking the body's absorption process.

Anderson and her colleagues have developed a way to extract and analyze an unprecedented number of chemical compounds from the silicone wristbands after they are worn. They described their methods in a study *(http://www.ncbi.nlm.nih.gov/pubmed/24548134)* published March 18 in the journal Environmental Science and Technology.

"Because of its ease of use and the huge number of chemicals that it can sequester, the wristband has opened up the field of passive sampling," said Anderson. Several studies, including one funded by NIEHS in Ohio (see story), are taking advantage of the wristbands to measure individual exposures to environmental chemicals.

The familiar rubbery wristbands that have promoted various causes in recent decades are now being used to archive a person's chemical exposure during a given period of time. (Photo courtesy of Kim Anderson)

Anderson leads a project at the OSU SRP center that focuses on developing new technologies to understand exposure to PAHs and assess the risk they pose for human health. She is also the director of the Food Safety and Environmental Stewardship Program (http://fses.oregonstate.edu/) at OSU. (Photo courtesy of Kim Anderson)

Contributing to understanding of the exposome

The combined effects of contaminants from air, water, and food, as well as chemicals produced by the body, complicate efforts to find links between chemical exposures and biological endpoints. Because of this complexity, environmental health researchers worldwide are investigating the exposome, or the measure of a person's lifelong exposure to agents.

"To understand linkages between the exposome and resulting toxicity, researchers are developing new technologies and methods to characterize exposure to an ever larger range of compounds," said Anderson. "With this new device, we can address some questions we haven't been able to address in the past concerning an individual's exposure to a wide range of chemicals."

Testing the samplers in the population

Researchers at OSU provided volunteers with wristbands, to investigate the sensitivity of the samplers and to test compliance issues in both general and occupational populations. Thirty volunteers wore the wristbands, during their day-to-day activities, for 30 days.

Also, eight volunteers, who work as roofers and experience a potentially high occupational exposure to polycyclic aromatic hydrocarbons (PAHs) in roofing tar, wore the wristbands for eight-hour time periods.

After wearing the wristband for 30 days, each volunteer placed the band in a Teflon bag and shipped it to Anderson's lab for analysis.

The researchers detected 49 compounds in the wristbands, including flame retardants, PAHs, phthalates, and pesticides, as well as caffeine, nicotine, and various chemicals found in personal care products.

All of the roofers' wristbands absorbed PAHs, including 12 on a federal priority list of harmful pollutants. Roofers who wore less protection and worked in more enclosed spaces had higher levels of the chemicals on their wristbands.

Steven O'Connell, OSU SRP trainee and lead author on the paper, demonstrates how the wristbands are worn, and why caffeine may be detected in their analysis. (Photo courtesy of Kim Anderson)

"With all volunteers, we found that the samplers had very good analytical sensitivity, and that people will wear the wristband. They are easy to use," said Anderson. "Given just hours of wearing the wristbands, we were able to sequester chemicals with great accuracy."

Anderson and her team are working with a variety of researchers to deploy the wristbands in studies around the country, including a population in an industrial corridor, a community with extensive hydraulic fracturing activity, and a cohort of mothers in their last trimester of pregnancy. The wristbands are also being deployed in separate studies in Peru and West Africa to better understand exposures from agricultural practices and industrial activities.

Citation: O'Connell SG, Kincl LD, Anderson KA.
(http://www.ncbi.nlm.nih.gov/pubmed/24548134)
2014. Silicone wristbands as personal passive samplers. Environ Sci Technol 48(6):3327-3335.

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The Environmental Factor is produced monthly by the National Institute of Environmental Health Sciences (NIEHS)
(http://www.niehs.nih.gov/)
, Office of Communications and Public Liaison.