Agilent Technologies Presents

Thought Leader Award to Influential Water-Quality Researcher, Dr. Shane Snyder

A Q&A

Shane A. Snyder, PhD
Professor of Chemical and Environmental Engineering
Co-Director of the Arizona Laboratory for Emerging Contaminants and theWater and Energy Sustainable Technology Center
University of Arizona

Agilent Technologies recently selected Shane Snyder, PhD, as a recipient of an Agilent Thought Leader Award, in recognition of his research on water sustainability, safety, and treatment. This award is part of an invitational program that promotes scientific advancement by contributing financial support, products, and expertise to the research of influential thought leaders in the life sciences, diagnostics and applied chemical markets.

Snyder and his team are working to create an end-to-end workflow for effect-directed analysis, designed to identify and remove contaminants from water supplies, and develop technologies for water reuse—purifying wastewater for distribution as potable, drinking water. Snyder is a professor of chemical and environmental engineering, as well as the co-director of the Arizona Laboratory for Emerging Contaminants (ALEC) and the Water and Energy Sustainable Technology Center (WEST) at the University of Arizona. *LCGC* recently interviewed Snyder about his important research and the Agilent Thought Leader Award.

LCGC: What does the receipt of the Agilent Thought Leader Award mean to you?

Snyder: First, I'd like to thank Agilent for recognizing both my own and my team's contributions to water safety and sustainability. The Agilent Thought Leader Award is really enhancing our ability to bridge life sciences and analytical chemistry. This involves crosscutting interdisciplinary research, which is an amazing opportunity for my team of students and staff at the University of Arizona. The Agilent Thought Leader Award is allowing us to move forward with new types of research to better ensure water safety.

LCGC: Can you provide a brief overview of your research into drinking water?

Snyder: I've conducted research related to drinking water for over 20 years. During that time, I've served on both the World Health Organization and on the US Environmental Protection Agency advisory boards. The research we conduct is related to how we can produce sustainable, safe, and reliable drinking water for various regions around the world.

Our work is not limited to North America. I work extensively in Southeast Asia, particularly Singapore, where a great amount of work is focused on how to convert wastewater into safe and reliable drinking water. So, our research is about the characterization of various contaminants that may enter water and how we can best remove them to ensure water safety.

LCGC: What are the major emerging contaminants in our water supply?

Snyder: Nearly every chemical in commerce has some propensity to enter the water system. Today, over 100 million chemical structures are registered and more than 60 million of those structures are available commercially. When we think about recycling wastewater back to drinking water in particular, an innumerable amount of chemicals could potentially be in the water. If we consider how we disinfect water with oxidants, we can create even more chemical structures of unknown toxicity and identification.

When we think broadly about emerging contaminants, we need to think about the mixtures, how they affect public health, and how we can better characterize those mixtures. This was the topic of the Agilent Thought Leader Award and the research we intend to pursue.

LCGC: Can you briefly explain what effect-directed analysis is?

Snyder: Effect-directed analysis is where we use a biological endpoint to help guide analytical procedures. So often, we use a high-throughput cellular bioassay, where we grow human cells in small containers, expose them to the water, and learn how the human cells respond in various ways, including genotoxicity or endocrine-disruptive effects.

From there, we can fractionate the water into various polarities or molecules sizes and begin to isolate the effect. Ultimately, we characterize fractions that have biological effects using high-resolution gas chromatography with mass spectrometry (MS) and liquid chromatography with MS. I should also mention we're now characterizing with inductively coupled plasma MS instruments, which is particularly helpful for disinfection byproducts.

LCGC: Which products are you using to assist you with your research?

Snyder: We utilize quite a large portfolio of instruments. The vast majority of them are coming from Agilent Technologies. We found them to be a great partner for the technology we need for water and environmental characterization.

We begin with more simplistic instruments like spectroscopy using ultraviolet or fluorescents. We also use organic carbon detection.

As we begin to target trace levels of organic chemicals in water, we generally use gas chromatography and liquid chromatography coupled to triple-quadrupole mass spectrometry. For unknown or non-targeted work, we then use gas chromatography and liquid chromatography coupled to quadrupole time-of-flight (Q-TOF) instruments. We have found the speed and resolution of Q-TOF systems to be ideal for environmental characterization.

We also do a lot of work on inductively coupled MS instruments and some new hyphenated techniques, which is extraordinarily beneficial to characterize halogenated species, especially some novel disinfection byproducts such as those that are brominated and iodinated. So, it's quite a large portfolio, which includes everything from preparative-scale separation to high-resolution mass spectrometry.

LCGC: What major trends do you see developing in the area of water safety research?

Snyder: I think the largest area of growth is how we deal with mixtures of chemicals in water. There is no natural scenario where only one chemical will be present. In fact, we know most waters contain thousands of anthropogenic substances. Again, this area bridges life sciences and analytical chemistry as the most important aspect of water safety characterization. By that, I very specifically mean the use of human cell bioassays and non-targeted high-resolution mass spectrometry.

Early detection of emerging contaminants is the key. We want to find these substances before people are exposed to them for long periods of time. And by coupling the in vitro bioassays in high-resolution mass spectrometry, we can get ahead of the curve and have very early detection.

We are also very much interested in online systems and even potentially real-time sensors. They allow for the autonomous control of water treatment systems and, again, very early alerts if something is awry in the water quality or in the engineered system. The Agilent Thought Leader Award and support from the University of Arizona are allowing us to break through in this kind of transformative research that will better ensure continued water safety and security.