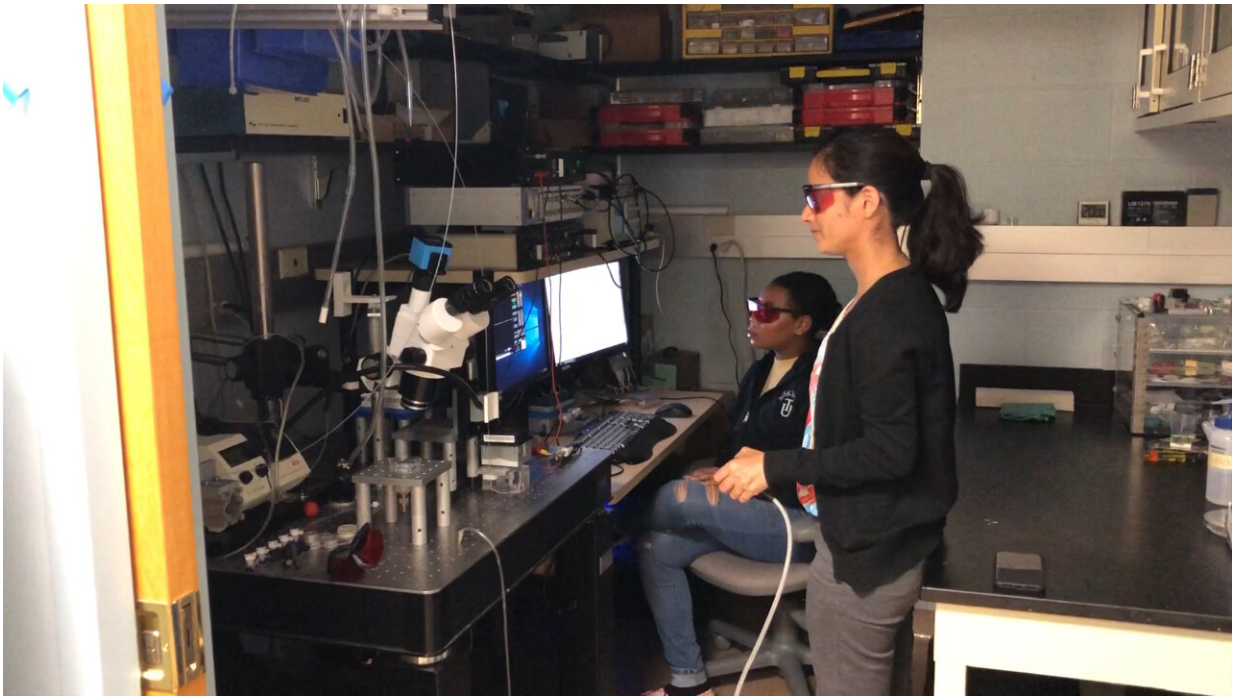
'Liquid forensics' could lead to safer drinking water

July 8 2019, by Eric Stann



The instrument is designed to analyze the quality of liquids using the photoacoustic effect, or the generation of sound waves after light is absorbed in a material. The MU scientists believe this might be the first use of this technology to analyze such small liquid samples. Credit: University of Missouri

Ping! The popular 1990 film, The Hunt for Red October, helped introduce sonar technology on submarines to pop culture. Now, nearly 30 years later, a team of scientists at the University of Missouri is using

this same sonar technology as inspiration to develop a rapid, inexpensive way to determine whether the drinking water is safe to consume. Based on their results, the scientists said they can determine changes in the physical properties of liquids.

"If the water isn't drinkable, then our method will tell you that something is wrong with the water," said Luis Polo-Parada, an associate professor of pharmacology and physiology in the MU School of Medicine and investigator at the MU Dalton Cardiovascular Research Center. "For instance, if a facility removes salt from sea water in order for water to be safe for drinking, our method can help alert the facility to potential changes such as an issue with the desalination process."

The instrument is designed to analyze the quality of liquids using the photoacoustic effect, or the generation of sound waves after light is absorbed in a material. Drops of sea water, dairy milk or ionic liquids, a class of molten salt, were used in the study. The MU scientists believe this might be the first use of this technology to analyze such small liquid samples.

"Let's use cymbals as an analogy," said Gary A. Baker, associate professor of chemistry in the MU College of Arts and Science. "Sunlight causes the cymbals to heat up and create a constant ringing sound. Here, on a much smaller scale, we create the same effect by sending flashes of laser light at our tiny homemade cymbal, which is the tape, and measure the speed of the sound that is generated."

The team is working to refine its recording methods and equipment to provide commercial industries with an inexpensive way to monitor the quality of liquids, such as the percentage of alcohol in alcoholic beverages, the amount of inferior oil in fraudulent olive oils, the quality of honey and the amount of sugar or sugar substitutes in soft drinks. They plan to publish updated results later this year.

How it works: A tattoo removal laser machine sends out a series of brief flashes of light each lasting about 10 nanoseconds. The flashes of light travel through a fiber optic cable wrapped on one end with paint-on liquid electrical tape. The cable's end, submerged in the liquid, converts the laser light into sound. The sound is recorded by a microphone and the data is analyzed in real time.

The study, "Laser-induced sound pinging: A rapid photoacoustic method to determine the speed of sound in microliter fluid volumes," was published in *Sensors and Actuators, B: Chemical*.

More information: Luis Polo-Parada et al, Laser-induced sound pinging (LISP): A rapid photoacoustic method to determine the speed of sound in microliter fluid volumes, *Sensors and Actuators B: Chemical* (2019). DOI: 10.1016/j.snb.2019.04.080

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