Keeping astronauts in space longer with better air and water

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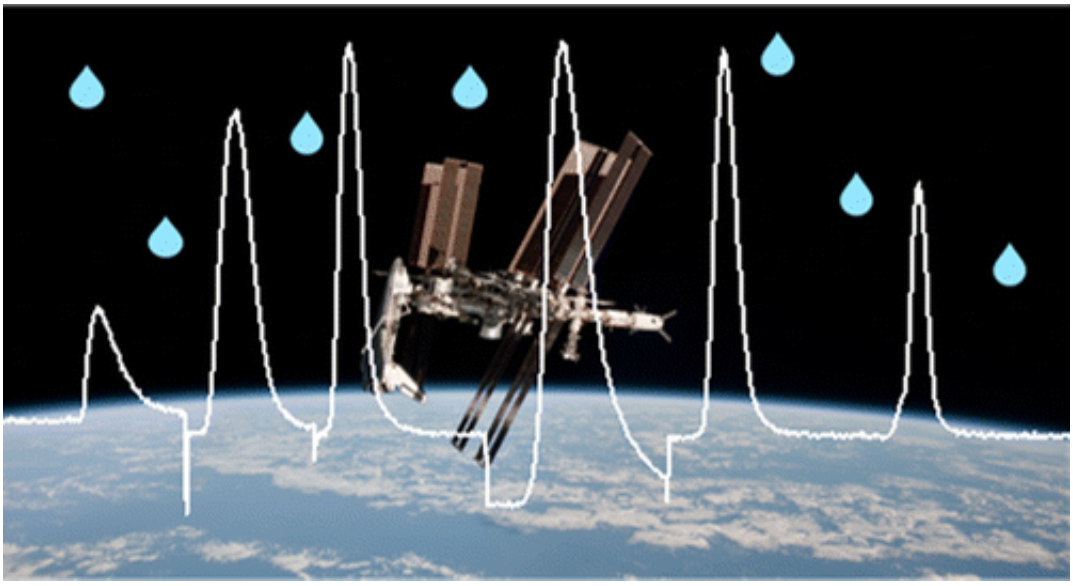

As astronauts embark on increasingly ambitious space missions, scientists have to figure out how to keep them healthy for longer periods far from Earth. That entails assuring the air they breathe and the water they drink are safe—not an easy task given their isolated locations. But scientists are now reporting in the ACS journal *Analytical Chemistry* a new method to monitor the quality of both in real time with one system.

Current options for testing air and water for contaminants, including microbes and radiation, require collecting samples and sending them

back to Earth for analysis. But for long missions—aboard the International Space Station (ISS), for example—this approach could take six months before the astronauts have their results. The ISS is also equipped with some real-time hardware for detecting unwanted substances, but it has limitations. Facundo M. Fernández, William T. Wallace and colleagues wanted to come up with a system to conduct real-time, sensitive monitoring.

The researchers outfitted a kind of air quality monitor (AQM) already used aboard space missions with a device that can vaporize water samples, turning its contents and any contaminants, into a gas. The gas can then enter the AQM for analysis. Astronauts could also use the same equipment, with a modification, for testing the air. The team says the system could be used in space or for remote locations right here on Earth.

More information: Electrothermal Vaporization Sample Introduction for Spaceflight Water Quality Monitoring via Gas Chromatography-Differential Mobility Spectrometry, *Anal. Chem.*, Article ASAP, DOI: 10.1021/acs.analchem.5b00055

Abstract
In the history of manned spaceflight, environmental monitoring has relied heavily on archival sampling. However, with the construction of the International Space Station (ISS) and the subsequent extension in mission duration up to one year, an enhanced, real-time method for environmental monitoring is necessary. The station air is currently monitored for trace volatile organic compounds (VOCs) using gas chromatography-differential mobility spectrometry (GC-DMS) via the Air Quality Monitor (AQM), while water is analyzed to measure total organic carbon and biocide concentrations using the Total Organic Carbon Analyzer (TOCA) and the Colorimetric Water Quality Monitoring Kit (CWQMK), respectively. As mission scenarios extend

beyond low Earth orbit, a convergence in analytical instrumentation to analyze both air and water samples is highly desirable. Since the AQM currently provides quantitative, compound-specific information for air samples and many of the targets in air are also common to water, this platform is a logical starting point for developing a multimatrix monitor. Here, we report on the interfacing of an electrothermal vaporization (ETV) sample introduction unit with a ground-based AQM for monitoring target analytes in water. The results show that each of the compounds tested from water have similar GC-DMS parameters as the compounds tested in air. Moreover, the ETV enabled AQM detection of dimethlsilanediol (DMSD), a compound whose analysis had proven challenging using other sample introduction methods. Analysis of authentic ISS water samples using the ETV-AQM showed that DMSD could be successfully quantified, while the concentrations obtained for the other compounds also agreed well with laboratory results.

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