

Miniature Liquid Chromatographic Systems for Human and Robotic Missions

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We report progress towards developing a Micro-Electro-Mechanical Systems (MEMS)-based ion chromatograph (IC) for crewed spacecraft water analysis. This IC-chip is an offshoot of a NASA-funded effort to produce a high performance liquid chromatograph (HPLC)-chip. This HPLC-chip system would require a desalting (i.e. ion chromatography) step. The complete HPLC instrument consists of the Jet Propulsion Laboratory's (JPL's) quadrupole ion trap mass spectrometer integrated with a state-of-the-art MEMS liquid chromatograph (LC) system developed by the California Institute of Technology's (Caltech's) Micromaching Laboratory.

The IC version of the chip consist of an electrolysis-based injector, a separation column, two electrolysis pumps for gradient generation, mixer, and a built-in conductivity detector. The HPLC version of the chip also includes a nanospray tip. The low instrument mass, coupled with its high analytical capabilities, makes the LC-chip ideally suitable for wide range of applications such as trace contaminant, inorganic analytical science and, when coupled to a mass spectrometer, a macromolecular detection system for either crewed space exploration vehicles or robotic planetary missions.