ORganics Exposure in Orbit (OREOcube) experiment on the International Space Station: Preliminary studies

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Organic compounds that survive in uncommon space environments are an important focus in astrobiology. The ORganics Exposure in Orbit (OREOcube) experiment will investigate, in real time, chemical changes in organic compounds exposed to low Earth orbit radiation conditions on an external platform on International Space Station (ISS). OREOcube is packaged as an identical pair of 10-cm cube instruments, each weighing < 2 kg and containing a highly capable UV-visible-NIR spectrometer, a 24-sample carousel, and integral optics enabling use of the Sun as a light source for spectroscopy, along with the electronics, microcontroller, and data storage to make each cube an autonomous stand-alone instrument package requiring only a standard power and data interface. In our preliminary laboratory investigation, three thin-film organics were studied: tryptophan (an amino acid), adenine (a nucleobase) and anthrarufin (a quinone). The organics were deposited on thin films of hematite (Fe_2O_3) and magnetite (Fe_3O_4) to examine the role that iron oxide minerals may play in the alteration of organics on Mars. In the laboratory, our samples were prepared on optical windows and then contained in hermetically sealed reaction cells. The reaction cells were filled with CO_2 (g), which is the primary component of the martian atmosphere. The objective of OREOcube is to investigate the influence of mineralogically relevant inorganic materials on the stability, modification, and degradation of the organic molecules during long-duration radiation exposure on the ISS. The results of our laboratory experiments will be used as the basis for the selection of samples for further investigations on the OREOcube ISS experiment.

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