Investigating the stability of aromatic carboxylic acids in hydrated magnesium sulfate under UV irradiation to assist detection of organics on Mars

Autorzy

Andrew Alberini

Teresa Fornaro

Cristina Garcia-Florentino

Małgorzata Biczysko

Iratxe Poblacion

Julene Aramendia

Juan Manuel Madariaga

Giovanni Poggiali

Álvaro Vicente-Retortillo

Kathleen C. Benison

Sandra Siljeström

Sole Biancalani

Christian Lorenz

Edward A. Cloutis

Dan M. Applin

Felipe Gómez

Andrew Steele

Roger C. Wiens

Kevin P. Hand

John R. Brucato

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The Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals (SHERLOC) instrument onboard the Mars 2020 Perseverance rover detected so far some of the most intense fluorescence signals in association with sulfates analyzing abraded patches of rocks at Jezero crater, Mars. To assess the plausibility of an organic origin of these signals, it is key to understand if organics can survive exposure to ambient Martian UV after exposure by the Perseverance abrasion tool and prior to analysis by SHERLOC. In this work, we investigated the stability of organo-sulfate assemblages under Martian-like UV irradiation and we observed that the spectroscopic features of phthalic and mellitic acid embedded into hydrated magnesium sulfate do not change for UV exposures corresponding to at least 48 Martian sols and, thus, should still be detectable in fluorescence when the SHERLOC analysis takes place, thanks to the photoprotective properties of magnesium sulfate. In addition, different photoproduct bands diagnostic of the parent carboxylic acid molecules could be observed. The photoprotective behavior of hydrated magnesium sulfate corroborates the hypothesis that sulfates might have played a key role in the preservation of organics on Mars, and that the fluorescence signals detected by SHERLOC in association with sulfates could potentially arise from organic compounds.

Słowa kluczowe

Aromatic organic compounds, FTIR spectroscopy, UV irradiation, Signs of biological activity, Mars 2020 Perseverance mission

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