EPSC Abstracts,
Vol. 4, EPSC2009-415-1, 2009
European Planetary Science Congress,

Development of a Sample Processing System (SPS) for the in situ analysis of organic compounds on Mars by Gas Chromatography : application to the Mars Organic Molecule Analyzer (MOMA) experiment

A. Buch (1), R. Sternberg (2), C. Fressinet (1,2), C. Szopa (3), P. Coll (2), C. Rodier (4), F. Raulin (2), and F. Goesmann (5)

(1) Laboratoire de Génie des Procédés et Matériaux, Ecole Centrale Paris, Grande voie des vignes, 92295 Chatenay-Malabry, France, (2) Laboratoire Interuniversitaire des Systèmes Atmosphériques, UMR 7583 CNRS, Université Paris 7 -12, 61 Avenue du Général de Gaulle, 94010 Créteil Cedex, France, (3) Service d'Aéronomie, SA/IPSL, 91371 Verrrières-le-Buisson, France, (4) Laboratoire de Synthèse et Réactivité des Substances Naturelles, UMR 6514, 86022 Poitiers, France, (5) Max Planck Institute for Solar System Research, 37191 Katlenburg-Lindau, Germany

Abstract

The search for signs of past or present life is one of the primary goals of the future Mars exploratory missions. With this aim the Mars Organic Molecule Analyzer (MOMA) experiment of the ExoMars 2016 next coming European Space Agency mission is designed to the *in situ* analysis of organic molecules of exobiological interest in the Martian soil such as amino acids, carboxylic acids, nucleobases or polycyclic aromatic hydrocarbons (PAHs). In the frame of the preparation of MOMA experiment we have been developing a solid Sample Processing System (SPS) allowing the Gas Chromatographic analysis, within space compatible operating conditions, of the refractory organic compounds able to be contained at trace level in the Martian soil.

The sample processing is performed in a oven (reactor), containing the solid sample (~200mg), the internal temperature of which is regulated between 20 to 1000 °C. First, the extraction step is achieved by using thermodesorption in the range of 250 - 300°C for 10 to 20 min. The temperature can be increased up to 500°C without a significant lost of the extraction efficiency if the heating run time is kept below 3 min. Then the chemical derivatization of the extracted compounds is achieved directly on the soil with a mixture of MTBSTFA –DMF [Buch et al.] or DMF-DMA solution [Freissinet et al.] when enantiomeric separation is required. By decreasing the polarity of the target molecules, this step allows their volatilization at a temperature below 250°C without any chemical degradation. Once derivatized, the target volatile molecules are swept through a heated transfer line in the gas chromatograph coupled with a mass spectrometer for the detection.

The SPS is operating as a "one pot/one step" sample preparation system which should allow the MOMA experiment to detect the refractory molecules absorbed in the Martian soil at a detection limit below the ppb level.

References

[1] A. Buch, R. Sternberg, C. Szopa, C. Freissinet, C. Garnier, J. El Bekri, C. Rodier, R. Navarro González, F. Raulin, M. Cabane, M. Stambouli, D.P. Glavin and P.R. Mahaffy**,** Development of a gas chromatography compatible Sample Processing System (SPS) for the in-situ analysis of refractory organic matter in Martian soil: preliminary results, Journal of *Advances in Space Research (2009) 43, 143-151.*

[2] A. Freissinet, R. Sternberg, C. Szopa, C. Rodier, M. Stambouli, On the space analysis of life chiral's remnants: gas chromatography-mass spectrometry analysis of enantiomeric organic molecules as their N,N-dimethyl formamide dimethyl acetal (DMF-DMA) derivatives, Journaal of Chromatography A., Submitted.