Searching for Biosignatures in Mars by LIBS Molecular Signals Discernment

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In the present study, LIBS analysis of a set of six selected molecules related to organic biosignatures - or their degradation compounds- have been carried out in both simulated Martian atmosphere and air in order to identify and discriminate them on the basis of their molecular emission features.

This strategy can reveal insights into how different emission spectral modes react to changes in atmospheric conditions and therefore can help to detect those species which are more sensitive to changes in pressure and composition of the atmosphere. At high laser irradiance, atomization of organic compounds is essentially complete, although at sufficiently delayed integration times, the formation of new molecules by recombination processes can be noticed[1]. Molecular species characteristic of organic emissions such as C2, CN, NH, OH and CH were studied. Results can contribute to establish the optimal conditions for the observation of organic carbon species in laser-induced plasmas and the bases for the ensuing detection of organic biosignatures in analogous geological materials from Mars. Likewise, this research is aimed at providing a tool in the interpretation of LIBS data though the application of adapted data processing algorithms for the identification and discernment of suspected compounds of organic nature[2].

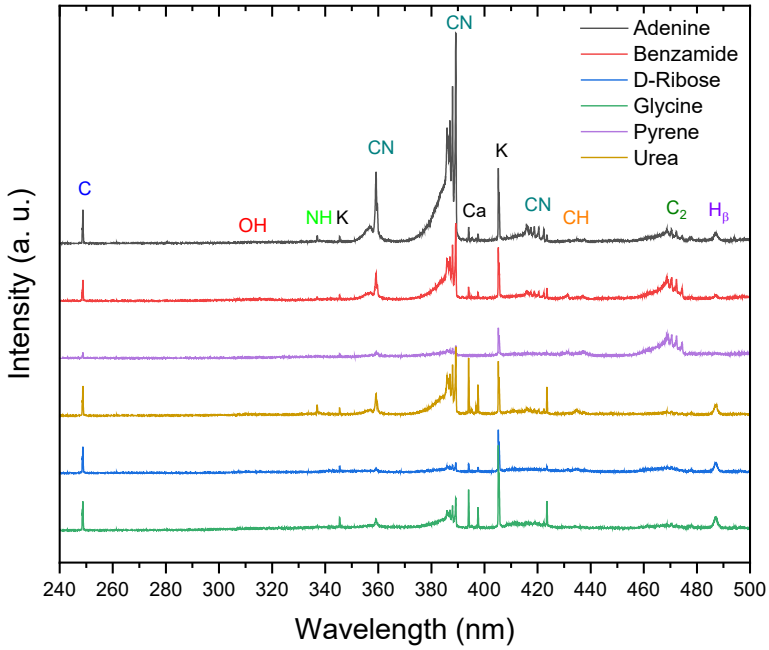

Figure. LIBS spectra comparison of organic compounds acquired at simulated Mars atmosphere.

[1] T. Delgado, L. García-Gómez, L. M. Cabalín, J. J. Laserna, Investigation on the origin of molecular emissions in laser-induced breakdown spectroscopy under Mars-like atmospheric conditions of isotope-labeled compounds of interest in astrobiology, *Spectrochim. Acta Part B* (2021) 179-106114.

[2] T. Delgado, L. García-Gómez, L. M. Cabalín, J. J. Laserna, Detectability and discrimination of biomarker organic precursors in a low pressure CO2 atmosphere by LIBS, *J. Anal. At. Spectrom*. (2020) 35:1947.