

7 APPENDIX 1: QUAD CHART



Microfluidic Ion Analyzer for Astrobiology Studies
PI: M. Fernanda Mora, JPL Section 389K

Project Description and Science Objectives

We will develop protocols and a miniaturized instrument for simple and simultaneous detection of inorganic and organic ions by microchip electrophoresis and capacitively-coupled contactless conductivity detection (ME-C⁴D).

O1 - Development of protocols for simultaneous analysis of inorganic and organic ions with ME-C⁴D. (Initial TRL 2, final TRL 4)

O2 - Demonstration of analysis on inorganic and organic ions by ME-C⁴D in relevant environmental samples. (Initial TRL 2, final TRL 4)

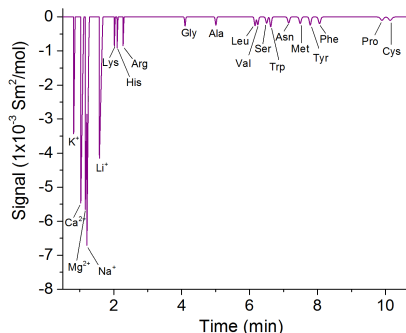
O3 - Design of a miniaturized ME-C⁴D instrument dedicated to simultaneous analysis of inorganic and organic ions. (This work will leverage from instruments previously developed in our laboratory, initial TRL 3, final TRL 4)

Approach

When analyzing “known terrestrial samples” we can select the appropriate methods for analysis and sample processing in such a way that the rest of the sample doesn’t interfere with the detection of the compound of interest. On the other hand, analyzing unknown samples like the ones expected on alien worlds is a little more challenging. *In this case, we can narrow the search to a certain group of analytes and then develop a method that allows the detection of as many of those compounds as possible.* This is exactly what we aim to do here. We will develop methods to simultaneously analyze inorganic and organic ions, as they are likely to be present at the same time on samples collected from the most relevant astrobiology targets like Mars, Enceladus, or Europa. We selected technique that allows detection of charged molecules and is easily miniaturized and automated ME-C⁴D. We will develop all the protocols for analysis and a model of a compact instrument.

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11/2015



Simulated separation of cations and amino acids performed with PeakMaster. This example demonstrates that is possible to do simultaneous analysis of ions but more importantly that even if inorganic ions are present at much higher concentrations than amino acids they don’t hinder their detection.

The first end product of this project will be protocols similar to the one shown in the figure above: one for inorganic cations and amino acids and another one for inorganic anions and carboxylic acids. The second end product would be the design of a compact and automated ME-C⁴D instrument to do these type of analyses.

Top Level Milestone Schedule

- Protocol for simultaneous analysis of inorganic cations and amino acids developed and validated 04/2017
- Protocol for simultaneous analysis of inorganic anions and organic acids developed and validated 02/2018
- Analysis on relevant environmental samples (i.e. soil from Atacama desert) demonstrated 10/2018
- Design of future instrument completed 04/2019

Entry TRL = 2