

FY23 Topic Areas Research and Technology Development (TRTD)

Novel Method for Analysis of Fatty Acids by Capillary Electrophoresis using Non-polar Solvents

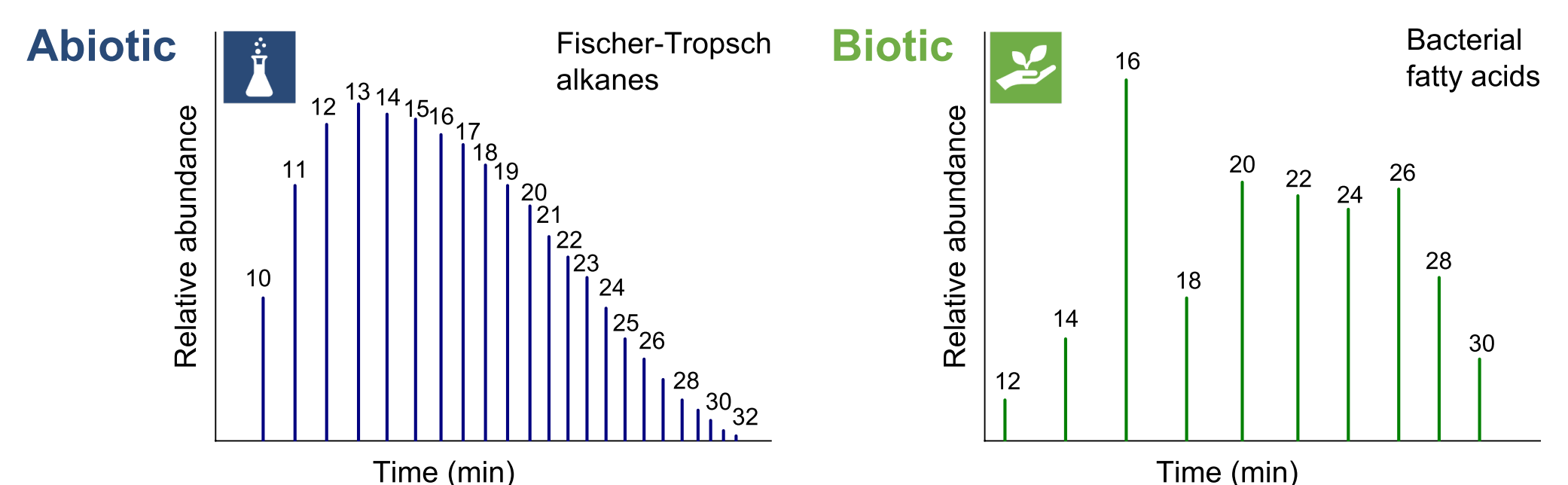
Principal Investigator: Maria Mora (389); Co-Investigator: Miranda Kok (389)

Strategic Focus Area: Remote/In Situ/Life Detection Sensors and Instruments

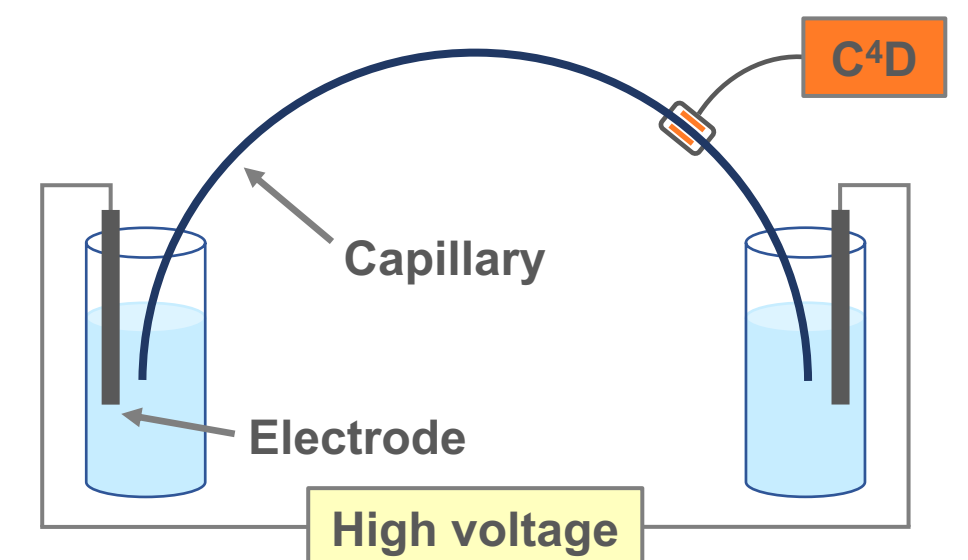
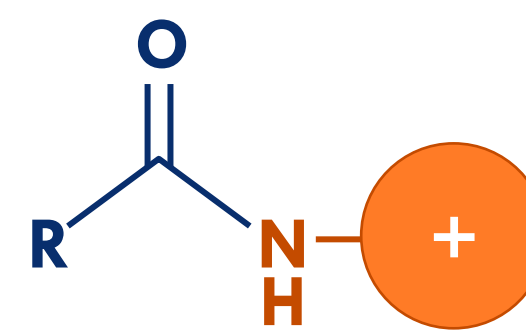
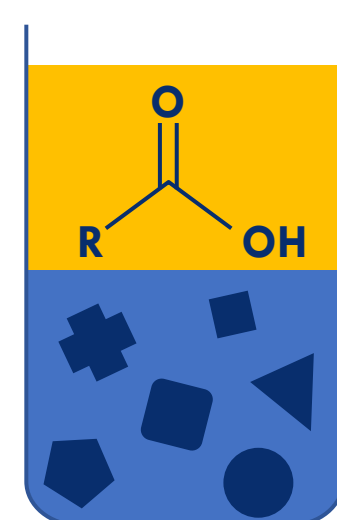
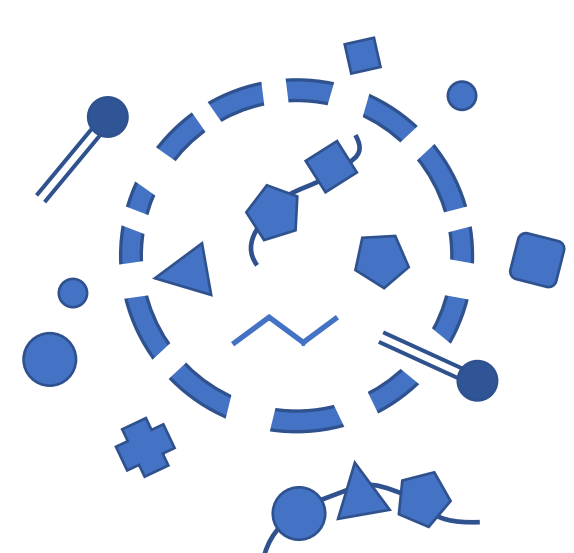
Objectives: Development of a simple method for the analysis of a wide range of fatty acids by capillary electrophoresis and contactless conductivity detection.

Background

Fatty acids are key targets for future in situ missions to ocean worlds looking for evidence of life. Fatty acids can be produced via abiotic and biotic processes resulting in different distributions. In order to obtain such distributions it is necessary to identify and quantify individual fatty acids. There is a need for a simple method to separate and uncover the relative abundances of fatty acids within samples.



Approach



Subcritical Water Extraction

Breakdown of cells and complex molecules into building blocks of life at high temperature and under pressure

Liquid-Liquid Extraction

Dissolution and isolation of fatty acids by the addition of an immiscible organic solvent

Derivatization

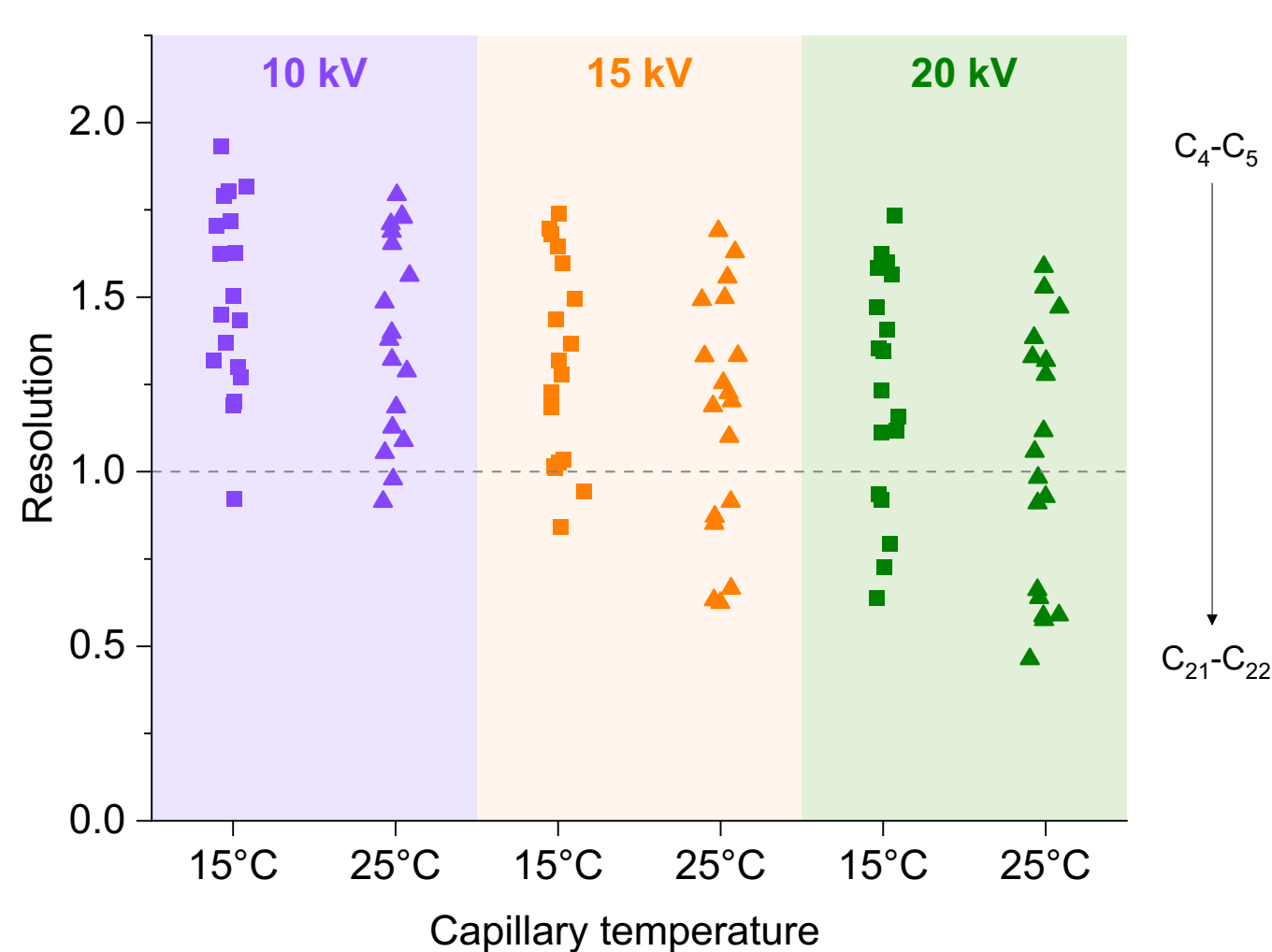
Labeling of fatty acids with a positively charged reagent

CE-C⁴D

Separation and detection of fatty acids with capillary electrophoresis coupled to contactless conductivity detection

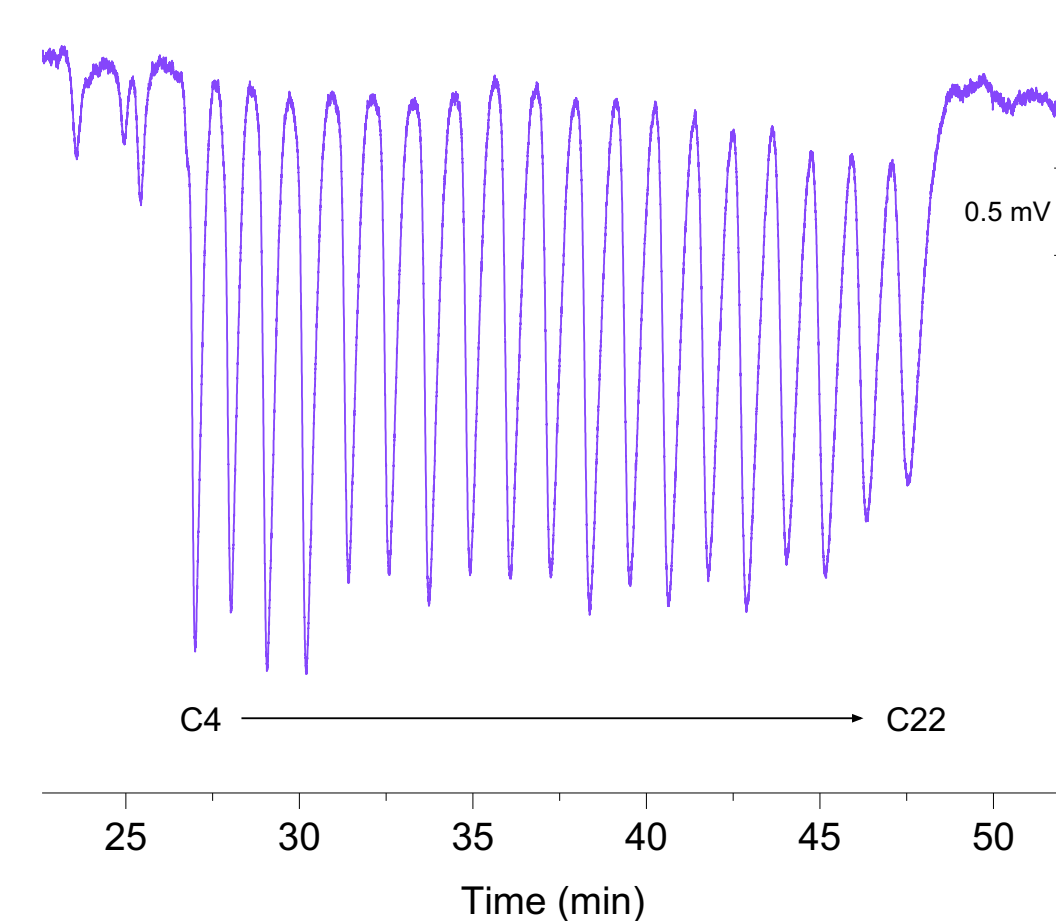
Results

Optimization of fatty acids separation



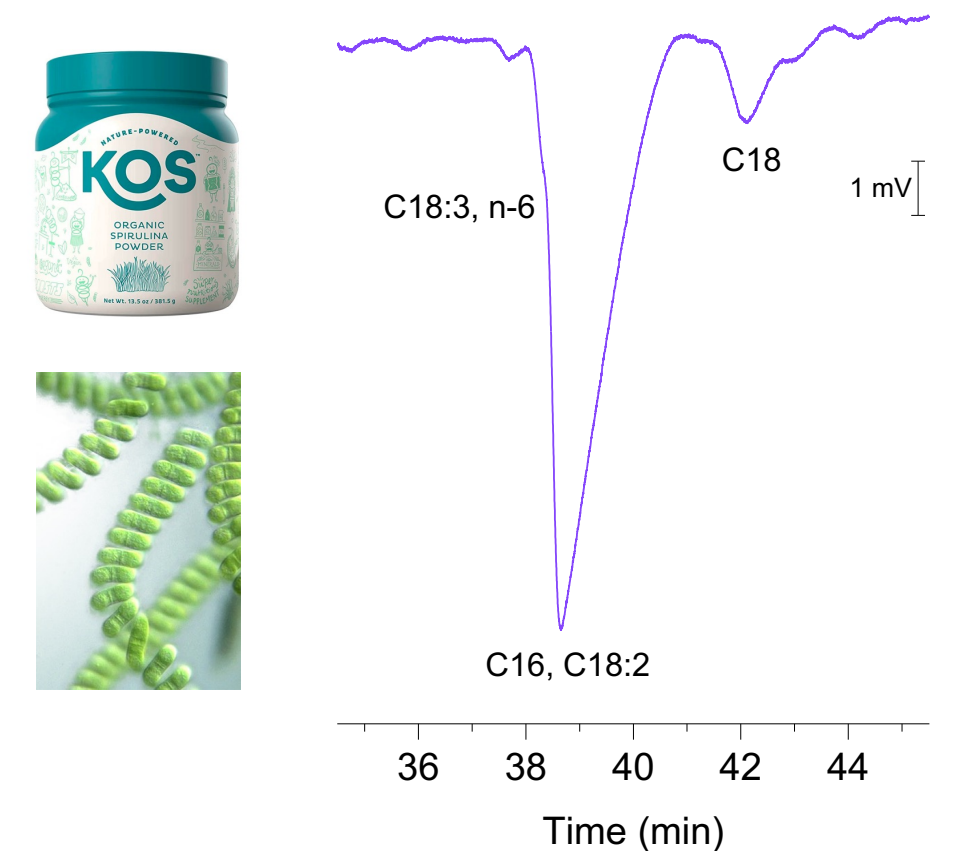
Resolution > 1.0 desirable
Optimum conditions: 10 kV, 15°C

Maximum separation of fatty acids



Baseline separation of most fatty acids with LODs of 3-5 μ M

Analysis of Spirulina sample



Multiple fatty acids detected in processed Spirulina sample

Significance/Benefits to JPL and NASA: The CE-C⁴D method developed for this project will provide JPL with unique capabilities to detect fatty acids biosignatures in samples collected during future life detection missions.

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Publications:

Kok, M.G.M. and Mora M.F., Fatty acid analysis by capillary electrophoresis with contactless conductivity detection for future life detection missions. ACS Earth Space Chem, 2023, *submitted*.

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