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Author: Mr. Dirk Claessens
QinetiQ Space nv, Belgium

Mr. Pieter Buysschaert
QinetiQ Space nv, Belgium

KINEMATICS OF ARTHROSPIRA INVESTIGATED IN BIOLAB ON BOARD THE ISS

Abstract

The cyanobacterium *Arthrospira* sp. strain PCC8005 is a candidate for use in spacecraft biological life support systems, for CO₂ and nitrate removal, and oxygen and biomass production. However, to ensure the reliability of such a biological life support system it is necessary to characterize the response of *Arthrospira* to in situ space flight conditions.

The overall objective is to determine the effect of space flight conditions, including reduced gravity and increased radiation, on the bacterial morphology, physiology, and metabolism. To determine this effect the response of the bacterium to space flight conditions at culture level, cellular level and molecular level will be examined. Further the kinetic parameters for subsequent mathematical modelling of the bacterium reproduction and metabolism under space flight conditions will be determined.

The hardware that is being developed to allow measurement of the above-mentioned parameters will be described: the heart of the experiment is the culture chamber where an original concentration of *Arthrospira* will be present in a Zarrouk medium (5 ml). The volume of the medium is increased to 50 ml and the growth of the *Arthrospira* will be activated by a temperature control of the medium to 35°C and by providing illumination by means of LEDs. Oxygen is produced as the *Arthrospira* are growing and multiplying which is measured by tracing the pressure increase in the medium as well as by verifying the removed oxygen volume. Other parameters that are measured to verify the growth of the *Arthrospira* are the optical density, a fluorescence measurement and a pH measurement. The last one is a decision criterion to decide to stop the experiment (when medium gets exhausted). Radiation and temperature are also continuously monitored.

Several samples are taken when the experiment is stopped to take in flight microscopic images, to perform a post-flight chemical analysis and to allow measurement of the biomass on samples that are fixed with RNA later.

The experiment is being developed for the BIOLAB facility which is present in the Columbus module of the ISS. The experiment will be performed in 2 phases: in a first step the *Arthrospira* will be grown in a batch regime and in a second step in a continuous steady state regime. Four culture chambers will be used in parallel to obtain statistical data.

The first runs of the experiment are planned in 2015.