Dimethylsulfonopropionate as a reactive oxygen species scavenger for phytoplankton cell

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The goal of this project is to improve knowledge about the role of dimethylsulphonopropionate (DMSP) and dimethylsulfoxide (DMSO) as antioxidant for phytoplankton and the impact of light intensity on their production and degradation by phytoplankton. In addition to their antioxidant role for the phytoplankton, DMS(P,O) are the precursors of the dimethylsulfide (DMS), a gas affecting the climate through the production of atmospheric aerosols. These lasts could have an effect on terrestrial albedo by creating clouds.

The production of DMS(P,O) by phytoplankton is specific and varies with environmental conditions in particular light. The research methodology will combine laboratory experiments, field measurements and mathematical modelling. DMS(P,O) production processes and related enzymatic pathways will be studied in laboratory experiments based on monospecific cultures of key phytoplankton species in different light conditions. We have chosen for laboratory experiments four key species: *Phaeocystis globosa, Skeletonema costatum, Nitzschia closterium* and *Thalassiasira pseudonana.*

Process level studies will be carried out using two complementary techniques:
(1) The expression of several candidate genes implied in DMSP production will be examined using molecular techniques (qPCR). This expression will be done in parallel to
(2) The production/degradation of DMSP and DMSO measured by gas chromatography for the phytoplankton species of the Southern North Sea (SNS) in different environmental conditions of light.

Reactive oxygen species (ROS; OH-, O2-, H2O2) relative production will also be measured to estimate their variability in different light conditions. Monthly field measurements will allow to quantify the importance of DMS(P,O) production and DMS emission in the SNS area related to phytoplankton diversity and environmental factors. It will also be measured the relation between the presence of phytoplankton species and bacteria diversity thanks to genomic data with in mind that DMS(P,O) could be the key molecule between them. A temporal series could be made to have a better understanding in time scale.

Data from laboratory experiments and field measurements will then be used to calibrate and validate the DMS(P,O) dynamics in the biogeochemical MIRO-DMS model applied to the SNS. Model simulations will allow to (i) determine the relative importance of biotic and abiotic factors in the production of DMS(P,O) by aquatic ecosystems and (ii) improve the prediction of current and future emissions of DMS.

Keywords: DMS; oxidative stress; DMSP; phytoplankton