

# An antioxidant function for dimethylsulfoniopropionate (DMSP) and dimethylsulfoxide (DMSO) within three phytoplankton groups

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## Context

<b>DMS</b>	Is the most volatile sulfur compound Is the precursors of sulphate aerosols and cloud condensation nuclei Impacting directly or indirectly the Earth's radiation balance
<b>DMS(P,O)</b>	Are the precursors of DMS Are playing several hypothetical roles on phytoplankton cells: cryoprotectant, osmoregulator or antioxidant
<b>ROS</b>	Reactive oxygen species derived from molecular O <sub>2</sub> due to an excess of energy
<b>DLA</b>	DMSP-lyase activity converting enzymatically DMSP into DMS and acrylate

## Goal

**Understand** the antioxidant function of DMSP and DMSO within three phytoplanktonic groups : diatoms, Prymnesiophyceae and Dinophyceae

## Methodology

**Oxidative stress produced by**

- High Light intensities (HL)
  - For a natural oxidative stress
- Menadone Bisulfite (MSB)
  - Producing <sup>1</sup>O<sub>2</sub> inside the cell
- DCMU
  - Blocking the photosynthesis

**On laboratory monoculture of three phytoplankton groups**

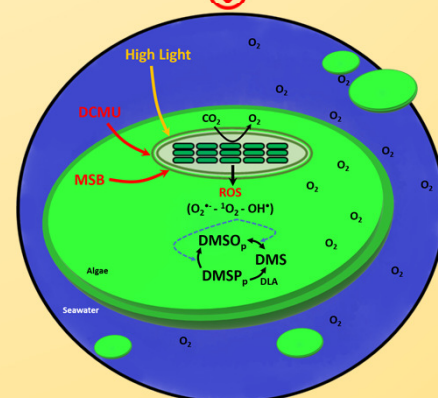
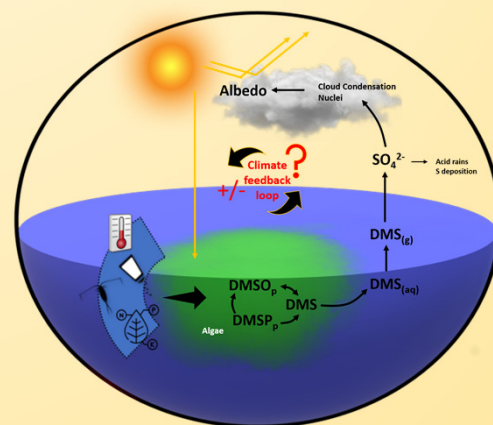
- (1) Diatom and low-DMSP producer: *Skeletonema costatum*
- (2) Prymnesiophyceae and high-DMSP producer: *Phaeocystis globosa*
- (3) Dinophyceae and high-DMSP producer: *Heterocapsa triquetra*

## Analysis

- ☐ ROS production
- ☐ Photosynthetic pigments
- ☐ *In vivo* Fluorescence (PSII)
- ☐ Cell damages (LOP)
- ☐ DMSP and DMSO cell quotas

### TAKE HOME MESSAGE

- ✓ DMSP and DMSO act as antioxidant
- ✓ Different responses between diatoms, Prymnesiophyceae and Dinophyceae
- ✓ Importance of the initial DMS(P,O) concentration and DLA to counteract the oxidative stress



## Results

→ Example of MSB oxidative stress on the diatom *S. costatum* (SC) – the Prymnesiophyceae *P. globosa* (PG) – and the Dinophyceae *H. triquetra* (HT)

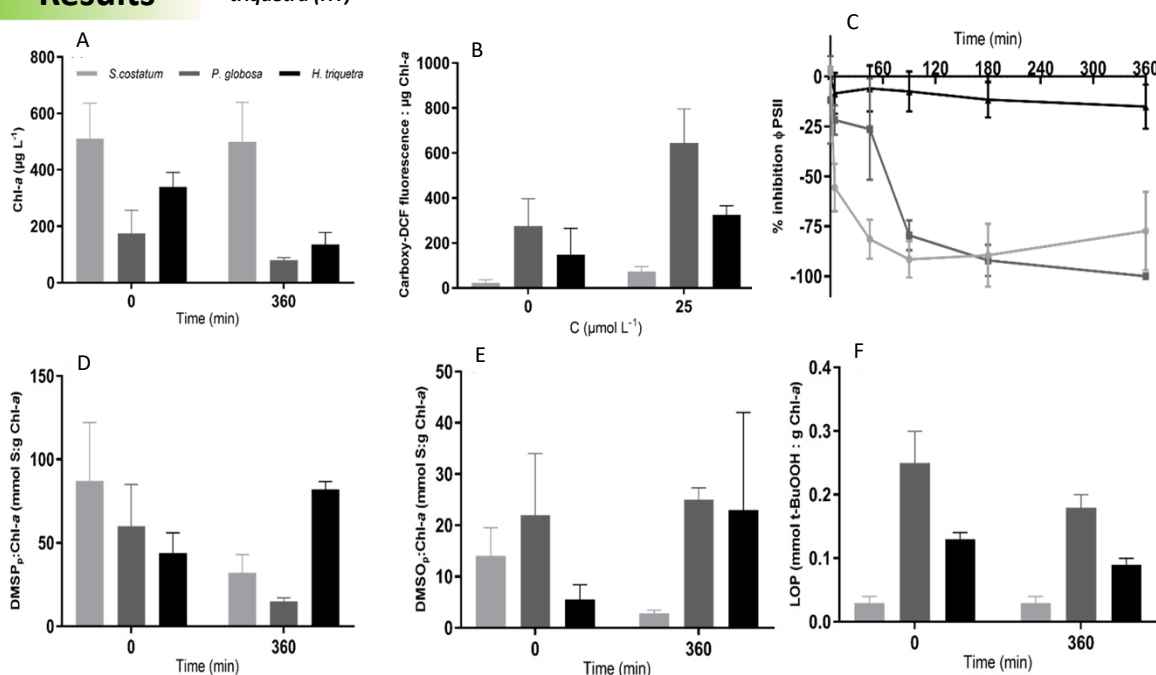


Figure: Evolution during 6h of (A) chlorophyll a (Chl-a) concentration; (B) ROS production; (C) percentage of inhibition of PSII; (D) DMSP<sub>p</sub>:Chla ratio; (E) DMSO<sub>p</sub>:Chla ratio; and (F) cell damages by lipid oxidation products (LOP).

### Evidence of the oxidative stress with

- The increase of ROS production (Fig. B)
- The decrease of the PSII efficiency for SC and PG but not for HT (Fig. C)

### Counteract the oxidative stress by

- Variations on DMS(P,O)<sub>p</sub>:Chla ratio (Fig. D, E)

	DMSP <sub>p</sub> :Chla	DMSO <sub>p</sub> :Chla
SC	≈	↓
PG	↓	≈
HT	↑	≈

### Leading to

- LOP constant or decreasing (Fig. F)