Monitoring photo-oxidative and salinity bacterial stress in the Canadian Arctic using specific lipid tracers

R. AMIRAUX*, J.-F. RONTANI

Aix Marseille Université, Université de Toulon CNRS/INSU/IRD, Mediterranean Institute of Oceanography (MIO), UM 110, 13288 Marseille, France (*Correspondence: remi.amiraux@mio.osupytheas.fr)

We determined the abiotic stress state of bacterial communities released into the water column during the Arctic sea ice melt season using specific lipid markers that are characteristic of type II photo-oxidation processes and *cis-trans* isomerase and 10*S*-DOX-like lipoxygenase activity, these last two reflecting salinity stress. More specifically, parent lipids and some of their oxidation products were quantified in the bottommost centimeters of sea ice, in sinking particles and in sediments. Our data show that salinity- and light-induced bacterial stress processes are temporally decoupled, with the former occurring at the beginning of ice melting and the latter observed mostly in open waters following ice melt. We suggest that during the early stages of ice melting only a slight release of highly salty brines occurs, inducing a strong bacterial salinity stress, while the healthy state of sea ice algae under hypersaline conditions associated with the production of high amounts of extracellular polymeric substances (EPS) limit photochemical stress. As sea ice melting progresses, brines channels become hyposaline, reducing the bacterial salinity stress as well as the ice algae viability that cause an enhancement of photo-oxidative stress, which is further exacerbated in open waters due to the low amounts of EPS. The small amount of active bacteria in the Arctic compared to temperate or tropical regions is thus attributed to the combined action of efficient salinity stress in spring and photo-oxidative stress in summer. These studies also suggest that surface sediments from the Arctic contain relatively high quantities of sea ice-derived organic matter that has undergone a strong degree of salinity-induced stress. Finally, biomarker products of 10*S*-DOX-like lipoxygenase and *cis-trans* isomerase activity are confirmed as useful indicators of salinity stress in Arctic bacteria.