Unraveling The Photoproduction of Acetaldehyde from Bacteria-Derived Dissolved Organic Matter

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Abstract

Marine bacteria directly produce and metabolize oxygenated volatile organic compounds (OVOCs), which will certainly influence the OVOCs flux across the air-sea interface. Photochemical degradation of dissolved organic matter (DOM) (e.g. CDOM, humic-like fluorescent DOM (FDOM)) in bulk seawater is also an important source of OVOCs including acetaldehyde (C_2H_4O) and acetone (C_3H_6O). Through incubation experiments, it has been shown that marine bacteria-derived DOM (B-DOM) has the characteristics of CDOM and humic-like FDOM. Moreover, marine bacteria humic-like FDOM is unstable under light irradiation, while the generation of OVOC on the ocean surface water via photochemical degradation of B-DOM has been still unknown. In this study, B-DOM originated from marine bacteria in coastal sea was used to determine if light irradiation on B-DOM is the potential source of OVOCs using PTR-ToF-MS. B-DOM composition was characterized based on the analyses of CDOM, amino acid-like, and humic-like FDOM, indicating that acetaldehyde was the major photoproduct but not acetone from B-DOM. Acetaldehyde photoproduction rates also seem to be dependent on the stage of early diagenesis of B-DOM (e.g. in the scale of days). In contrast to acetaldehyde, the photoproduction of acetone from B-DOM was negligible, implying other potential sources of acetone on the ocean surface water. Whilst these results imply that marine bacteria also contribute to acetaldehyde production via DOM, whether this has a potential impact on the global OVOC dynamics is an area of ongoing studies.

Early Career Scientist

NO, I am not an early career scientist.

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