

Simultaneously enhanced iron oxide dissolution and iodide oxidation in cold environment

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Iron(Fe) is one of the most important trace elements for living species and the limiting component to control primary production in HNLC(High Nutrient and Low chlorophyll) regions including Southern Ocean. Consequently, this stimulated primary production by bioavailable iron can absorb atmospheric CO₂ and then affect climate change. Most of the iron in environment is existed as iron oxide or (oxy)hydroxides form and they are not directly bioavailable for living organisms. Dissolution of iron oxides increases their bioavailability. The chemical fate of active halogen compounds in the polar atmosphere controls ozone and mercury depletion events, oxidizing capacity, and dimethyl sulfide(DMS) oxidation to form CCN(cloud-condensation nuclei). The sources and mechanisms of iodine species in polar atmosphere are not well understood compared to those of chlorine and bromine. It is known that the chemical processes taking place in ice phase is different from that in aqueous water. This difference between two phases might control the mobility, bioavailability, toxicity, and the environmental fate of organic and inorganic species. In general, most chemical reactions slow down as the reaction temperature decreases. However, various redox chemical processes are accelerated when the solution is solidified. In this work, we studied the reductive dissolution of iron oxide particles to produce bio-available Fe(II)_{aq} and simultaneous oxidation of I⁻ (iodide) to produce I₃⁻ (tri-iodide) in ice phase under UV irradiation or dark condition. The reductive dissolution of iron oxide and oxidation of iodide was markedly enhanced in ice phase regardless of presence or absence of light. The detailed experimental conditions and mechanism will be discussed in the presentation.