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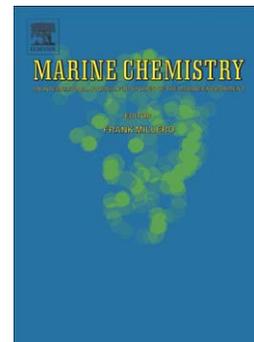
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Influence of atmospheric dry deposition of inorganic nutrients on phytoplankton biomass in the coastal Bay of Bengal

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Abstract

The aerosols from continents contain relatively higher amounts of inorganic nutrients than those of marine origin and can make a notable contribution to the coastal biological productivity. To test this hypothesis, the composition of aerosols over the city of Visakhapatnam (central east coast of India) were studied when continental flow was dominant and its impact on phytoplankton biomass was estimated through microcosm experiments between September 2013 and November 2014. Higher nitrate (NO_3^-) and ammonium (NH_4^+) concentrations were observed in the aerosols collected in January while higher phosphate (PO_4^{3-}) was observed in September. Simultaneous observations of aerosols over the city and neighboring coastal waters revealed that the concentrations of nitrate in ambient aerosols ranged from 0.56 to 1.89 $\mu\text{g m}^{-3}$ and 0.09 to 0.86 $\mu\text{g m}^{-3}$, respectively. Our results suggest that 52-89% of city's aerosols borne nitrogen deposited over waters within 10 km from the coastline. Microcosm experiments were conducted by spiking the surface water samples, collected from the coastal Bay of Bengal (BoB), with the dust borne nutrients. Upon spiking, dissolved inorganic nitrogen ($\text{NO}_3^- + \text{NH}_4^+$) increased from 0.3 to 11.7 $\mu\text{mol L}^{-1}$ and the N:P ratio increased from 2 to 97. This led to enhanced phytoplankton biomass (1.5 to 4 times) upon spiking. The increase in phytoplankton biomass was linearly related to dissolved N: P ratios in water as aerosol deposition increased the N: P ratios in the microcosms, leading to phytoplankton growth. Though aerosols did not contribute to bioavailable silicate, our microcosm experiments showed linear relationships between ambient silicate phytoplankton biomass, and concentrations of Fucoxanthin (a marker pigment for diatoms). This indicates that the availability of silicate in coastal waters facilitated dominant diatom growth in the presence of higher N: P ratios due to aerosol deposition. The deposition of soluble aerosol nitrogen appears to support ~3 to 33% of the biological production in the coastal waters off Visakhapatnam with higher contribution in winter (~33%) than in summer (10%). This

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