



Nitric oxide turnover in permeable river sediment

Frank Schreiber, Peter Stief, Marcel M. M. Kuypers and Dirk de Beer

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ABSTRACT: We measured nitric oxide (NO) microprofiles in relation to oxygen (O_2) and all major dissolved N-species (ammonium, nitrate, nitrite, and nitrous oxide [N_2O]) in a permeable, freshwater sediment (River Weser, Germany). NO reaches peak concentrations of $0.13 \mu\text{mol L}^{-1}$ in the oxic zone and is consumed in the oxic – anoxic transition zone. Apparently, NO is produced by ammonia oxidizers under oxic conditions and consumed by denitrification under microoxic conditions. Experimental percolation of sediment cores with aerated surface water resulted in an initial rate of NO production that was 12 times higher than the net NO production rate in steady state. This initial NO production rate is in the same range as the net ammonia oxidation rate, indicating that NO is transiently the main product of ammonia oxidizers. Stable isotope labeling experiments with the ^{15}N -labeled chemical NO donor 5-nitroso-N-acetylpenicillamine (SNAP) (1) confirmed denitrification as the main NO consumption pathway, with N_2O as its major product, (2) showed that denitrification combines one free NO molecule with one NO molecule formed from nitrite to produce N_2O , and (3) suggested that NO inhibits N_2O reduction.

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