THE INTERACTION OF NITRATE AND AMMONIUM ASSIMILATION BY PHYTOPLANKTON: A STEADY-STATE ANALYSIS

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ABSTRACT

The results of 14 steady-state experiments, representing a wide range of \( \text{NH}_4^+:\text{NO}_3^- \) regimes, are presented. The investigations utilized nitrogen-limited populations of *Dunaliella tertiolecta*, growing at rates approaching \( \mu_{\text{max}} \). The data describe the relationships between the ambient nitrate concentration, phytoplankton biomass, physiological state indicators, and bioassay parameters and the ammonium:nitrate delivery ratio.

The limiting nitrate concentration showed no dependence upon the ammonium:nitrate input ratio. These data indicate that the suppression of nitrate assimilation by ambient ammonium may be produced only by abnormally high limiting nutrient concentrations in batch culture or non-nitrogen limiting conditions in nature. The physiological characteristics, carbon/cell and chl-\( \alpha \)/cell were statistically invariant over the range of delivery ratios. At ammonium contributions \( \geq 24 \) percent the yield coefficient, \( q \), was inversely proportional (\( P = .001 \)) to the percent ammonium in the incoming media. The linear decline of N/cell and N/C values supports the concept that there is no intracellular reservoir for nitrogen when the limiting source is ammonium-N. Bioassay experiments, involving the transfer of test populations from open to closed culture systems, described a linear relationship (\( P = .001 \)) between \( q \) and the resultant population increase.