The cyanate utilization capacity of marine unicellular Cyanobacteria

Kamennaya, Nina A., Mark Chernihovsky, Anton F. Post

Limnol. Oceanogr., 53(6), 2008, 2485-2494 | DOI: 10.4319/lo.2008.53.6.2485

ABSTRACT: Cyanate, a by-product of urea decomposition, is a potential nitrogen (N) source in marine environments, but to date it has received scant attention. Cyanobacteria presumably acquire this compound via a substrate-specific ABC-type transporter (*cynABD*), and they convert it to ammonium and carbon dioxide by cyanase (*cynS*) activity. Participation of cyanate utilization genes in N-stress responses in cyanobacteria has been implied previously, but its ecological context has not been studied. We employed polymerase chain reaction protocols for *cynA* amplification to examine the potential for cyanate recruitment in the Gulf of Aqaba, northern Red Sea. We also monitored growth of cyanobacterial strains with different cynABDS complements on cyanate-containing media. We showed that cyanate is utilized as the sole N source by strains with the full gene complement, and residual growth, fed by natural decay of cyanate to ammonium, was observed in strains lacking any of these genes. Natural abundance of *cynA* products in the oligotrophic Gulf of Aqaba indicates that cyanate constitutes an essential N source for *Prochlorococcus*, but not for *Synechococcus* populations. Noncyanobacterial *cynA* sequences indicate cyanate utilization by a variety of other phototrophic microorganisms. We hypothesize that in stratified water bodies, cyanate utilization is confined to the N-deplete upper photic zone, where it plays a role in "regenerated" primary production.

Article Links

Download Full-text PDF

Return to Table of Contents