Urease activity in cultures and field populations of the toxic dinoflagellate Alexandrium

Dyhrman, Sonya T., Donald M. Anderson

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ABSTRACT: Nitrogen availability is an important factor controlling phytoplankton abundance and species composition in marine waters. In addition to inorganic nitrogen, some phytoplankton species can use dissolved organic nitrogen sources such as urea for growth. Herein we demonstrate that axenic laboratory cultures of the toxic dinoflagellate, *Alexandrium fundyense* strain CB301A and *A. catenella* strain TN9A were able to grow on urea as a sole nitrogen source in the presence of nickel. This nickel dependence suggests that these *Alexandrium* species hydrolyze urea into ammonia with the enzyme urease rather than adenosine triphosphate urea amidolyase. Cells grown on urea had lower toxin content (15%-30%) than f/2-grown cells. In *A. fundyense* the urease enzyme appears to be nitrogen-regulated. In culture experiments, enzyme activity was highest in nitrate-starved and urea-grown (replete) cells, whereas activity was undetectable in f/2-grown (replete) and phosphate-starved cells. Urease activity in ammonia-grown (replete) cells was also depressed. Urease activity also appeared to increase with decreasing nitrate-limited growth rate in semicontinuous cultures. May and June cruises in the Gulf of Maine followed the yearly bloom of *A. fundyense*. On average, inorganic nitrogen concentrations in May were higher than in June, whereas cell abundances, urea concentrations, and urease activity in May were lower than in June. The latter measurements relied on an immunomagnetic bead separation to isolate living *A. fundyense* cells from mixed phytoplankton samples for analysis. The differences between May and June suggest that urea may be important for *Alexandrium* nutrition as inorganic nitrogen concentrations in surface water decline.

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