Impacts of 1,2-Propanediol Effluent Discharge on Reproductive Rates and Dispersion Patterns of Anabaena inaequalis and Chlamydomonas reinhardtii

Berg, Nicolas

1,2-propanediol is a common de-icing fluid used by airports to prepare planes for takeoff during cold weather. Airports can discharge glycol into nearby bodies of water. As an effluent, glycol decomposes in the presence of oxygen and causes anoxic zones, and, in rare cases, it can be a significant source of chemical energy. Although the enzymatic pathway by which glycol decomposition occurs has been determined, research on how it affects reproductive rates of photosynthetic microorganisms and its specific impacts on their behaviors in a controlled environment is limited. The goal of this study was to assess the effects of propanediol on the reproductive rates of cyanobacteria (Anabaena inaequalis) and algae (Chlamydomonas reinhardtii). Samples were grown in swan neck flasks with freshwater medium. Microbial growth was measured with a spectrophotometer, and readings were taken every other day for one week. Experimental groups contained 100μL/L propylene glycol. Spectroscopy analysis displayed elevated reproductive rates in both Chlamydomonas and Anabaena. As a supplementary test, a 100μL/L solution of glycol was given one week to aerobically decompose at 4°C. The decomposed glycol solution was then inoculated with Anabaena. Levels of Anabaena were much greater than the cultures grown with non-degraded glycol. In addition to the increased reproduction, introduction of propanediol to the system radically changed clumping behaviors. Observations suggested that glycol may prematurely induce a biofilm state. Microscopy analysis showed clumps of dead biomass in the glycol biofilm cultures. These data suggest that glycol discharge has more impacts than previously known, and its potential to upset systemic balances in lakes and ponds has been undervalued.

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