

Water Hazard: The Effect of Paracoccus Denitrificans-Based Remediation Techniques on the Levels of Nitrate and Oxygen in Freshwater Environments

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Nitrate (NO_3) is a major component of plant growth and the most common fertilizer ingredient in the world. The extensive use of nitrate-based fertilizers has contaminated countless bodies of water, though, leading to health problems across the world. This experiment's goal was to discover if the denitrifying bacteria *Paracoccus denitrificans*, which is harmless to humans, could be used to reduce nitrate levels in fresh water. The experiment was split into two parts. Part 1 examined the effects of *Diffugia lobostoma* and *Paracoccus denitrificans* with glycerin as a carbon source upon oxygen and nitrate levels, while Part 2 examined and refined combinations of *Paracoccus* with and without glycerin, as well as aeration in some groups. Hypotheses included: 1) Glycerin added to *Paracoccus* would increase rates of oxygen depletion and nitrate reduction. 2) Aeration would maintain a constant oxygen level and higher rates of denitrification. Each test group consisted of five glass one-quart jars, with three replicates per trial. Jars were established with water, *Spirogyra* (to help simulate a freshwater ecosystem), plant food and ammonium nitrate, bringing the water's nitrate level to 45 mg/L. Nitrate and oxygen levels were tested using Vernier Dissolved Oxygen Probe and Vernier Nitrate Ion Specific Probe, with data collected daily. Data analysis has indicated that groups with both *Paracoccus* and glycerin added exhibited rapid rates (~85-95%) of nitrate reduction and similar rates of oxygen reduction, with deoxygenation being proportional to glycerin level; groups with aeration experienced significantly lower deoxygenation rates. Therefore, it is conclusive that *Paracoccus* is capable of reducing nitrate levels in freshwater, albeit coupled with rapid deoxygenation.