Engineering a Biomimetic System That Maximizes Surface Area Exposure to Water Flow Thus Increasing the Rate of Bioremediation in an in vitro Hypereutrophic System (A Novel Fourth Year Study)

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Previous research determined that using Chlorella Vulgaris infused Sodium Alginate beads was an effective strategy to return hypereutrophic water systems to natural nutrient levels. Determining if these bio-active bioremediation units (BABU), in biomimicry designs which maximize surface area exposure to water flow, would be able to yield an increased rate of orthophosphate and nitrate remediation was explored. Two hundred BABUs were distributed into each biomimicry system and were placed into an in-vitro eutrophic system. The effectiveness of bioremediation was measured by the rate of nutrient depletion (ppm) over three weeks in flowing and stagnant water. The positive control remediated 89% , while the BABUs in the biomimicry structures remediated between 91-97% of the nutrient solution. A Two-factor ANOVA Analysis of Orthophosphate and Nitrate generated a p-value of 0.01846. An ANOVA test analyzing the difference in nutrients between experimental groups generated p- values lower than the alpha value of 0.05 for both orthophosphate and nitrate, therefore the null hypothesis was rejected, "The mechanism in which the BABU’s are situated will not alter the rate of nutrient remediation.” There was a statistically significant difference between these Biomimicry Designs and the Positive Control. A two-sample t-test between Percent Remediation in stagnant water and flowing water generated a p-value of 0.5, suggesting that there is no statistically significant difference between the remediation of these Biomimicry Designs in flowing water and stagnant water. Although there was a significant increase in bioremediation in the biomimicry designs, all groups including the positive control, were able to bring the nutrients to natural levels for average Florida systems.

Awards Won: