Comparison of Struvite and Chlorella vulgaris Solution to Phosphorus Water Pollution

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Agricultural fertilizer runoff contains high phosphorus concentrations, which directly correlates with eutrophication and, ultimately, has an adverse effect on ecosystems and organisms. Often overlooked, a practical solution to agricultural phosphorus pollution has not been explored. The objective of this study was to evaluate the effectiveness of Struvite (MAP) Recovery and Chlorella vulgaris Algae Growth as phosphorus filtration methods for agricultural runoff. Fertilizer water was collected from a local celery field in Yuma, Arizona and then treated with either Magnesium Chloride and Ammonium Nitrate to form Struvite, or with 10-day growth of C. vulgaris. Results indicate C. vulgaris as the most effective phosphorus filtration method when comparing initial and after-treatment phosphorus concentrations per trial. While the Struvite method removed 71.43% of the initial phosphorus, C. vulgaris removed 100% of the initial phosphorus for four out of five trials. Both methods have similar nominal value as each removed up to 1.0 ppm of phosphorus. The methods also show effectiveness in high and low phosphorus concentrations. The Sturvite method decreased phosphorus concentrations for trials within a range of [0.6, 1.4] ppm of initial amounts. C. vulgaris Method decreased phosphorus concentrations for trials within a range of [0.4, 1.0] ppm of initial amounts. While C. vulgaris method is more effective than Struvite method, both filtration methods show promise in preventing phosphorus pollution while also benefiting agricultural systems as a fertilizer (Struvite) and the health supplement industry (Chlorella).

Awards Won:
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $52,000 each)
University of Arizona: Renewal Tuition Scholarship