SymBead Aquatic Technologies: The Development of a Low-Impact, Cost-Effective, Multi-Pollutant Bioremediation System

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It is estimated that only 1% of Earth's water supply is freshwater available for use by humanity and other organisms for survival. With 70% of this freshwater being contaminated, the need for a cost-effective, environmentally-friendly method of cleaning water pollution has never been more critical. This project partners environmentally-sourced bacteria with algae in a sodium alginate bead. Named after the symbiotic relationship that takes place between the algae and bacteria within the sodium alginate substance, SymBeads promote bacterial biofilm growth to enable the use of certain mechanisms that intake water pollutants. SymBeads are uniquely created for each pollution type studied, including Heavy Metals, Agricultural Runoff, and Fracking Wastewater. This customization for each SymBead system is accomplished through a five phase approach, starting with the collection of water at polluted sites in the environment, followed by bacterial isolation, bacterial screening, identification with a 16S Ribosomal Subunit Analysis, and partnership with algae to create the SymBeads. Approximately 200 different bacteria-algae-contaminant were developed and analyzed. Most of the SymBead systems for the 16 aquatic contaminants tested showed to successful removal over 90% of the pollutant concentration in less than a two week period. Results indicate that SymBeads can remove a significant concentration of each type of water pollution in a short period of time in a simulated stream. A flotation device for the implementation of the SymBeads into an active stream was designed, 3D Printed, and tested in the model streams. A cost analysis of 1000 SymBeads and a complete implementation device resulted in a $16.13 price.

Awards Won:

Second Award of $1,500

University of Arizona: Renewal Tuition Scholarship

International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention