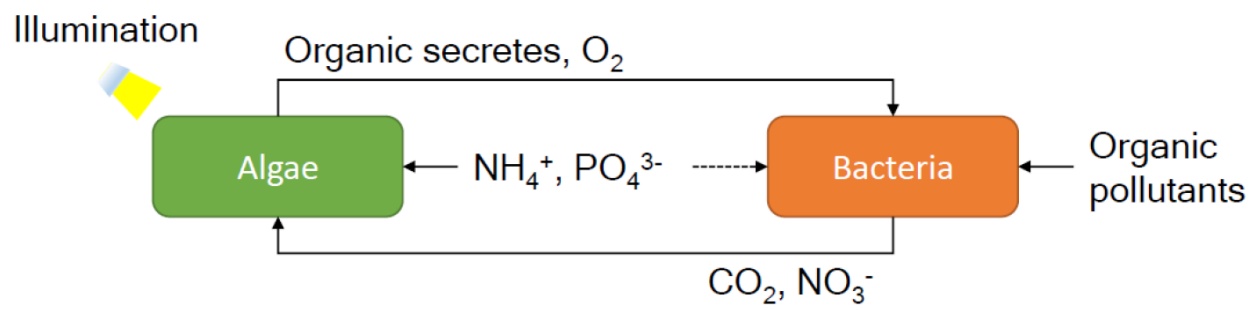


Developing a Diatom Algae-based Biological Treatment System for Simultaneous Removal of Organic Carbon, Nutrient, and Micropollutants from Domestic Wastewater: Pilot-scale Demonstration

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More than two-third of the wastewater, generated from Class I cities and Class II towns, is discharged to water bodies without any treatment. Government of India is decentralizing wastewater treatment by urging urban residential communities to setup on-site wastewater treatment plants that can generate recyclable water for non-potable purposes. However, existing aerobic bacteria-based treatment technologies are costly and require skilled supervision. Moreover, these systems are not designed to remove nutrients from wastewater. Government's upcoming regulations put emphasis on nutrient removal which cannot be done without significantly modifying the existing structures and processes. Therefore, it is the need of the day to develop a cost-effective, efficient and simple technology to meet the new requirements. We intend to develop a symbiotic algae-bacteria based technology which can remove organic carbon, nutrient, and even some targeted micropollutants from wastewater in a single tank and meet the above objectives. It will be a new product; at the same time, we will suggest minimum modifications to upgrade existing bacteria-based systems into algae-based systems.

Processes like conventional Activated Sludge Processes, Biological Nutrient Removal (BNR) systems have been extensively used for nearly a century. These systems primarily use heterotrophic bacteria which feed on organic pollutants in wastewater. These systems require mechanical aeration to support bacterial respiration which makes the process costly. BNR processes, which are combinations of aerobic/anaerobic/anoxic processes, come under advanced wastewater treatment processes which require more space and more skilled supervision. In our proposed bacteria and diatom microalgae based system, bacteria and diatom will coexist in a single reactor and participate in a symbiotic relationship, thereby, simultaneously removing organic carbon, nutrient and some targeted micropollutants. Diatoms are photosynthetic organisms which produce oxygen. Heterotrophic bacteria will utilize this oxygen for respiration (carbon removal), thereby, reducing the net requirement for mechanical aeration. Consequently, the cost of treatment will reduce. Diatom will also take up nutrient from wastewater for cell synthesis. The lipid extracted from diatom can be used for synthesis of biodiesel which is a value-added by-product of wastewater treatment. The proposed system will require less space and less skilled supervision. Usually, polishing of wastewater has been done in algal ponds. The design of such system has been done following empirical relationships and design values. However, in this research, diatom will be included in the main biological treatment process. Detailed design procedure will be developed similar to activated sludge system by combining material balance method with bio-kinetic parameters for algal biodegradation (organic carbon, nutrients, and micropollutants). The system (or the bioreactor) will require a significant structural and process modifications over existing bacteria-based systems. Therefore, patent can be filed on the novel features of the bioreactor as well as on the process.



Demonstrable Hybrid Reactors under development