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Phototrophic granular bioreactor system for converting carbon dioxide and wastewater to biomass for biofuels

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After one century of dependence on activated sludge process for treatment of wastewater, aerobic granulation has emerged as new technology being implemented for both domestic and industrial wastewater. It is a superior activated sludge process as it exhibits higher biomass density, very high biomass retention, treatment and settling in single tank, fast bioremediation kinetics and resistance to loading fluctuations. The biomass is primarily constituted by *Eubacteria*, thereby possessing a limited metabolic diversity like conventional activated sludge. We have taken the technology to higher step by reconstituting natural aquatic biofilms in laboratory in the form of phototrophic granules. Phototrophic aquatic biofilms are the major contributors in restoration of water bodies by treating discarded wastewater. But they need extensive area for exposure to sunlight. By developing phototrophic granules consisting of bacteria, cyanobacteria and microalgae, we have overcome both the problems of limited metabolic diversity of aerobic granules as well as large foot print of phototrophic biofilms. Furthermore, by virtue of being phototrophic, they sequester carbon dioxide as well while carrying out bioremediation of wastewater. The biomass generated in the process can be used for biofuel (methane) generation in anaerobic digester or hybrid processes like Nisargruna (a BARC technology). The phototrophic granular sludge sequencing batch reactors thus can be used simultaneously for wastewater treatment, carbon dioxide sequestration and biomass generation for biofuel production. Laboratory scale five liter photo-bioreactors removed more than 90% total organic carbon (TOC) from wastewater containing 900 ppm to 1500 ppm TOC and removed nutrients like ammonium to below permitted limits. The work for pilot scale testing is in progress.

Biography

Rajesh Kumar has joined Bhabha Atomic Research Centre, India after obtaining his Post-graduation in Biotechnology from Banaras Hindu University and later obtained his PhD from University of Madras. He is currently working as a Scientific Officer E and his main research interests include assessment of environmental impact of power plant discharge and wastewater treatment.

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