Abstract

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Algal-fungal interactions for dewatering and pretreatment of microalgal biomass targeting improved biofuel production

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Abstract

Use of pellet forming filamentous fungi (PFFF) for algal bioharvesting presents an interesting approach to enhance the sustainability of algal biofuels. The present work describes the critical factors governing algal-fungal interactions in two different modes i.e. during algal-fungal co-cultivation and while using pre-cultivated algal and fungal biomass. To begin with, identification of the limiting factors and subsequent optimization of the process during co-cultivation was attempted using eight fungal strains (Prajapati et al., 2014). It was found that the conventional algal growth media (BG11) needs to be supplemented with carbon and nutrient sources to support PFFF growth. Further, only Aspergilluslentulus could grow and pelletize, resulting in nearly 100 %harvesting of Chroococcus sp. within 24 h. However, the harvesting time increased with decrease in glucose levels. To further simplify and shorten the process time, a rapid method was developed which includes mixing of algae with pre-cultivated fungal pellets in a prefixed ratio and optimized conditions, resulting in nearly 100% harvesting within 4 h (Prajapati et al., 2016). An insight into the critical parameters revealed that metabolically active fungal pellet with undamaged hyphae is a prerequisite for flocculation. FTIR data showed the involvement of specific groups (C-N groups) in the interaction (Bhattacharya et al., 2017a). A mathematical model developed for the first time (Bhattacharya et. al., 2017b) shows dependence on the radius of the algae and fungi along with the velocity gradient of the media. The theoretical model showed good agreement with the experimental data. A simple incubation of harvested algal? fungal pellets under controlled conditions was associated with significant enzyme activity due to which>54% enhancement in digestibility and up to 50% increase in methane production during anaerobic digestion were noticed. The invented method (1593/DEL/2015) is a unique process of its kind and has potential application in algae based biofuel production. Recent Publications 1. Prajapati, S. K., Kumar, P., Malik, A., &Choudhary, P. (2014). Exploring pellet forming filamentous fungi as tool for harvesting non-flocculating unicellular microalgae. BioEnergy Research, 7(4), 1430-1440. 2. Prajapati, S. K., Bhattacharya, A., Malik, A., & Vijay, V. K. (2015). Pretreatment of algal biomass using fungal crude enzymes. Algal research, 8, 8-14. 3. Prajapati, S. K., Bhattacharya, A., Kumar, P., Malik, A., & Vijay, V. K. (2016). A method for simultaneous bioflocculation and pretreatment of algal biomass targeting improved methane production. Green Chemistry, 18(19), 5230-5238. 4. Bhattacharya, A., Mathur, M., Kumar, P., Prajapati, S. K., & Malik, A. (2017). A rapid method for fungal assisted algal flocculation: critical parameters & mechanism insights. Algal Research, 21, 42-51. 5. Bhattacharya, A., Malik, A., & Malik, H. K. (2017). A mathematical model to describe the fungal assisted algal flocculation process. Bioresource technology, 244, 975-981.

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Biography

Anushree Malik is a Professor at the Center for Rural Development (CRDT), Indian Institute of Technology Delhi (IIT Delhi) and her research areas include Bioremediation, Wastewater Treatment, Algal Biofuels, and Biological Pest Control. She did her Ph.D. from IIT Delhi in the year 2000 and post doc from Utsunomiya University, Japan where she received prestigious Japan Society for the Promotion of Science (JSPS) fellowship awarded by Government of Japan. Later, she joined School of Environmental Sciences, Jawaharlal Nehru University (JNU) as Assistant Professor. She got associated with IIT Delhi as Assistant Professor in the year 2004 and contributed towards establishing Applied Microbiology Lab. Her lab has developed “Novel Mycotablets” for bioremediation which are designed to possess a unique and ideal combination of characteristics for easy storage & transportability to remote small scale industries.

