

## Integrated Wastewater Treatment and Biopolymer Production Using Algae-Bacteria Consortia

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### Project Description

Water is life and the role of wastewater treatment plants (WWTP) as water purifiers is undiscussable. WWTP prevent contamination of surface waters with carbon and nutrients and thus contribute to the preservation of the environment and human health. Traditional wastewater treatment is based on biological processes carried out by bacterial consortia naturally occurring in wastewater. The exploration on new algae-bacteria consortia in wastewater treatment is in its infancy, but it is a promising biotechnology due to the algae superior metabolic pathways to remove pharmaceutical compounds from wastewater. Wastewater contains a considerable amount of organic carbon that has been traditionally recovered as methane gas. Another very promising way of recovering carbon in the wastewater is the production of biopolymers by bacteria and algae.

The present project proposes an integrated approach combining wastewater treatment and production of biopolymers by algae-bacteria consortia. To achieve sustainable and scalable biopolymers production using algae-bacteria consortia we need to overcome multiple challenges which would lead to achievement of our research objectives. The proposed contribution will further enhance our fundamental knowledge and provide novel tools for algae-bacteria research and development.

### Work developed at LUH

2019	Different algae species will be cultivated using wastewater. The methods for cultivation, growth measurement and activity determination will be imported from the lab of Prof. Bala. <i>Output:</i> algae cultures that grow best in wastewater.
2020	The algae cultures obtained previously will be tested for their capacity to synthesize biopolymers. <i>Output:</i> biopolymer production capacity of different algae species using wastewater.
2021	The biopolymers obtained during the second year of the project will be characterized concerning its mechanical and chemical properties. <i>Output:</i> fully characterized biopolymers produced from wastewater.
2022	During the last year of the project an integrated concept will be developed for wastewater treatment and biopolymer production using algae-bacteria consortia. <i>Output:</i> scientific publication from LUH and IIT Indore and a project proposal ready to be submitted.

## Work developed at IIT Indore

2019	Wastewater collection, analysis and development of bacteria. Bacterial species development and characterization with guidance of Prof. Nogueira's Lab. <i>Output:</i> Bacterial species growing well in wastewater environment.
2020	Development and characterization of algae-bacteria consortia in nutrient media under controlled conditions and shifting the same to wastewater to observe the effect of real wastewater. <i>Output:</i> Best algae-bacterial combination and optimized conditions for their growth and survival.
2021	Comparative evaluation of biopolymer production from algae-bacteria consortia in controlled nutrient media and real wastewater environment. Biopolymer production and characterization will be done with the help of Prof. Regina's Group. <i>Output:</i> Optimized conditions for maximum output of biopolymer production.
2022	Designing and Development of set up for wastewater treatment using algae-bacteria consortia. <i>Output:</i> In house developed Bioreactor and scientific publication from IIT Indore and LUH.

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## Sustainability Factors

1. Scientific papers will be prepared with the project results.
2. A project proposal will be developed based on the results of both institutions. Possible financing entities already identified include BMBF (Bundesministerium für Bildung und Forschung) and IGSTC (Indo-German Science and Technology Centre).