



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Microalgal wastewater treatment, enhanced biomass productivity, and biofuel conversion under a biorefinery approach**

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SHORT ABSTRACT

In view of globalization and energy consumption, an economic and sustainable biorefinery model is essential to address energy security and climate change. Recently, biofuel production from microalgae under the biorefinery approach had gained wide attention. However, the economic viability of the process at its current state is not considered sustainable. In this context, the present study aimed to develop a sustainable biorefinery model that includes producing microalgal biomass using wastewater, converting biomass to biofuel via chemical and thermochemical processes, and valorizing waste to produce co-products. In the present study, eight native microalgal strains were isolated from domestic sewage wastewater and its screening study showed that *Monoraphidium* sp. KMC4 had superior biomass (1.47 ± 0.08 g L⁻¹) and lipid (436 ± 0.06 mg L⁻¹) yield followed by 88-100% removal of ammonia, nitrate, phosphate, and COD. The process optimization had significantly enhanced biomass yield to 2.49 g L⁻¹, 3.62 g L⁻¹ and 6.14 g L⁻¹ in batch, fed-batch and semi-continuous mode of growth study in the photobioreactor. The harvested biomass was further processed for biofuel productions such as biodiesel (FAME) and biocrude. The biocrude production via co-hydrothermal liquefaction (Co-HTL) process used domestic sewage sludge as a co-feedstock. The optimized Co-HTL had resulted in a 39.38 wt% biocrude yield that had 10.13% of heavy naphtha, 23.92% of kerosene, and 27.09% of gas oil fractions. In addition, the present study also valorized solid residues and liquid effluents for the production of value-added products under a circular bioeconomy based biorefinery model.