



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : YASHAVANTH P R

Roll Number : 166106021

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Thesis Title: Production and recovery of Polyhydroxybutyrate (PHB), biodegradable plastic from cyanobacteria under photoautotrophic conditions

Name of Thesis Supervisor(s) : Dr. Soumen Kumar Maiti

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SHORT ABSTRACT

The current study investigates the single-stage cultivation of *Chlorogloea fritschii* TISTR 8527 with phototrophic CO₂ assimilation and polyhydroxybutyrate (PHB) production using acetate as an inducer under dark. The study focuses on the improvement of PHB production in photobioreactor under diurnal light mimic to sunlight. Initially the effect of constant and diurnal light on growth of *C. fritschii* and effect of nitrate under diurnal light on PHB production have been explored. Also, the optimum level of acetate inducer has been decided based on experiments. A phosphate and nitrate feeding strategy has been used to improve the PHB production using single-stage cultivation. NaNO₃, K₂HPO₄, TRACE (micronutrient solution), Na₂EDTA, and MgSO₄·7H₂O were screened as important media compositions. The multi-objective media optimization based on desirability approach with response surface methodology (RSM) was performed to simultaneously enhance the dry cell weight (DCW, g/L), PHB (% w/w) and auto-sedimentation concentration factor (SCF) in single stage cultivation under diurnal light to reduce the process cost. This is the first multi-objective optimization study for media optimization using cyanobacteria reported till now under diurnal light mimic to sunlight for bioplastic production. The effect of CO₂ supply and multiple additions of acetate inducer on growth, PHB accumulation and SCF were also studied under diurnal simulated sunlight with optimized medium in flat panel photobioreactor (PBR). PHB extraction from cyanobacteria increases production cost since PHB is an intracellular product and must be purified in various steps. The intracellular PHB was recovered with various methods utilizing pretreatment of biomass with hypochlorite or methanol along with solvent extraction by halogenated and green solvents. PHB recovered from *C. fritschii* using green solvent dimethyl carbonate (DMC) has improved thermal and material characteristics compared to PHB recovered using dispersion. Characterization of recovered PHB suggested that *C. fritschii* can accumulate biopolymer similar to commercial PHB.