INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Phenol is a xenobiotic released in wastewaters of industries as coal industries, phenol manufacturing, pharmaceuticals, dying, petrochemicals, pulp mill etc. Owing to high ecological toxicity risks of phenol, it is considered a priority pollutant requiring efficient phenol removal technologies. Biological treatment of phenol has gained wide interest owing to its advantages of complete phenol mineralization and cost effectiveness. Phenol degradation capabilities of bacteria and fungi have been profoundly studied compared to that in algae. Out of the six microalgal isolates (05 isolated and 1 obtained from NCIM, Pune), *C.pyrenoidosa* and diatom BD1IITG showed significant capability for phenol degradation showing prospective application for phenol remediation. Owing to the complete phenol degradation ability of *C.pyrenoidosa*, the strain was used to develop an efficient phenol degradation process that could remediate phenol concentration in the range of 50-1200 mg/l within a short time period. The spent biomass after phenol degradation showed prominent enhancement in total lipid and neutral lipid productivity suggesting exciting possibility to be used as biodiesel feedstock. The algae could completely degrade 10 mg/l and 250 mg/l phenol in petroleum refinery wastewater with high growth kinetic parameters adding to practical applicability of the process. High lipid as well as neutral lipid productivities obtained in spent biomass after treatment of phenol containing refinery wastewater qualifies the process as a source of algal biodiesel feedstock. The lipid extracted biomass from *C.pyrenoidosa* was used as substrate for bioethanol fermentation further enhancing its economic feasibility for biofuel applications. The complete pathway of phenol degradation in *Chlorella pyrenoidosa* and diatom BD1IITG was elucidated using HPLC, LC-MS and UV-Visible spectrophotometry. Phenol hydroxylase is the first enzyme in the phenol degradation pathway and has been purified and characterized. The enzyme owing to its broad substrate specificity and storage stability could find potential application in enzyme based phenol remediation technology or phenolic biosensor.