INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Water hyacinth is considered to be the world's worst aquatic due to its phenomenal reproduction potential. It can grow within a week and cover an entire freshwater body by forming thick dense mats. These thick dense mats hamper the aquatic ecosystem alongwith the health, livelihood and recreation of human beings. Water hyacinth is difficult to manage as it can re-grow miraculously even if it is completely eradicated. Presence of cellulose and its availability in abundance makes water hyacinth an attractive feedstock for biogas production through anaerobic digestion. Biogas production from water hyacinth can effectively manage the aquatic weed as well as mitigate environmental pollution which is caused by burning of fossil fuel. But the presence of lignin in water hyacinth makes hydrolysis the bottleneck of anaerobic digestion thereby delaying the hydrolysis phase and producing decreased amount of biogas. Therefore pretreatment of water hyacinth is essential for accelerated hydrolysis period and enhanced biogas production. In this study, thermal, electrohydrolysis and biological (microbial) pretreatment were investigated to enhance solubilisation of water hyacinth. Hot air oven pretreatment of water hyacinth at 90ºC for 1h demonstrated the highest solubilisation and biogas production when compared to the other pretreatment techniques. Even mono-digestion of water hyacinth produces lesser amount of biogas therefore co-digestion of water hyacinth is essential to balance the nutrients and dilute the toxic inhibitors. During the BMP assay F/M ratio 2 was observed to be ideal for untreated water hyacinth whereas for the pretreated water hyacinth F/M ratio 1.5 was observed to be ideal. Co-digestion of water hyacinth was tried not only with cow dung as inoculum but also with other organic wastes (i.e., food waste, *Hydrilla verticillata*, banana peels) with and without pretreatment. Pretreatment and anaerobic co-digestion of water hyacinth not only enhanced the quantity of biogas production but also the quality of the produced biogas by increasing the percentage of methane content. At last, a novel anaerobic digester was designed, fabricated and operated in continuous mode. The novel anaerobic digester proved its immense prospective in treating water hyacinth in untreated, pretreated or co-digested form. The design of the novel anaerobic digester is proficient in minimising the cost, difficulty in operation and manages space constraint when compared to the traditional two stage anaerobic digesters with mixing operation.