INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Biochemical Evaluation of Landfill Leachate and Gas Generation Dynamics Followed by Treatment Under Actual Landfill Conditions**

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SHORT ABSTRACT

Landfilling is a common way of disposing of municipal solid waste (MSW). Poor waste management techniques in developing countries like India are the main cause of environmental concerns like groundwater, surface water, and air pollution. As a result, this research focuses on the biochemical assessment of leachate and gas *dynamics within landfill simulation reactor* (no inoculum addition, no recirculation of leachate). The combined *process for removing contaminants from fresh landfill leachate combining physico-chemical and biological treatment approaches was studied.* **Phase-1:** This study compared the environmental impacts of several waste treatment technologies and their life cycle costs in order to promote the best waste management solution for Guwahati. A sanitary landfill with gas utilization replaces an open dumpsite and windrow with efficient manual sorting + windrow composting + sanitary landfill with gas utilization. Waste treatment without reduction is feasible in developing countries. **Phase-II:** The research aims to analyze the anaerobic degradation of mixed solid waste in fresh municipal solid waste landfills and the seasonal fluctuation in solid waste stabilization rates. Fabrication of a 1mx1mx1.1m laboratory-scale landfill simulation reactor (length, width, and height, respectively). Reactor 1 (R1) had a high amount of wet waste (73%) and dry (27%), while reactor 2 (R2) had a high amount of dry (62%) and wet (38%) waste. Reactor 3 (R3), operated at 50 years at a weighted average actual rainfall rate of 73 percent wet waste and dry waste (27%). Monitoring of leachate from the simulated reactors was done once a week, and gas was done twice a week during operating phases. The exponential model was developed using simulated landfill leachate data to predict the future trends of landfill leachate pollution with time. Conclusion drawn from this study "low leaching actions during dry season resulted in a smaller volume but high-strength leachate quality. In addition, the highest degradation of MSW occurred during the rainy season and the lowest degradation of MSW during the dry season due to lack of moisture in the simulated landfill. **Phase-III:** treatment of fresh landfill leachate from the high amount of organic waste contained MSW landfill using combined treatment system, i.e., the coagulation-flocculation process (pretreatment) followed by an upflow anaerobic filter under conventional way and evaluation of the treatment performance based on removal efficiency of organic pollutants. The maximum removal efficiency of COD of landfill leachate (78%) was obtained in 50% (v/v) of digested cow dung (DCD) digester. Therefore, this microbial seeding was found to have potential low cost applications in leachate treatment with high COD. This entire research outcome provides useful information for the design and management of landfill leachate for the realistic prediction of future trends.