Microbial Reaction Kinetics for Correlating First Phase Anaerobic Reactions in Laboratory and Pilot Scale Digesters

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Abstract

Sustainable management of solid waste should be the basis for research in a system that could combine anaerobic and aerobic digestion processes. Three laboratory scale solid-state anaerobic reactors made of PVC pipe of 200 mm diameter with a volume of 32 liters was used for the experiments. These results were compared with 500-liter pilot scale anaerobic digesters.

The results showed that optimising the process conditions in the first phase of anaerobic digestion could be achieved using logistical growth kinetics to compare laboratory level experiments with that of pilot scale plants. The downward movement of elute with stabilization of 7-7.5 days and subsequent feeding at 3-day intervals at maximum substrate utilization rate was optimum for continuous operations of the first phase. In batch operations, the daily extraction of elutes as opposed to 7^{th} day extraction increased soluble COD stripping and reduced the percentage of ammonia production with higher level of TKN removed from wastes. Higher frequency of re-circulation increased enzyme and microbial activities. These relationships indicated the optimum densities that would be suitable for landfill bioreactor applications and would provide the basis of a scientific explanation for differences in performance between slurry and solid phase reactions.

Keywords: *Anaerobic reactors, digestion, municipal solid waste, hydrolysis, landfill bioreactor*

1. Introduction

Most developing countries are searching for an integrated approach to solve the growing problems of managing Municipal Solid Wastes (MSW) where as Asian counties are