

Landfill Leachate Treatment by Yeast and Bacteria based Membrane Bioreactors

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ABSTRACT

Biological treatment of medium-age landfill leachate was investigated on a membrane bioreactor. The experiments were conducted in two 5-liter reactors with immersed hollow fiber microfiltration membranes. One reactor was operated with a mixed bacterial culture termed as bacteria based membrane bioreactor (BMBR) while the other with mixed yeast culture termed as yeast based membrane bioreactor (YMBR).

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The leachate was characterized with a chemical oxygen demand (COD) concentration of 7,000-9,000 mg/l, biochemical oxygen demand (5 days) to chemical oxygen demand ratio (BOD_5/COD) of 0.35-0.45 and total Kjeldahl nitrogen (TKN) of 1,800-2,000 mg/l. The performance was assessed with and without ammonia stripping. In both the reactors, the average COD and TKN removal efficiency without ammonia stripping ranged between 52-66% and 14-28 %, respectively. The performance of both the membrane bioreactors improved with ammonia stripping in terms of both COD (72-76%) and TKN (82-89%) removal efficiency. Though, the difference in the performance of the BMBR and YMBR was not significant in terms of COD removal, the YMBR showed better removal efficiency in terms of BOD_5 . The molecular weight cut-off showed that the degradation pathway of the leachate by bacterial and yeast are different. In regard to membrane fouling, the YMBR showed better performance with lower trans-membrane pressure as well as longer operating time. This superior performance of the YMBR could be due to the structure of yeast cells which are larger in size as well as reduced soluble extracellular polymeric substances (EPS) production, which are the main cause of membrane biofouling.

Key Words: Landfill leachate; Biological treatment; Yeast; Membrane bioreactor; Extracellular polymer substance; Molecular weight cut-off; Ammonia stripping.

INTRODUCTION