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Title

Laboratory investigation of the aerobic biodegradation of municipal landfill materials

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Abstract

Municipal solid waste (MSW) landfills are rapidly becoming a drain on the resources of local municipalities as the requirements for stabilization and containment become increasingly stringent. EPA guidelines for landfills include complete containment of the MSW mass with liners, covers, leachate collection/treatment systems and landfill gas collection/treatment systems. Consequently landfill costs have more than doubled in the last 15 years. This study compares the use of aerobic and anaerobic management strategies and their potential advantages. Three 200-liter tanks filled with fresh waste materials were used to provide the following conditions: (a) aerobic (air injection with leachate recirculation), (b) anaerobic (leachate recirculation), and (c) a dry-tomb anaerobic landfill (no air injection, no water addition and no leachate recirculation). The moisture content in the aerobic and anaerobic tanks averaged 17% and the dry-tomb tank averaged 1%. Leachate from the aerobic tank had significantly lower concentrations of all potential contaminants, both organic and metal. Indeed the overall concentrations in the aerobic tank leachate were an order of magnitude lower after only a few weeks of operation. Respiration tests on the aerobic tank showed a steady decrease in oxygen consumption rates from 1.3 mol/day at 20 days to 0.1 mol/day at 300 days. Over the test period, the aerobic tank settled 35%, the anaerobic tank 21.7% and the dry-tomb tank 7.5%. The aerobic tank produced negligible odor compared to the anaerobic tanks. These results suggest that aerobic management of MSW landfills could increase the rate of stabilization, produce less potent greenhouse gases, eliminate the need for leachate and air emissions treatment systems, reduce odor, and reduce the need for extensive containment strategies.