Landfills as Energy Bioreactors: Testing a Leachate Recirculation Technique for Optimization of Methane Recovery

Amarante, Trevor (School: Fowler High School)

Bioreactors are landfills that aim to accelerate the process of waste decomposition through the recirculation of leachate in order to produce higher concentrations of methane. Methane can be used as an alternative energy source by increasing methanogenic microbial populations. The aim of this experiment was to determine if the establishment of bioreactor conditions increased methanogenic populations when compared to a standard landfill environment, which would in turn, increase the amounts of methane produced with the potential for energy production. The experiment was carried out through two types of systems built to simulate the standard landfill (without leachate recirculation) and bioreactor environments. Each system maintained pressure and contained all gases produced for accurate measurements. Measurements were taken using the same device currently used in landfills, a GEM 2000 (Gas Emissions Monitor), which measures the gas concentrations of carbon dioxide, oxygen, methane, and a balance by siphoning out the gases, acting as the disposal method of hazardous gases. The results provided sufficient evidence showing the recirculation of leachate increased decomposition rates. The system simulating a standard landfill had a 23.05% concentration of gasses related to methanogenic decomposition while the system simulating bioreactor conditions had a concentration of 29.20%. Within this, there was a 0.8% higher concentration of methane in the bioreactor system than in the standard landfill system. Through the recirculation of leachate and the establishment of bioreactor conditions, landfills could accelerate waste decomposition and be a viable source of energy due to the increased production of methane.

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