Similtude in Bioreactor Landfill Research: Sizing of Refuse for Laboratory Studies

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Preferential flow in landfills affects the success of *in situ* biological treatment of the refuse because microorganisms are transported by the flow of leachate and degradation can occur only when the moisture content of the refuse exceeds 40% ($^{m}/_{m}$). One cause of preferential flow in landfills is the spatial heterogeneity of the waste. During laboratory-scale studies of waste, refuse is usually shredded to a uniform size (e.g., 2 inch minus) before use. This has the effect of homogenizing the spatial composition of the waste within the laboratory reactor and reducing the incidence of preferential flow through the refuse. To create laboratory bioreactors that more accurately represent full-scale landfills, it may be necessary to decrease the size of all refuse components by the same percentage. This reduction may be based on the ratio between the volume of the laboratory landfill and the volume of the full-scale landfill. One method of determining the method of scaling is to use the theory of similitude, which includes similarity and dimensional analysis. The ideal scaling method would maintain the spatial heterogeneity of the landfill system in small-scale experiments. In this preliminary study, a LMS 200 Laser Sensor mounted on an overhead rail was calibrated using objects of a known size. Some initial sizing studies (surface area and volume) on refuse components from standardized refuse are reported. The goal of this ongoing research is to develop a shredding protocol to create standardized refuse for laboratory studies that most accurately represents the refuse emplaced in landfills in terms of the spatial heterogeneity of the waste.