УСТОЙЧИВО УПРАВЛЕНИЕ НА ИНФРАСТРУКТУРАТА: ВЪЗСТАНОВЯВАНЕ НА РЕСУРСИТЕ И ПОВТОРНО ИЗПОЛЗВАНЕ В ДЕПАТА

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SUSTAINABLE INFRASTRUCTURE MANAGEMENT: RESOURCE RECOVERY AND REUSE IN LANDFILLS

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Abstract:
We generate millions of tons of solid and liquid waste every day. This waste is rich in water, nutrients and organic compounds. Resource recovery is the selective extraction of disposed materials for reuse, which reduces the consumption of virgin resources. The current sustainable waste management is based on a hierarchy of three principles: waste prevention, recycling/reuse/treatment, and final disposal. Final disposal in landfills is the least desirable as the landfill, if not managed appropriately, may release massive pollutants to the environment. The emission of methane to the atmosphere is an important source of greenhouse gasses (GHGs). To realize the resource value in waste, the focus is shifting from treatment for waste disposal to treatment of waste for resources recovery and reuse. Viable commercial approaches to resource recovery and reuse are emerging around the globe, with many of them being innovative approaches: through sludge reuse, wastewater irrigation and recycling, solid waste composting or energy generation (methane) through bioreactor landfills. For example, a number of studies on municipal solid waste (MSW) have indicated that source separation followed by reuse and recycling of the liquid (leachate) can generate energy (methane) in bioreactor landfills through efficient solid waste decomposition and landfill gas (LFG) collection.
The bioreactor landfill simultaneously degrades the waste and generates LFG (a renewable energy) with a much faster rate, and thus, can shorten the landfill process to less than ten years, rather than 30 or more years in the conventional "dry tomb" landfill. In a bioreactor landfill, liquids (leachate + stormwater or wastewater if needed) are added to the landfill through vertical wells, horizontal pipes, or trenches. The liquids can stimulate naturally occurring microorganisms (either aerobic or anaerobic) by maintaining optimal moisture conditions at or near field capacity (at ~34–65%), and thus, promote the accelerated decomposition. Thus, a bioreactor landfill has several potential advantages: reduced leachate disposal costs; increased waste decomposition and settlement that results in gain in landfill space due to an increase in density of waste mass; and finally, significant increase in LFG production due to accelerated decomposition.

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The bioreactor landfill changes the goal of landfilling from the storage of waste to resources recovery and reuse. This presentation reviews the status and future trends in sustainable development of bioreactor landfill technology and infrastructure management. Technical challenges and research needs remain related to sustainability, liquid addition, leachate hydrodynamics, leachate quality, the addition of air, and cost analysis. Research on and the improvements of these techniques are the future trend in sustainable infrastructure management and development of landfill technology through resource recovery and reuse.

Keywords:
Bioreactor Landfill, Resource Recovery, Reuse.