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Commentary

Landfill Gas Waste Utilization through Leachate Recirculation and Mitigation

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DESCRIPTION

The gas produced by landfill waste is mainly landfill gas, which is a mix of different gases created by the action of microorganisms within a landfill as they decompose organic waste. Landfill gas is approximately forty to sixty percent methane and mostly carbon dioxide for the remainder. Trace amounts of other Volatile Organic Compounds (VOCs) and Non-Methane Organic Compounds (NMOCs) comprise the remainder (<1%). Recent years have seen an increase in interest in the study of trace gas emissions from municipal solid waste landfills. 1% or less of the landfill gas contains a collection of substances known as "trace gases," which have the potential to significantly harm the environment and human health. Organic sulphide compounds, oxygenated compounds, aromatics, aliphatic hydrocarbons, and hydrogen sulphide are a few examples of prevalent trace gases. Trace gases can be created by the breakdown of waste, the direct chemical volatilization found in waste items, or chemical conversions or reactions. The various stages of garbage degradation are dominated by different chemical groups. Trace gas emissions from landfills can be sampled, analyzed, and measured using a variety of techniques, each of which may have advantages and disadvantages.

The concentrations of trace gases and their surface emission rates vary largely from site to site, and fresh waste dumping areas and uncovered waste surfaces are the most important fugitive emission sources. The adverse effects of trace gas emission are not fully understood, and more emission data are required in future studies to assess quantitatively their environmental impacts as well as health risks. Boosting of landfill gas waste production is a process of enhancing the generation of Landfill Gas (LFG) from Municipal Solid Waste (MSW) landfills. LFG is a natural byproduct of the decomposition of organic material in landfills, and it is composed of roughly 50 percent methane and 50 percent carbon dioxide, with a small amount of non-methane organic compounds. Methane is a valuable energy resource that can be converted into fuels, electricity or used for heating homes. Boosting of landfill gas waste production can be achieved by manipulating the environmental conditions that affect the microbial activity in landfills, such as moisture content, temperature and pH. Some methods for boosting LFG production include adding water or leachate to increase the moisture content and accelerate the anaerobic digestion of organic waste. Heating the landfill or recycling the exhaust gas from LFG combustion to increase the temperature and stimulate bacterial activity. Adding alkaline materials or biodegradable organic waste to increase the pH and buffer the acidity produced by organic acids. Injecting air or oxygen to create aerobic zones that enhance the degradation of recalcitrant organic compounds and increase the availability of substrates for methanogens. Boosting of landfill gas waste production can have several benefits, such as increasing the LFG recovery rate, reducing the greenhouse gas emissions from landfills, extending the lifespan of landfills and generating more revenue from LFG utilization. However, it may also pose some challenges, such as increasing the operational costs, requiring more monitoring and control systems, and affecting the stability and settlement of landfills. Waste leachate recirculation in landfill gas can increase the moisture content and temperature of the waste mass, which can improve the microbial activity and biodegradation rate. This can accelerate the waste degradation and stabilization process, which can increase the landfill gas production and recovery.

CONCLUSION

Waste leachate recirculation is different from bioreactor landfills, which involve adding fresh water or treated leachate to flush out soluble contaminants in the waste. Waste leachate recirculation does not aim to achieve flushing, but rather to enhance the anaerobic digestion of organic waste. Leachate recirculation can also reduce the volume and strength of leachate that needs to be treated or disposed offsite, which can save costs and environmental impacts.

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