Anaerobic Digestion of Food Waste

ENVE 737

Anaerobic Biotechnology for Bioenergy Production

Food Waste Digestion - Videos

Energy from Anaerobic Digestion in Ludlow, UK

- http://www.youtube.com/watch?v=ND9QoDS4ScY

Turning Food Waste into Biogas - India

- http://www.youtube.com/watch?NR=1&v=JwE9qIpTY-E

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Improvement of fruit and vegetable waste anaerobic digestion performance and stability with co-substrates addition

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ABSTRACT

The effect of fish waste (FW), abattoir wastewater (AW) and waste activated sludge (WAS) addition as co-substrates on the fruit and vegetable waste (FVW) anaerobic digestion performance was investigated under mesophilic conditions using four anaerobic sequencing batch reactors (ASBR) with the aim of finding the better co-substrate for the enhanced performance of co-digestion. The reactors were operated at an organic loading rate of 2.46–2.51 g volatile solids (VS) l^{-1} d^{-1}, of which approximately 90% were from FVW, and a hydraulic retention time of 10 days. It was observed that AW and WAS additions with a ratio of 10% VS enhanced biogas yield by 51.5% and 43.8% and total volatile solids removal by 10% and 11.7%, respectively. However FW addition led to improvement of the process stability, as indicated by the low VFAs/Alkalinity ratio of 0.28, and permitted anaerobic digestion of FVW without chemical alkali addition. Despite a considerable decrease in the C/N ratio from 34.2 to 27.6, the addition of FW slightly improved the gas production yield (8.1%) compared to anaerobic digestion of FVW alone. A C/N ratio between 22 and 25 seemed to be better for anaerobic co-digestion of FVW with its co-substrates. The most significant factor for enhanced FVW digestion performance was the improved organic nitrogen content provided by the additional wastes. Consequently, the occurrence of an imbalance between the different groups of anaerobic bacteria which may take place in unstable anaerobic digestion of FVW could be prevented.

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Full-scale anaerobic co-digestion of organic waste and municipal sludge

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ABSTRACT

A full-scale experiment on the anaerobic co-digestion of organic waste from domestic refuse (swill) and municipal sludge is described. In a wastewater treatment plant of 50,000 population equivalents, two conventional mesophilic digesters with a combined volume of 2000 m^3 and 20 days hydraulic retention time were used. The digesters' usual influent is waste sludge from wastewater treatment plants (a mixture of primary sludge and waste activated sludge) with an average organic loading rate of 0.8 $kg\,m^{-3}\,d^{-1}$ of volatile suspended solids. In the experiment, organic waste was added to the digester influent to increase the organic loading rate by 25% to 1.0 $kg\,m^3\,d^{-1}$ of volatile suspended solids. Biogas quantity increased by 80% and specific biogas production increased from 0.39 $m^3\,kg^{-1}$ volatile suspended solids inserted prior to the experiment to over 0.60 $m^3\,kg^{-1}$ volatile suspended solids' inserted, peaking at 0.89 $m^3\,kg^{-1}$ volatile suspended solids inserted. The excess biogas was used in a boiler and a 50 kW combined heat and power engine. Electrical energy production increased by 130% and heat production increased by 55%. Volatile suspended solids degradation efficiency increased from 71% to 81% with no increase of volatile suspended solids in the digester effluent. Virtually all of the organic waste was degraded.

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Review

The anaerobic digestion of solid organic waste

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ABSTRACT

The accumulation of solid organic waste is thought to be reaching critical levels in almost all regions of the world. These organic wastes require to be managed in a sustainable way to avoid depletion of natural resources, minimize risk to human health, reduce environmental burdens and maintain an overall balance in the ecosystem. A number of methods are currently applied to the treatment and management of solid organic waste. This review focuses on the process of anaerobic digestion which is considered to be one of the most viable options for recycling the organic fraction of solid waste. This manuscript provides a broad overview of the digestibility and energy production (biogas) yield of a range of substrates and the digester configurations that achieve these yields. The involvement of a diverse array of microorganisms and effects of co-substrates and environmental factors on the efficiency of the process has been comprehensively addressed. The recent literature indicates that anaerobic digestion could be an appealing option for converting raw solid organic wastes into useful products such as biogas and other energy-rich compounds, which may play a critical role in meeting the world's ever-increasing energy requirements in the future.

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Optimization of food waste hydrolysis in leach bed coupled with methanogenic reactor: Effect of pH and bulking agent

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ABSTRACT

The effects of pH and bulking agents on hydrolysis/acidogenesis of food waste were studied using leach bed reactor (LBR) coupled with methanogenic up-flow anaerobic sludge blanket (UASB) reactor. The hydrolysis rate under regulated pH (6.0) was studied and compared with unregulated one during initial experiment. Then, the efficacies of five different bulking agents, *i.e.* plastic full particles, plastic hollow sphere, bottom ash, wood chip and saw dust were experimented under the regulated pH condition. Leachate recirculation with 50% water replacement was practiced throughout the experiment. Results proved that the daily leachate recirculation with pH control (6.0) accelerated the hydrolysis rate (59% higher volatile fatty acids) and methane production (up to 88%) compared to that of control without pH control. Furthermore, bottom ash improved the reactor alkalinity, which internally buffered the system that improved the methane production rate (0.182 l CH_4/g VS_{added}) than other bulking agents.