

Valorization of a Food Residue Biomass product in a two-stage anaerobic digestion system for the production of hythane

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The scope of the present research work was to evaluate the potential of valorizing a biomass product (FORBI, Food Residue Biomass) through a two-stage anaerobic digestion system for the production of hythane (mixture of hydrogen and methane). FORBI is generated through a drying/shredding process of door-to-door source-separated Household Food Waste (HFW).

A fully-automated and remotely controlled lab-scale anaerobic system was used: it consists of a 4 L Continuous Stirred Tank Reactor (CSTR), as a hydrogen producing acidogenic step (dark fermentation) followed by a 40 L CSTR used for production of methane. The acidogenic bioreactor operated at a Hydraulic Retention Time (HRT) of 4 hours, whereas the HRT of the methanogenic bioreactor was 20 days. During the whole process no pH adjustment was required.

During the operation, parameters of pH, alkalinity, Total Suspended Solids, Volatile Suspended Solids, total Chemical Oxygen Demands, soluble Chemical Oxygen Demand Volatile Fatty Acids, hydrogen and methane productivity, as well as hydrogen and methane content in the two biogas streams were continuously monitored.

Preliminary results were promising in terms of biogas productivity (1L/L_{bioreactor}/day hydrogen and 1.3L/L_{bioreactor}/day methane) and biogas content (40-45% hydrogen from the first reactor and 55-60 % methane from the second). A proper mixing of the first biogas stream with part of the biogas stream generated from the second reactor, followed by biogas upgrading (CO₂ removal) secures the desired proportion (typically 15:85) of hydrogen and methane for the generation of hythane, while the rest of the biogas from the second reactor can be used as methane biogas.

Keywords: hythane, household food waste valorization, FORBI, two-stage anaerobic system

References

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