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Bioproducts from anaerobic co-digestion of organic fraction of municipal solid waste: substrate mixing ratios for power, heat and digestate potential assessment as support for scale-up

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ABSTRACT

This research investigated the use of food waste - FW and garden waste - GW as substrates for producing thermic and electric energy on a lab bioreactor. A mesophilic continuous stirred-tank reactor (CSTR) was used to support the operational planning of a pilot-scale Plant, consisting in digesters of 430 m³. The bioreactor was operated during 284 days under organic loading rates from 1.4 to 3.9 kg VS/m³. d and using different FW:GW ratios to simulate cities routine. The operation of the CSTR showed pH stability, high efficiency of solids removal (74.8 to 97.3%), and a maximum methane yield of 0.51 L CH₄/gVS. Considering the most efficient scenario, it was calculated an electric and thermic energy potential of 183 kWh_e and 554 kWh_t per ton of fresh matter. Regarding to the energy yield, up to 18.5 kJ/g VS was estimated. The composite sample of the digestate revealed nitrogen, sodium and potassium as major compounds (1530, 1350, and 1300 mg/L, respectively), and heavy metals under safe limits. As future scope, the presented energy simulations through methane-based energy production system may serve as a boosting step for Biogas Plants, providing valuable references for real scale applications from different proportions of organic urban residues.