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Co-digestion of food waste and domestic wastewater: Effect of intermittent feeding strategy on long and short chain fatty acids accumulation

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mixture of food waste and domestic wastewater was treated through anaerobic digestion using upflow anaerobic sludge blanket $A_{(UASB)}$ reactor to generate renewable energy as biogas (methane). The reactor was operated under the conditions of mesophilic temperature (35°C), pH 6.5 (controlled by the addition of 3,500 mg/L calcium carbonate) and 10 days of hydraulic retention time (HRT). The sludge maturation and granulation process was achieved in 40 days with a stable biogas production (0.71 L/day) with methane content and yield of 54% and 0.214 L CH₄/g COD removed, respectively. When the reactor was fed continuously with a mixed wastewater at the organic loading rate of 2 g COD/L/day, the chemical oxygen demand (COD) removal efficiency and the methane content were 80% and 56%, respectively, within 2 days of the reactor operation. The methane content, however, dropped to 37% due to the accumulation of long chain fatty acids (LCFAs), subsequently promoting the sludge wash out and inhibiting the methanogenic activity. To overcome the physical and metabolic inhibition by LCFAs, the application of intermittent feeding mode (48 hours feed and 48 hours feedless) was chosen and applied at different organic loading rates (2, 3 and 4.5 g COD/L/d) to evaluate the reactor performance in terms of COD removal, methane content, accumulation of LCFAs and short chain fatty acids (SCFAs). The COD removal and the methane content were $82\pm1.1\%$, $75\pm0.9\%$ and $62\pm1.5\%$; 58%, 56% and 51% for the OLRs at 2, 3 and 4.5 g COD/L/d, respectively. The LCFAs accumulation decreased considerably at the intermittent feeding (82, 97 and 120 mg/L at OLR 2, 3, 4.5 g COD/L/d) compared to the continuous mode (488 mg/L). The total concentration of SCFAs accumulated in the reactor at the continuous mode was 1,377 mg/L but decreased significantly when the intermittent mode (677 mg/L) was applied, especially in case of propionate.

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