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Optimization of anaerobic co-digestion of multiple feedstocks for bioenergy recovery: An empirical model application

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Transition from wastewater treatment facilities as energy consumers to resource recovery facilities with ability to produce energy and value-added products is achievable by optimizing digestion capacity with the existing infrastructure. This study investigated a novel method for optimizing anaerobic digestion of multiple feedstocks for biomethane recovery. A series of experiments were conducted to develop an empirical model for optimizing the mixing ratio based on lipids, proteins and carbohydrates ratios of the feedstocks as compared to carbon to nitrogen (C:N) or COD to nitrogen ratio (COD:N). The selected feedstocks were real municipal wastes including dairy manure; Source Separated Organic (SSO) and Thickened Waste Activated Sludge (TWAS). The experimental data were fitted into the proposed second order polynomial model. The COD:N ratios of TWAS, manure and SSO were 15,47 and 27 respectively. For the co-digesters, COD:N varied from 19 to 40. The lipids:proteins:carbohydrates ratios were 1:10:4, 1:4:20 and 1:1.6:9 for TWAS, manure and SSO respectively. Among them SSO had the most ultimate methane production and methane yield corresponding to 1373 mL and 332 mL CH4/g COD added. The minimum ultimate methane production and the methane yield occurred at TWAS mono digestion corresponding to the COD:N ratio of 15 and lipids: proteins: carbohydrates ratio of 1:10:4. The results indicated that both minimum ultimate methane and minimum methane yield values occurred at TWAS mono digestion corresponding to the COD:N ratio of 15 and lipids:proteins:carbohydrates ratio of 1:10:4. On the other hand, the maximum ultimate methane and methane yields occurred at the mixing ratios of 2:4:4 corresponding to the COD:N ratio of 28 and lipids:proteins:carbohydrates ratio of 1:3:12 in co-digestion of TWAS/manure/SSO.

Biography

Anahita Rabii obtained her PhD in Civil-Environmental Engineering from Toronto Metropolitan University and is focused on waste to energy conversions. Currently her expertise is harnessed with Anaergia Inc. North America, in resource recovery. She and the engineering group at Anaergia Inc. are developing leading industry innovations by taking waste and wastewater treatment technologies to a whole level of energy conversions by anaerobic digestion and co-digestion. She is Chair of Magazine Committee at Water Environment Association of Ontario and is a Sessional Lecturer at George Brown College in Toronto, Ontario, Canada.

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