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Removal of organic matter and nutrients from food waste using a combined two-phase anaerobic digester and granular sequencing batch reactor system

Kyung Mo, Fenghao Cui, Wonbae Lee, Mingyueong Kim, Jihyeon Hwang, Moonil Kim*

Department of Civil & Environmental Engineering, Hanyang University, 55 Hanyangdaehak-ro, Ansan City, Kyeonggido 426-791, Korea, Tel. +82 31 400 5142; Fax: +82 31 502 5142; email: moonilkim@hanyang.ac.kr (M. Kim), Tel. +82 31 400 4096; emails: nambird@hanyang.ac.kr (K. Mo), choibongho@hanyang.ac.kr (F. Cui), iwtllbe100@nate.com (W. Lee), mk4848@naver.com (M. Kim), hjh1017h@naver.com (J. Hwang)

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ABSTRACT

A unique system combining a two-phase anaerobic digester (AD) and a granular sequencing batch reactor (GSBR) was developed to remove organic matter and nutrients (nitrogen and phosphorus) from food waste. The start-up and stabilized performances of the AD were investigated by changing the organic loading rate (OLR). The AD effluent was treated using the GSBR process without using supplemental carbon sources or alkalinity. The combined system was capable of removing approximately 99% of the suspended solids, 99% of the chemical oxygen demand, 84% of the total nitrogen, and 88% of the total phosphorus. In addition, a modeling simulation was employed to estimate the net energy yield potential of the combined system. The simulation demonstrated that the two-phase AD and GSBR design can comprise an energy-producing system upon increasing the OLR to 1.5 kg/m^3/d. Therefore, the combined system can improve the removal of organics and nutrients, while also allowing for significant energy recovery. This study provides a novel approach for the design of a promising system that will improve the stabilization of organic waste.

Keywords: Anaerobic digestion; Aerobic granular sludge; Biogas; Food waste; Net energy yield

* Corresponding author.

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