Investigation of AD-MEC integrated systems for enhanced biogas production from renewable biomass

Rapidly increasing energy demands around the world cause fossil fuel resources to be depleted at an enormous rate. Therefore, researchers all over the world have been working on finding alternative energy sources with minimum impact on the environment. Biogas obtained from anaerobic digestion (AD) is a common sustainable energy source that can be produced from various types of industrial and agricultural biomass. Biogas typically contains %60-70 methane and %30-40 carbon dioxide and its high methane content makes the biogas a useful fuel that can be converted to electricity and used for heating purposes. In addition to the conventional waste to energy systems, bio electrochemical systems (BES) are newly discovered technology including different processes used for energy production from organic wastes. Methane production in BESs can be achieved by development of electroactive methanogenic biofilm on the cathode of microbial electrolysis cells (MECs) with the addition of a small amount of external voltage. In the literature, there is a limited number of studies, which investigates the integration of AD and MEC systems for enhanced biogas production from real wastes. This study aims to enhance methane production from cattle manure (CM) and wastewater biosolids (WBS) in the AD-MEC integrated reactor system by investigating the impact of external voltage addition. For this purpose, in the experimental design, three different voltages and different substrate mixing ratios of WBS and CM were used in single chamber AD-MEC reactors. The set consisted of AD-MEC reactors with different CM to WBS mixing ratios of 100:0, 30:70, 70:30 and 0:100. Reactors were operated in duplicate under mesophilic conditions (35^{o}C) with no mixing, and current production was monitored continuously during incubation. Preliminary experimental results indicated that AD-MEC integration is more advantageous for CM digestion in comparison to WBS.

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