**Title: Promoting anaerobic digestion technology by struvite precipitation and anaerobic digester - microbial electrolysis cell (AD-MEC) system**

**Abstract:**
Anaerobic digestion (AD) is a renewable technology that generates biogas (methane and carbon dioxide) from organic waste and wastewater. AD is a process known over 100 years and can be considered both economically and environmentally feasible since it allows clean energy production from organic wastes. However, even so, AD has several drawbacks such as long start-up and hydraulic retention times, poor organic conversion efficiency, unstable performance, high nutrient content in the effluent, and scale formation on the equipment and post-digestion systems. This thesis will investigate two emerging processes for promoting long-established AD technology and making it more feasible and applicable: the first focuses on post-treatment and the second focuses on re-configuration. As per the post-treatment process, we have selected struvite precipitation for the management of nutrients from the effluent stream of anaerobic digesters. The process of struvite precipitation provides both removal and recovery of nutrients with a simple operation. Recovered struvite can be used as high-quality fertilizer, adsorbent, and building material. Precipitation occurs in the presence of equimolar magnesium, ammonium, and phosphate ions under appropriate pH and supersaturation. Since magnesium and phosphate are generally less abundant than ammonium species in biogas plant effluents, these ions have been added externally. Commonly, pure chemicals have been used for this purpose, increasing the cost of the process. Hence, here we investigated the potential of using low-cost materials instead of pure chemicals as P and Mg sources to recover nutrients in the form of struvite. As per the re-configuration of AD, we have focused our efforts on integrating AD with an emerging bioelectrochemical reactor known as microbial electrolysis cell (MEC). Several studies showed that methane production yield, process kinetics, and stability were enhanced with AD-MEC integration. Even so, there are a very limited number of studies focusing on the best start-up strategy of AD-MEC systems. Hence, our efforts are directed on determining the best start-up strategy of AD-MEC systems, and we compare two strategies: (i) start-up by introducing bioelectrodes into AD-MEC system, (ii) start-up by directly placing bare electrodes (without biofilm) into the AD-MEC system.

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