Treating anaerobic effluents using forward osmosis for combined water purification and biogas production

Forward osmosis (FO) can be used to reclaim nutrients and high-quality water from wastewater streams. This could potentially contribute towards relieving global water scarcity. Here we investigated the feasibility of extracting water from four real and four synthetic anaerobically digested effluents, using FO membranes. The goal of this study was to 1) evaluate FO membrane performance in terms of water flux and nutrient rejection 2) examine the methane yield that can be achieved and 3) analyse FO membrane fouling. Out of the four tested real anaerobically digested effluents, swine manure and potato starch wastewater achieved the highest combined average FO water flux (>3 liter per square meter per hour (LMH) with 0.66 M MgCl2 as initial draw solution concentration) and methane yield (>300 mL CH4 per gram of organic waste expressed as volatile solids (VS)). Rejection of total ammonia nitrogen (TAN), total Kjeldahl nitrogen (TKN) and total phosphorous (TP) was high (up to 96.95%, 95.87% and 99.83%, respectively), resulting in low nutrient concentrations in the recovered water. Membrane autopsy revealed presence of organic and biological fouling on the FO membrane. However, no direct correlation between feed properties and methane yield and fouling potential was found, indicating that there is no inherent trade-off between high water flux and high methane production.

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