World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:11, No:06, 2017

Performance of an Anaerobic Osmotic Membrane Bioreactor Hybrid System for Wastewater Treatment and Phosphorus Recovery

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Abstract : The submerged anaerobic osmotic membrane bioreactor (AnOMBR) integrated with periodic microfiltration (MF) extraction for simultaneous phosphorus and clean water recovery from wastewater was evaluated. A laboratory-scale AnOMBR used cellulose triacetate (CTA) membranes with effective membrane area of 130 cm^2 was fully submerged into a 5 L bioreactor at 30-35 ℃. Active layer was orientated to feed stream for minimizing membrane fouling and scaling. Additionally, a peristaltic pump was used to circulate magnesium sulphate ($MgSO_4$) solution applied as draw solution (DS). Microfiltration membrane periodically extracted about 1 L solution when the TDS reaches to 5 g/L to recover phosphorus and simultaneously control the salt accumulation in the bioreactor. During experiment progress, the average water flux was around 1.6 LMH. The AnOMBR process showed greater than 95% removal of soluble chemical oxygen demand (sCOD), nearly 100% of total phosphorous whereas only partial of ammonia was removed. On the other hand, the average methane production of 0.22 L/g sCOD was obtained. Subsequently, the overall performance demonstrates that a novel submerged AnOMBR system is potential for simultaneous wastewater treatment and resource recovery from wastewater. Therefore, the new concept of this system can be used to replace for the conventional AnMBR in the future.

Keywords : anaerobic treatment, forward osmosis, phosphorus recovery, membrane bioreactor
Conference Title : ICWPC 2017 : International Conference on Water Pollution and Control
Conference Location : Paris, France
Conference Dates : June 25-26, 2017