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Navigating Wastewater Energy Recovery Strategies: A Life Cycle Comparison of Anaerobic Membrane Bioreactor and High Rate Activated Sludge with Anaerobic Digestion

Wednesday, March 20, 2013, 4:00 – 5:00 PM
2315 G.G. Brown Building (North Campus)
The University of Michigan
Refreshments served before and after the seminar

Abstract. Anaerobic membrane bioreactor (AnMBR) and high rate activated sludge with anaerobic digestion (HRAS+AD) are two processes that strive to recover energy in the form of biogas either directly from domestic wastewater (AnMBR) or during sludge digestion (HRAS+AD). Energy balance, life cycle assessment (LCA), and life cycle costing (LCC) methods were applied to compare AnMBR and HRAS+AD at two temperatures, three sludge disposal scenarios, and two wastewater strengths. At 15°C and for medium strength wastewater treatment, AnMBR recovered over 30% more energy in the form of biogas than HRAS+AD but used over 300% more energy, primarily to prevent membrane fouling. In addition, while AnMBR and HRAS+AD had similar life cycle costs, AnMBR had greater environmental impacts in all impact categories. AnMBR global warming impact was dominated by direct emissions of effluent dissolved methane (70% of impact). Despite these results, there is future potential for AnMBR to have greater energy recovery and lower environmental impacts than HRAS+AD provided that energy demands for fouling control are reduced and effluent dissolved methane emissions are mitigated. These findings represent targets for AnMBR research moving forward.