**Get it Twisted: Modeling Helical Flow in a Tubular Membrane for AnMBR**

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Anaerobic membrane bioreactors (AnMBRs) for municipal wastewater have been proven at a lab scale to be an effective treatment option for converting and destroying carbon oxygen demand (COD). The benefits of AnMBRs are twofold; they do not require aeration which makes the operating costs comparatively minimal, and they recover methane which allows them in some cases to operate at a positive net energy.

Membrane fouling in these reactors is still one of the primary concerns in implementing the technology in a full-scale application; fouling is considered more problematic in AnMBRs than in aerobic membrane bioreactors (MBRs). Fouling mitigation is often accomplished by applying shear forces to the membrane surface using crossflow in the form of recirculation or gas bubbling.

This study attempts to quantify the impact of helical flow in a tubular membrane, both on fouling rate and shear applied to the membrane. A lab scale set up was created using two Pentair X-Flow Compact membranes, one with a smooth interior and the other with a helical ridge extruded on the inside of the membrane tube. Both membranes were run in a side-stream configuration connected to a two-liter AnMBR with varying crossflow velocities. Membranes were operated with constant flux, and trans-membrane pressure increase was recorded.

The membranes were also modeled in a computational fluid dynamics program to estimate the shear force applied to the surface of the membranes at each crossflow velocity. Models were created for turbulent flow conditions with crossflow velocities ranging from 0.1-1 m/s.

The first goal is to examine the relationship between shear force applied and fouling rate as quantified by TMP increase. The question is whether the helical flow membrane reduces the fouling rate without significantly increasing shear to the membrane surface. Secondly, we want to determine net energy expenditure for each membrane on a per volume of permeate basis, to determine whether the helical membrane has lower energy requirements than the smooth membrane.

AnMBRs are a potential solution to the massive energy requirements of aerobic wastewater treatment, especially as wastewater becomes more recognized as a resource than a liability.

This poster focuses on effective fouling mitigation in the form of patterned membranes and cross-flow variance.