REDUCING MEMBRANE FOULING WITH 3D PRINTED SPACERS

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Abstract

The dairy industry, like most other food industries, produces a large volume of wastewater which contains diluted milk and chemicals (acids, alkalis, detergents). There are many technologies used to treat dairy wastewater, such as biological and physico-chemical methods but they have their disadvantages (high operating costs, high space requirements, operational difficulties). Membrane technologies are promising methods to treat dairy wastewaters. The main disadvantage of membrane filtration in dairy wastewater treatment is membrane fouling, which causes flux decline, decreased membrane life-time, and increased operational cost.
One way to reduce the fouling is to increase the surface shear rate of the membrane. The method for increasing shear rate is to change flow properties (stirring and using 3D printed spacers). 3D printing technology is an emerging and promising technology to create an object through a layer-by-layer fabrication method. 3D printing technology and membrane module design, it could potentially address the membrane fouling problem through the optimization of spacers to increase mass transfer and reduce the concentration polarization at the membrane surface. 3D printing technology could possibly revolutionize the current design of membrane modules and potentially reduce the energy consumption and chemical usage in the wastewater treatment.
Ultrafiltration (*UF*) experiments were performed model dairy wastewater with different transmembrane pressures (0.2, 0.3 and 0.4 MPa) and stirring velocities (200, 300 and 400 rpm). Polyethersulfone (*PES*) UF membranes with molecular weight cut-off (*MWCO*) of 50 kDa and polylactic acid (*PLA*) 3D printed spacer configurations were used. The permeate flux values, resistances and membrane rejection were examined and the effect of spacer was observed.

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