ENHANCING HYDRODYNAMIC CHARACTERISTICS THROUGH THE INTEGRATION OF 3D-PRINTED SPACERS WITHIN THE VSEP MEMBRANE FILTRATION MODULE

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ABSTRACT

In our work, different 3D printed spacers were tested in a special Vibratory Shear Enhanced Processing (VSEP) device during model dairy wastewater ultrafiltration. Our goal is to change the hydrodynamic flow conditions in the filtration module in order to increase the membrane surface shear forces with mechanical module vibration and the integration of spacers into the module. It can significantly reduce the fouling tendency of the used polymer membranes.

We were curious as to whether better results could be achieved with a further developed, redesigned shapes (shape test) and PETG material usage next to PLA (material test) compared to the previously tested one. We performed our experiments with and without spacers of different shapes, as well as with and without module vibration of variable amplitude. The laboratory membrane separation experiments were carried out with 30 kDa cut-off ultrafiltration membrane at room temperature, at transmembrane pressure of 0.8 MPa, with a recirculation volume flow of ~15 L/min.

Compared to the control measurements, the results obtained when the spacer was inserted into the module, the values obtained with module vibration and the results obtained when the spacer and module vibration were used together resulted in improvements in all cases.

Keywords: Dairy Wastewater, Ultrafiltration, Membrane Fouling Mitigation, 3D Printing and Design, Spacers

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