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Fouling potential evaluation of soluble microbial products (SMP) in membrane bioreactor coupled with worm reactor

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Abstract

Membrane fouling is a major obstacle to the wide application of membrane bioreactor (MBR), in which soluble microbial products (SMP) are identified as the key membrane foulants. A hybrid MBR, composed of a conventional MBR and a worm reactor, was proposed to achieve significant wastewater treatment efficiency and sludge reduction simultaneously. It was noted that the flux decrements of H-SMP (SMP in hybrid MBR) with PVDF and PES were respectively 8.5% and 9.5% lower compared to those of C-SMP (SMP in Control-MBR) with corresponding membranes. This meant that the worm predation reduced the fouling propensity of the SMP. The structural parameters analysis indicated the H-SMP fouling layer showed a higher porosity, lower biovolume and thinner average thickness than the C-SMP fouling layer at the end of filtration. Modeling work well indicated that the main fouling mechanisms for H-SMP and C-SMP filtration were standard blocking. As the driven force of standard blocking, the hydrophobic/hydrophilic attractive force was supposed to play a major role in SMP filtration. Based on the extended XDLVO analysis, the decreases in the hydrophobic interactions between H-SMP and membrane and between the H-SMP themselves were found. By investigating the difference of H-SMP and C-SMP characteristics, it was demonstrated that these changes could be attributed to the lower hydrophobic interaction caused by the decrease in the relative abundance of unsaturated groups (aromatic protein-like substances) in the H-SMP. Accordingly, the H-SMP has lower fouling potential, and effective fouling mitigation was obtained in the hybrid MBR.

Biography

Professor Yu Tian has completed her Ph.D and postdoctoral studies from Harbin Institute of Technology (HIT) of Environmental Engineering. She is the head of department director of Environmental Science and Engineering at HIT. Her research fields mainly focus on the Process, efficiency and mechanism of wastewater treatment and sludge reduction. She has published more than 40 papers in reputed journals. More than 30 national research projects in China have been in charge of by her ever since 1997.