



Fouling mitigation in a submerged membrane bioreactor treating dyeing and textile wastewater

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ABSTRACT

The present study aims to assess the treatment efficiency and membrane fouling propensity of a submerged membrane bioreactor (MBR) treating dyeing and textile wastewater by introducing Powder-Activated Carbon (PAC) and Alum (called “fouling reducer”). The treatment performance and fouling behavior of MBR when adding PAC and Alum were compared to those of the control MBR. The components of dyeing and textile wastewater were fluctuated with Chemical oxygen demand (COD), color, and turbidity of 500–2,500 mg/L, 370–2,700 Pt-Co, and 50–370 NTU, respectively. The Mixed Liquor Suspended Solids (MLSS) concentration in an MBR fluctuated from 6,000 to 9,000 mg/L. The mixed liquor volatile suspended solids (MLVSS) to MLSS ratio was 0.76. The organic loading rate was operated in the range of 1.4–1.7 kg COD/m³ d. In the control MBR (without the addition of a fouling reducer into the bioreactor), the results showed that the MBR could only remove the color at a maximum efficiency of 50% and COD of 60–94% during the operation time. The trans-membrane pressure (TMP) increased from 2.1 to 4.4 kPa during 30 days of operation. When PAC and Alum were introduced into the MBR at the concentrations of 1,000 and 40 mg/L_{sludge}, respectively, the two compounds helped to enhance the removal efficiency of the COD, color, and fouling control. The treatment performance of the MBR and the fouling propensity were noticed to be much improved, compared to the control MBR. The efficiency to remove color was 40–80% and 80–90% for PAC and Alum, respectively. There is a significant difference in the COD removal efficiency between the addition of PAC and Alum. While the removal efficiency of COD removal ranged from 50 to 94% for PAC, it was stable at around 80–90% for Alum during the operation. Generally, the fouling mitigation of PAC and Alum was almost similar and even much effective compared to the control MBR. The TMP increased slowly from 2.2 to 2.9 kPa to 2.4 to –3.0 kPa in PAC and Alum in 22 days of operation. This fact reveals that Alum and PAC were excellent substances in fouling control, COD, and color removal for MBR treating the dyeing and textile wastewater.

Keywords: Membrane bioreactor (MBR); Fouling mitigation; Dyeing and textile wastewater; Alum; Powder activated carbon (PAC)

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