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Fouling mitigation behavior of magnetic responsive nanocomposite membranes in a magnetic membrane bioreactor

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Abstract

The aim of this study is the synthesis of a magnetic nanocomposite membrane to reduce fouling in a magnetic membrane bioreactor. To this end, Fe_3O_4 nanoparticles with an approximate size of 60 to 70 nm were settled into the polysulfone ultrafiltration membrane matrix through blending of Fe_3O_4 nanoparticles with the dope solution. Nanocomposite membranes containing 0 to 0.11wt.% Fe_3O_4 nanoparticles submerged in the magnetic bioreactor system in which the MLSS was considered between 8000 to 16000 g/L and the magnetic field intensity was 40 to160 mT. The results showed that an increase in the concentration of nanoparticles reduced the filtration resistance as much as 48% and developed the COD removal as much as 24% and increased the flux as large as 30%. The presence of a magnetic field around the bioreactor reduced the total filtration resistance as much as 68% and increased the COD removal as much as 34% due to the production of some changes in the membrane morphology and the sludge properties. Comparing the performance of the synthesized nanocomposite membranes with a MICRODYN-NADIR commercial membrane sample showed that magnetic nanocomposite membranes possess 30% higher flux, 27% lower filtration resistance, 41% higher COD removal compared to a commercial membrane.