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Integrating a novel TS-af-HFM NF process for portable treatment of oilfield produced water

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Abstract

A novel two-stage anti-fouling hollow fiber membrane (TS-af-HFM) nanofiltration (NF) process was integrated with a super hydrophobic organic silica modified polyvinylidene fluoride (PVDF/Si-R) hollow fiber membrane and a super hydrophilic silica modified polyethersulfone (PES/SiO_2)based TFC hollow fiber membrane for portable treatment of oilfield produced water. The performance of the TS-af-HFM NF system was investigated in terms of organics removal efficiency, permeate water flux and salt rejection. The result showed that the PVDF/Si-R membrane can dramatically remove dissolved organics from the produced water in the first stage, with the organics rejection efficiency up to 98.7%. Meanwhile, the PES/SiO_2 TFC membrane showed encouraging desalination ability with a relatively low operating pressure in the second stage. The high-efficient removal of dissolved organics in the first stage effectively eliminated the organics fouling occurred during the desalination process in the second stage. The variation of feed rate (0.05-0.2ml/min) and operating pressure (0-30 psi) in the first stage has no significant effect on the performances of the TS-af-HFM NF system. However, with the increase of operating pressure from 50 psi to 80 psi in the second stage, the permeate water flux and salt rejection