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研究论文

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纳米Ag粒子原位杂化PVDF超滤膜的抗污染性能

Antifouling property of hybrid PVDF ultrafiltration membrane containing in situ formed Ag nanoparticles

关键词：纳米Ag粒子 原位杂化 PVDF膜 抗有机污染 抗生物污染

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摘要：以$AgNO_3$为前驱体，聚偏氟乙烯（PVDF）为聚合物基体，聚乙烯吡咯烷酮（PVP）为分散剂和成孔剂，N，N-二甲基甲酰胺（DMF）为还原剂和溶剂，利用相转化法制备了纳米Ag粒子原位杂化PVDF超滤膜.采用扫描电镜、透射电镜、原子力显微镜及接触角测定仪对杂化膜的结构和性能进行了表征.结果表明：原位形成的纳米Ag粒子均匀地分散在聚合物基体中，纳米Ag粒子的添加改善了PVDF膜的亲水性能.以腐殖酸和牛血清蛋白作为污染物的代表，考察了Ag/PVDF膜的抗有机污染性能.以大肠杆菌、耐甲氧西林金黄色葡萄球菌及活性污泥作为微生物的代表，考察了杂化膜的抗生物污染性能.结果证实了与纯PVDF膜相比，Ag/PVDF膜通量衰减较慢，可有效抑制微生物的生长，表面受活性污泥污染程度小，具有显著的抗有机污染和抗生物污染性能.

Abstract：Hybrid poly (vinylidene fluoride) (PVDF) ultrafiltration membrane containing in situ formed Ag nanoparticles have been prepared via phase inversion method using $AgNO_3$ as precursor, PVDF as polymeric matrix, polyvinylpyrrolidone (PVP) as dispersing agent and porogen, N,N-dimethylformamide (DMF) as reducing agent and solvent. The structure and performance of hybrid membranes were characterized by scanning electron microscope, transmission electron microscope, atomic force microscope and contact angle measuring instrument. The results indicated that the in situ formed Ag nanoparticles were well dispersed throughout the polymeric matrix. The addition of Ag nanoparticles improved the hydrophilicity of PVDF membranes. The organic antifouling property of Ag/PVDF membrane was evaluated using humic acid and bovine serum albumin (BSA) as model foulants and the antibiofouling performance of hybrid membrane was investigated using *Escherichia coli* (*E. coli*), MRSA and activated sludge as the representative of microorganism. The results showed that the flux reduction of Ag/PVDF membrane was slower than that of pure PVDF membrane. The Ag/PVDF membrane restrained the growth of microorganism and showed lighter surface contamination to activated sludge, indicating significant organic antifouling and antibiofouling performance.

Key words：Ag nanoparticles in situ hybrid PVDF membrane organic antifouling antibiofouling