

Characterization of PVDF/TPU Hollow Fiber Membrane and Its Effect on Membrane Performance in MBR for Dye stuff Wastewater Treatment

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Abstract PVDF membranes blended with thermoplastic polyurethane (TPU), using poly(vinylpyrrolidone) (PVP) as polymeric hydrophilic were prepared by phase inversion process. The PVDF/TPU hollow fiber membranes were used in MBR process for the treatment of synthetic Reactive Brilliant Blue KN-R dye stuff wastewater. Based on the running result and treatment effect, the result showed COD of non-degradable pollutants account only around 4% of the total COD.

Key words polyvinylidene fluoride hollow fiber membrane; thermoplastic polyurethane; polyvinyl pyrrolidone; membrane bioreactor; dye stuff wastewater

CLC number X703.1 **Document code** A **Article ID** 0529-6579 (2007) SI-0161-02

The treatment of dye stuff wastewater is one of the most difficult issues to be solved because of its visibility and toxicity even at the very low concentration of dyes^[1-4]. The use of membrane technology to replace a separation or purification step in an existing industrial process may reduce the overall consumption of energy and produce acceptable results^[3-5]. We choose thermoplastic polyurethane (TPU) as blend polymer. To our best knowledge, low fouling PVDF/TPU blend hollow fiber membranes for dye stuff wastewater has not been reported previously. In MBR process COD removal was analyzed and structures of fouled membranes and cleaning membranes were examined by SEM.

1 Experimental

1.1 Material

PVDF used was a commercial product (FR904), TPU which we chose was an amorphous polymer obtained from Townsend Corporation. N,N-dimethylacetamide (DMAc > 99% reagent) was employed as the solvent and water was used as the nonsolvent for the polymer precipitation. Polyvinylpyrrolidone (PVP K30) with average M_w of 25~40 kg·mol⁻¹ was added to the casting dope to improve the membrane performance.

1.2 MBR Process for dye stuff wastewater

Experimental set up of MBR for wastewater treatment was shown as Fig 1.

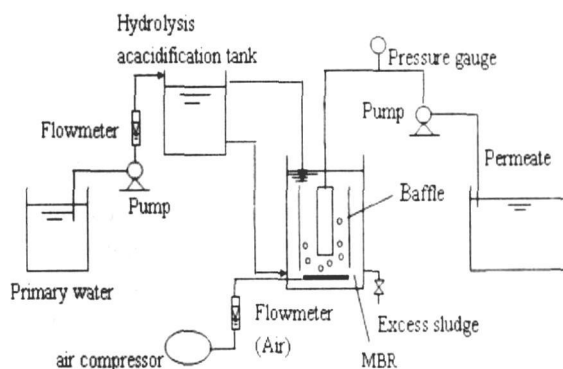


Fig 1 Experimental set up of MBR for dye wastewater treatment

2 Results and discussions

2.1 Morphologies of PVDF/TPU membranes

From experiments it can be indicated that the membranes with polymer concentration 16%, PVDF/TPU ratio 80:20 with 5% content of PVP, DMAc as a solvent possessed the best integrated property. The structure of the surface (i.e. skin) and cross section was shown in Fig 2.

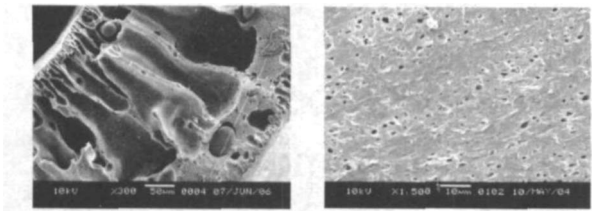


Fig 2 SEM micrographs of membranes

2.2 COD removal after operation in MBR

During MBR process operating period including 20 days and running period 50 days respectively. Fig 3 showed COD of non-degradable pollutants account only around 4% of the total COD.

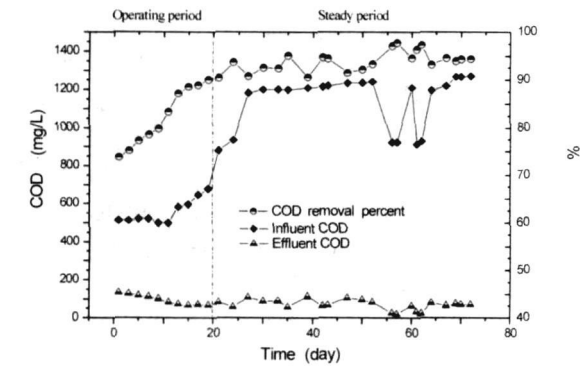


Fig 3 Effluent COD during MBR process

2.3 SEM micrographs of fouled membranes

The measures to reduce the membrane fouling recovered membrane flux by chemical backflush cleaning by NaOH. The structures of fouled membranes were shown in Fig 4. Surface of fouled membranes were more lubricous than membranes cleaned by NaOH. The sludge covered skin membranes were wiped off efficiently. The jammed finger like macrovoid were recovered mostly.

3 Conclusions

A low cost ultrafiltration hollow fiber membrane can be successfully developed using low cost polymeric

material blends. This kind of low fouling blend membrane gives promising results for possible dyestuff wastewater treatment in textile characteristic countries or regions.

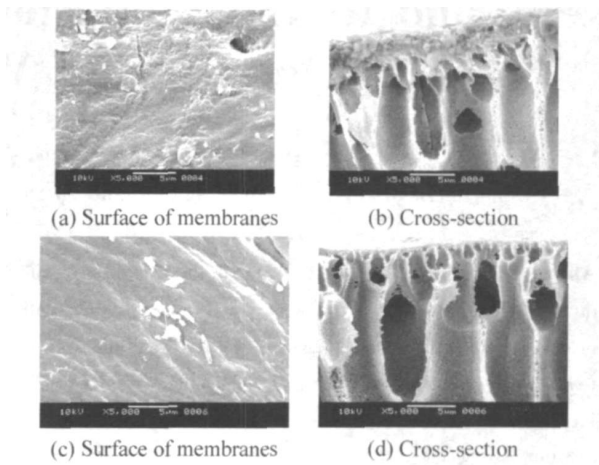


Fig 4 SEM micrographs of fouled membranes (a, b) and membranes washed with NaOH (c, d)

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PVDF/TPU共混中空纤维膜的表征及 MBR处理染料废水性能的影响研究

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摘要: 采用相转化法制备 PVDF/TPU 共混中空纤维膜, 选择 PVP 为添加剂可以改善 PVDF/TPU 的成膜性能。运行结果表明染料废水中不可降解物质的 COD 占总 COD 的 4% 左右, MBR 组合工艺是处理活性染料废水的高效工艺。

关键词: 聚偏氟乙烯中空纤维膜; 热塑性聚氨酯; 聚乙烯吡咯烷酮; 膜生物反应器; 染料废水

中图分类号: X703.1