Effect of Operating Pressure on Reverse Osmosis Permeate Quality in a Hybrid MBR–RO Treatment of Textile Wastewater

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OBJECTIVE

The objective of this study is optimization, i.e., effect of operating pressure on reverse osmosis (RO) permeate quality during textile wastewater (TWW) treatment.

Introduction

The textile industry generates complex wastewaters with high concentrations of organic matter, salts, dyes, and surfactants. Conventional treatment processes often do not meet the water quality standards required for safe discharge or reuse. Hybrid systems that combine biological treatment with membrane separation process have emerged as effective strategies to achieve higher removal efficiencies and support water reuse.

Materials and Methods

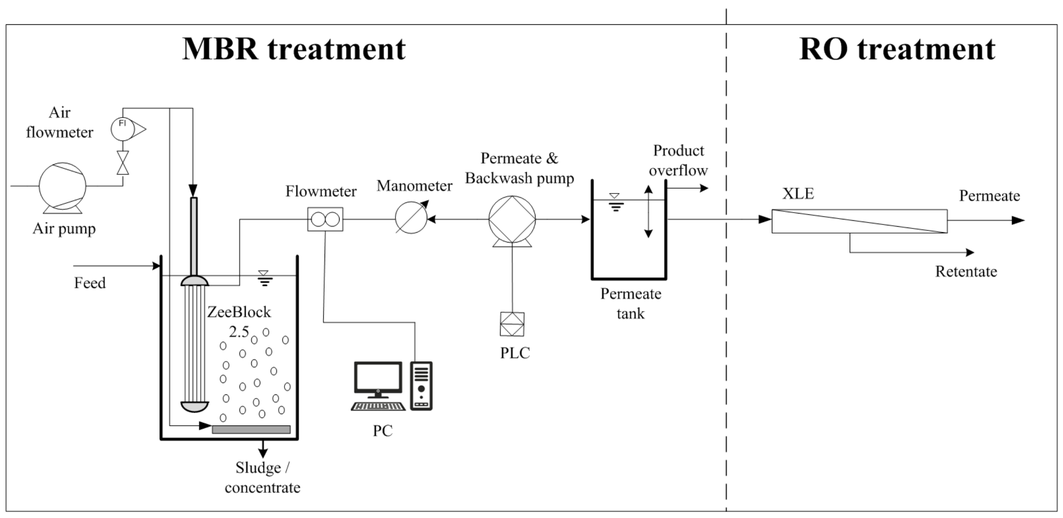

Figure 1. Shematic presentation of MBR-RO treatment

1. stage – membrane bioreactor (MBR)
   - aerobic treatment, MLSS: 10 g/L, HRT: 10 – 12 h
   - membrane – ultrafiltration hollow-fiber ZeeBlock 2.5 (Veolia)

2. stage – RO
   - flat sheet membrane XLE (DuPont)
   - operating pressure – 10 bar, 12 bar, and 14 bar

- Measuring parameters – chemical oxygen demand (COD), turbidity (NTU), electrical conductivity, and totan nitrogen (TN)
- Flux monitoring in long-term operation
- Chemical cleaning – Nalco PermaClean 98 (PC 98) and Nalco PermaClean 77 (PC 77)

	Removal / %			
	COD	Turbidity	Conductivity	TN
10 bar	82.4	78.8	98.2	31.7
12 bar	81.8	33.8	98.3	40.2
14 bar	84.1	80.7	98.8	33.9

- COD feed to RO was relatively low (between 50 mg/L and 70 mg/L) due to 1. stage treatment with MBR.
- COD removal arround 80% due to low COD feed concentration to RO
- Turbidity showed relatively low removal because very low feed concentration to RO (0.74 – 1.14 NTU).
- Conductivity almost completely decrease due to the main role of RO for removal of dissolved inorganic compounds.
- Total nitrogen also low decrease due to low feed concentration (2.04 – 4.73 mg/L)

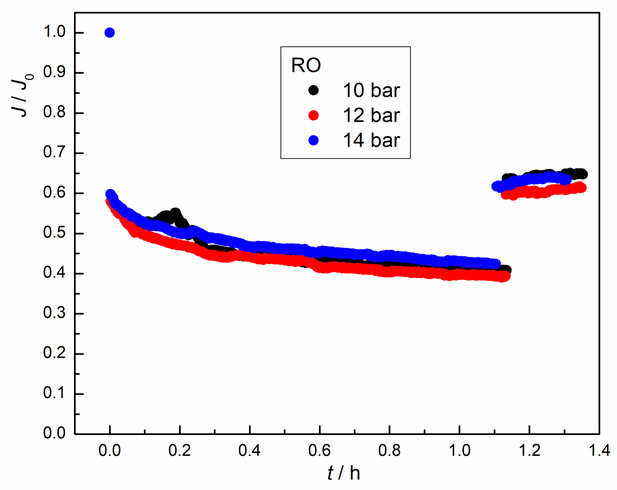

Figure 2. Normalized flux of RO permeate at investigated pressure

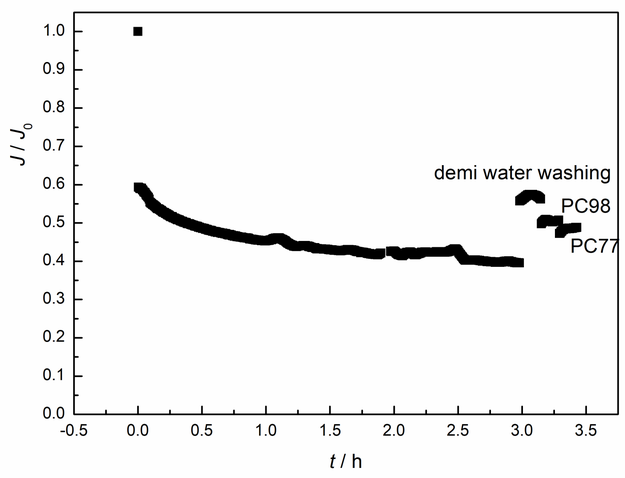

Figure 3. Normalized flux of RO permeate at 14 bar with cleaning

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