Treatment of dyeing wastewater by membrane process

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Abstract

The main purpose of this work is to investigate the performance of membranes for treatment of dyeing wastewater. The microfiltration (MF) membranes (titania-blended polysulfone & alumina) were prepared. The nanofiltration (NF) and reverse osmosis (RO) membranes were kindly supplied by the Sae-Han. In order to reuse the wastewater for dyeing, the effluents were treated by the high flux RO and the fouling resistant RO (FRM) membranes. Also, the NF membrane was used for water reuse in rinsing.

Introduction

Textile dying is a chemically intensive process and consumes large quantities of water. The wastewater generated usually contains substances that are severely harmful to the environment. In typical dyeing processes, 50-100% of the dye is fixed on the fiber, and the unfixed dyes are discharged in spent dye-baths or in wastewater from subsequent textile-washing operations. Chemical auxiliaries such as salt and surfactants also contribute to aquatic toxicity.

In general, the treatment of the wastewater can be divided into three sections-namely a physico-chemical section using flocculation and coagulation processes, a biological treatment section using an activated sludge process and a final section using an overland flow method. However, the use of a method of chemical coagulation produces large quantities of sludge. Color removal by the biological treatment method was found to be inadequate because most textile dyes have complex aromatic molecular structures that resist degradation.

In this work an experimental investigation of membrane filtration of the dyeing wastewater is reported. In order to eliminate the chemical coagulation process, polymeric and ceramic MF membranes were used. The final effluents of the

conventional processes were treated by NF, RO and FRM RO membranes.

EXPERIMENTAL

The dyeing wastewater was supplied by the Sam-Yang Tex. The wastewater contains various dyes, salts, surfactants. The parameters of raw waste and treated waste are listed in Table 1.

Table 1 The parameters of waste water

	Temperature (°C)	pH	COD (ppm)	Conductivity (mS/cm)
Raw water	40	11.1	330	5.63
Coagulated water	30	8.2	134	5.50
Biologically treated water	20	7.5	50	5.60

All the wastes were treated by the MF membranes (polymeric and ceramic). The polymeric and the ceramic MF membranes were prepared in our lab. The MF-treated wastes were filtered by the NF, PVA-coated NF, RO and the FRM membranes. The possibility of membrane application in the dyeing waste was investigated.

RESULTS AND DISCUSSION

The effluent (biologically treated waste) was filtered by the RO and the FRM membranes. The RO membrane was more fouled than the FRM membrane because of less ionized membrane surface (figure). The FRM membrane is coated with neutralized polymeric material.

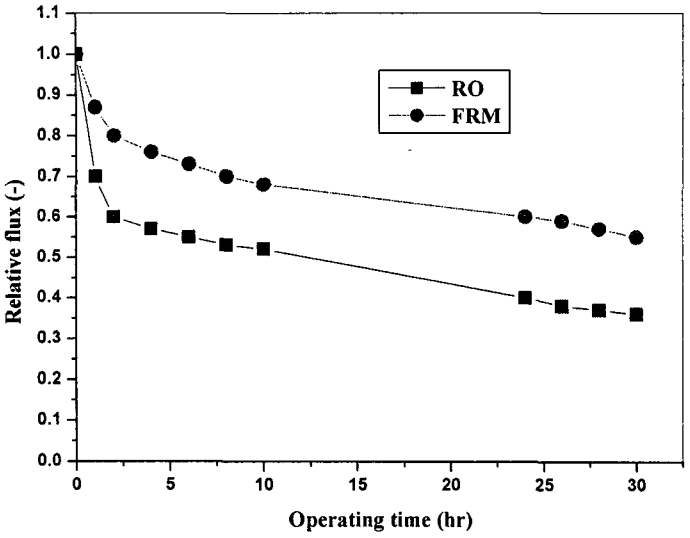

Figure Relative flux for effluents using RO and FRM membranes.

CONCLUSION

The alumina tube membrane (0.1μm pore size, 40% pore size distribution) was less fouled than the polymeric MF membranes. The dyeing wastewater could be successfully treated by the membrane process without chemical coagulation of conventional process. For effluent (biologically treated waste) treatment the FRM membrane was useful for recycling of the wastewater in terms of fouling and performance (COD < 1ppm, conductivity < 150μS/cm).

REFERENCES

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