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Treatment and Reuse of Acrylic Wastewater using Membrane Separation System

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Abstract

The separation characteristics were investigated with the variations of pressure and temperature using ultrafiltration and reverse osmosis membrane module sets composed of different membrane types and materials. TDS, T-N and COD removal efficiencies were not affected and low with the change of temperature and pressure in case of using UF modules contained in module set 1, 2, 3. TDS, T-N and COD removal efficiencies were very high in RO modules. The final water quality of acrylic wastewater was satisfied within the discharge limit value of plant wastewater. It was known that membrane module sets could be used for the reuse of wastewater.

INTRODUCTION

Advanced treatment is suggested by pollution of water supply sources from the increase of wastewater generation quantity. Membrane separation technology minimizing the wastewater effluent quantity and reducing the plant site and reclaiming treated water is required as more efficient technology than existing treatment technologies. As the quantity of concentrated wastewater was able to reduce within 10% of total original wastewater, the membrane process has been recognized with principal technology of the zero discharge wastewater treatment system noted recently.

In fiber industry, ultrafiltration and reverse osmosis were applied to treat with latex pollution effluent, wool washing water and the stream from dyeing operation. The conventional mechanical-biological processes and physical-chemical processes such as precipitation, aggregation, suspension and adsorption with the aim of possible partial reuse of components in wastewater could be replaced by membrane processes.

This research investigated the separation characteristics with the variation of applied pressure and temperature using acrylic wastewater with the object of membrane module sets composed of UF and RO membrane. Also, effective membrane separation

process was proposed with the analysis of membrane pollution lowering of membrane separation performance.

MATERIALS AND METHODS

Membrane

Ultrafiltration membrane modules were GUF-3040 (U) and GUF 2050-0950 made by 'P' Co., KCF-1205 made by 'K' Co. Reverse osmosis membrane modules such as RO 14-100 and RO 11-50, RO NO-50 made by 'S' Co. were used. Characteristics of each module were shown in Table 1.

Experimental procedure

Acrylic wastewater was fed to feed tank of UF/RO process and was applied with the change of temperature and pressure. The circulation constant temperature bath was used to maintain the feed temperature constant. After fixing the applied pressure of UF membrane, it was experimented with the variation of applied pressure 4 steps using RO membrane. If the applied pressure of RO membrane was changed, the already fixed pressure of UF membrane would be affected. To remove this effect, reservoir which UF permeate was fed was installed. Sampling for wastewater analysis was done at the same time with measuring flow rate.

RESULTS AND DISCUSSION

Performance of ultrafiltration and RO module for the treatment of acrylic wastewater

Permeate flux was increased linearly with the variation of temperature and pressure. The permeate of wastewater, which was collected from the UF operation, was also

applied to RO spiral wound type module.

In the case of applying acrylic wastewater in UF process under the constant feed solution flow rate, turbidity removal efficiency was showed above 80% average with the variation of temperature and pressure. Turbidity removal efficiency of UF module affected that of RO module.

When wastewater was applied in module sets under the constant feed solution flow rate, TDS removal efficiency was shown to be about above 10%. It was very difficult for TDS to be effectively removed by using only UF membrane. From the result of applying this permeates in RO spiral wound type module, RO membrane showed excellent efficiency in TDS removal because of above 94% TDS removal efficiency. Removal efficiency of TDS was independent of applied pressure and temperature. Acrylic wastewater was applied in both UF and RO process. In all module sets, pH was not highly affected by pressure change .

In case of applying the wastewater in UF and RO module sets, removal efficiency of acrylic wastewater was not affected with the change of temperature and pressure because of removal efficiency of lower than 10%. From the result of applying permeate in RO process, removal efficiency of RO module was shown to be above 90% average .

From the application of coagulation-filtration-neutralization pretreated wastewater in UF and RO module sets, COD was not nearly affected by the variation of temperature and pressure. COD removal efficiency was shown to be within about 10%. COD removal efficiency of RO module sets was shown to be above about 78% totally.

CONCLUSIONS

When the acrylic wastewater was applied to module 1 to module 3, turbidity was removed effectively in UF process. In RO process, the removal efficiency of T-N was increased with the increment of temperature but it didn't almost change with regard to applied pressure. The final permeate from UF and RO was ascertained to reuse.

REFERENCES

1. Hwang, H.J. and Park, J.Y., Effect of periodic N_2-back-flushing in paper wastewater treatment using carbon ceramic ultrafiltration and microfiltration membranes, *Membrane J.*, **12**, 8-20 (2002).
2. Taylor, J.S., Mulford, A., Duranceau, S.J. and Barrent, W.M., Cost and performance of a membrane pilot plant, *J.AWWA*, **81**, 52-54 (1989).
3. Kim, Jeong-Hak, State of art of membrane processes for water re-use, *Membrane J.*, **10**, 175-185 (1995).
4. Osada, Y. and Nakagawa, T., Membrane Science and Technology, Marcel Dekker Inc., New York, U.S.A. (1992).
5. Zahid Amjad, Reverse Osmosis, Chapman and Hall, New York, U.S.A. (1993).

Table 1. Specifications of ultrafiltration and reverse osmosis membrane.

	Model	**Membrane material**	**type**	**Area of membrane (m^2)**	**MWCO (Daltons)**	**Module set No.**
UF	GUF 3040(U)	polysulfone	hollow fiber	2.26	50,000	1
RO	14-100	polyamide	spiral wound	0.6	-	
UF	GUF 2050-0950	polysulfone	hollow fiber	2.2	50,000	2
RO	W-60	polyamide	spiral wound	0.5	-	
UF	KCF-1205	PVDF	tubular	1.18	200,000	3
RO	W-60	polyamide	spiral wound	0.5	-	