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Study on Recycling Alkali from the Wastewater of Textile Mercerization Process by Nanofiltration

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Abstract

This study has researched the treatment ability of nanofiltration technology in printing and dyeing mercerization process alkali wastewater and investigated the effect of different pressures and alkalinities on membrane flux. The effect of different operating conditions on COD removal rate and alkali penetration rate has been also investigated in this study. The experimental results show that nanofiltration technology can remove the COD in printing and dyeing mercerization process wastewater effectively and the removal rate is above 80%. We conclude that the membrane flux tends to increase as the operating pressure increases, and decrease as the concentration of alkali in feed liquor and COD increases. The infiltration liquor through membrane can be satisfactorily reused by the method of concentration, and the final recovery efficiency of alkali by nanofiltration membrane treatment is above 90%.

1. Introduction

The wet process technology with freshwater as a medium, has been widely employed in textile printing and

dyeing industry in China. The process is divided into 3 sections: pretreatment, dye and after treatment, including multiple processes such as desizing, rinsing, mercerizing, dyeing, sizing and etc. Almost every process needs huge quantity of freshwater and steam in printing and dyeing industry and discharges desizing, mercerizing and dyeing wastewater, which is the representative of high pollution, alkalinity and chroma, resulting in high load and difficulty in the end treatment.

In order to improve fiber tension, increase fiber surface gloss, decrease fiber contractility and enhance the affinity of dye, the sodium hydroxide solution is used to treat the textile in mercerization process. The wastewater of textile mercerization is a high alkali waste liquor and always is mixed with other wastewater in production processes to be treated in the end treatment system. Because of its high alkalinity, large amount of acid is consumed to neutralize the alkali when the wastewater is treated; otherwise, it will cause the difficulty in the subsequent bio-treatment process and have a negative effect on the equipment. Therefore, it is necessary to purify and recover the alkali from the waste alkali liquor of the mercerization,   reducing the quantity of alkali into end processing system.

Nanofiltration (NF) is a kind of membrane technology which is rapidly growing and widely recognized as superior water and wastewater treatment in recent years, and has the separation characteristics of sieve effect and Donnan charge effect [1]. Generally, nanofiltration can retain the divalent and higher-valence ions; whereas the monovalent ions such as sodion and chloridion can pass through an NF membrane. Thus, NF technology is widely used in de-salting of the process stream [2, 3]. In this study, nanofiltration membrane separation technology is used to purify and recover alkali from the waste alkali liquor of the mercerization; the influence factors in operation process of membrane separation are investigated to offer the technical support to wastewater treatment using nanofiltration technology.

2. Materials and Methods

2.1 Expremental materials

The compositions of mercerizing wastewater of printing and dyeing are uncertain, therefore, wastewater with different concentrations should be studied when NF membrane technology is used to treat printing and dyeing wastewater. In this research, the wastewater was collected from the mixture of multi-effect mercerizing rinsing waste alkali liquor and normal mercerizing waste alkali liquor of BY Printing and Dyeing Co., Ltd., Haicheng city, Liaoning province, China, which contained 10.1%wt of alkalinity, 185NTU of turbidity, 1320mg/L of COD, and 342mg/L of SS. Three experimental samples with alkalinities of 20.16g/L, 30.24g/L and 71.2g/L respectively were obtained by diluting the original water sample. The index of COD and turbidity are shown in table 1.

Table 1 The water quality of various influent

No. of liquor sample	Alkalinity (g/L)	COD (mg/L)	Turbidity NTU
1	20.16	330	4.6
2	30.24	376	6.8
3	71.2	1075.7	13

Special alkali-resisting nanofiltration membrane, SelRO^{R}MPS-34-pH Stable Membrane 4040 A2Z from Koch Industries (USA.) was used in this study.