Recovery of Optical Brightening Agents (Textile Industry)

NFX Nanofiltration Membrane

Background

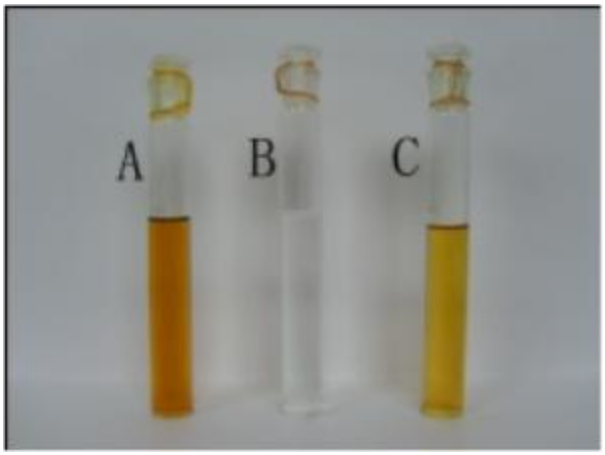
Optical brightening agents are special dyes that absorb ultraviolet light and re-emit light in the blue region, usually at 420-470nm. This application is called the "whitening effect", which is commonly used to enhance the appearance of certain colors without the damaging effects of bleaching. By increasing the amount of blue light reflected, yellow tones appear whiter. Membrane technology can be applied to capture and concentrate the optical brightening agent for reuse to lower the operating cost in textile and paper industries. Membrane technology provides a process of simultaneous concentrating and desalinating dye solution and thus obtaining concentrated dye with low salt content.

Feed Solution, Membrane, & Operating Conditions

An optical brightening agent was used to test the feasibility of using Synder's NFX nanofiltration membrane to concentrate the dye for reuse.

Membrane Type & Feed Conditions

Feed Solution	
Material	Optical Brightening Agent
Molecular Weight (Da)	430
Dye Manufacturer	JiNing XinHui Chemical Industry CO. LTD.
Conductivity (µs/cm)	11.1×10^4
Membrane	
Element	NFX-2-2540HF
Spacer Size (mil)	31
Surface Area (sq. ft)	28
Operating Parameters	
Element Inlet Pressure (PSI)	115
Pressure Drop (PSI)	15
Temperature (°F/°C)	95/35
Crossflow rate (GPM)	5
Run time (min)	38
Feed volume (Gal)	14.5



Comparison between the concentrate (A), permeate (B) and feed solution (C) at the end of the experiment

Test Results

In a 38 minute batch process, the initial volume of 14.5 gallons was concentrated to 6.9 gallons while achieving a rejection rate of greater than 99%. The effectiveness of the NFX membrane in concentrating this dye is represented visually in a side-by side comparison (Picture 1), where the difference between permeate (B) and concentrate solution (A) is clear. The results of the filtration are summarized in table 2.

Results	
Dye Rejection	>99%
Concentrate Volume (Gal)	6.9
Average Permeate Flux (GFD)	9.4
Conductivity (concentrate, µs/cm)	12.5×10^4
Conductivity (permeate, µs/cm)	9.7×10^4
Overall salt rejection (final)	22.4%

Conclusions

Synder's NFX membrane is very effective in concentrating the optical brightening agent. The average permeate flux is 9.4 GFD, while exhibiting a 49% decline over the entire batch process. Through a comparison of the conductivity of the permeate and concentrate, the salt species in the dye solution seems to pass through the NFX membrane easily. This low salt rejection is ideal to improve the quality of dye solution during the concentration process. Thus, the implementation of the NFX membrane can potentially reduce the capital costs associated with textile manufacturing and give plants an increased ability to meet discharge regulations.