Chapter 7

PULP AND PAPER WASTEWATER TREATMENT BY COMPOSITE POLYPHENYLENE OXIDE MEMBRANES

Surendra Singh
Industrial Membrane Research Institute, Department of Chemical Engineering, University of Ottawa, Ottawa, Canada.

1. INTRODUCTION

The pulp and paper industry is currently faced with the challenge of substantially reducing the discharge of contaminants to the receiving environment. Water is of primary importance in the paper making process. The pulp and paper industry has been a large user of fresh water in comparison to several other manufacturing industries. Continuous progress has been made by the pulp and paper industry in reducing the fresh water use because of growing environmental concerns and stricter government regulations. Water use reduction in a paper mill has been accomplished primarily by closing up the water system. Water system closure, however, results in an increased concentration of suspended, dissolved and colloidal materials in the system, which in turn could result in a poor quality of paper and operational problems. Because of the solid buildup problems, paper mills are looking for alternative processes for internal treatment of water. Among the alternative processes, membrane separation process is getting an ever-increasing acceptance.

The membranes that were used in the early days of membrane filtration were made of cellulose acetate, and the application of these membranes was limited, especially with respect to pH and temperature.
These drawbacks resulted in serious limitations in the use of membrane filtration in the pulp and paper industry. However, today, with the development of more pH and temperature resistant membranes, membrane filtration is getting more and more acceptance as a separation process in the pulp and paper industry. One of the major problems of membrane application to pulp and paper stream treatment is the flux decline due to fouling.

2. MEMBRANE APPLICATIONS IN PULP AND PAPER INDUSTRIES

Paleologou et al. (1994) discussed membrane applications in the pulp and paper industry with respect to technical feasibility, process integration and the economics of the mill system. The following are some applications of membrane separation processes in the pulp and paper industry.

2.1 Bleach plant effluent

The two major contaminated bleach plant effluents are the acidic filtrate from the chlorination stage (C-stage) or from the chlorine dioxide stage (D-stage) washer and the first alkaline extraction filtrate from the extraction stage (E-stage) washer, as most of the chlorinated substances and colored materials originate from these two stages. Most of the published works on membrane applications in the pulp and paper industry have focused on E-stage effluent treatment. E-stage effluent is very well suited for treatment by the ultrafiltration process because it has a comparatively small volume and contains relatively high-molecular-weight-substances. There are several ultrafiltration plants of commercial scale, for example, the Sanyo Kokusaku Pulp Mill and Taio Paper Co., Japan (Jonsson, 1987). Ultrafiltration of this effluent can reduce Total Organic Chloride (TOCl) by 60-70% (Jonsson, 1987), Chemical Oxygen Demand (COD) by 50-80%, Absorbable Organic Halogen (AOX) by 90% (Jonsson, 1989), color by 90% and Biochemical Oxygen Demand (BOD) by 25-50% (Lundahl and Mansson, 1980). The overall effect of the ultrafiltration of E-stage effluent on the total mill effluent is 65-70% reduction in color, 40% reduction in COD and 10% reduction in BOD. C-stage effluent contains mostly low-molecular-weight-substances. Most of the substances in the C-stage effluent are too small to be retained, even by a very dense ultrafiltration membrane.