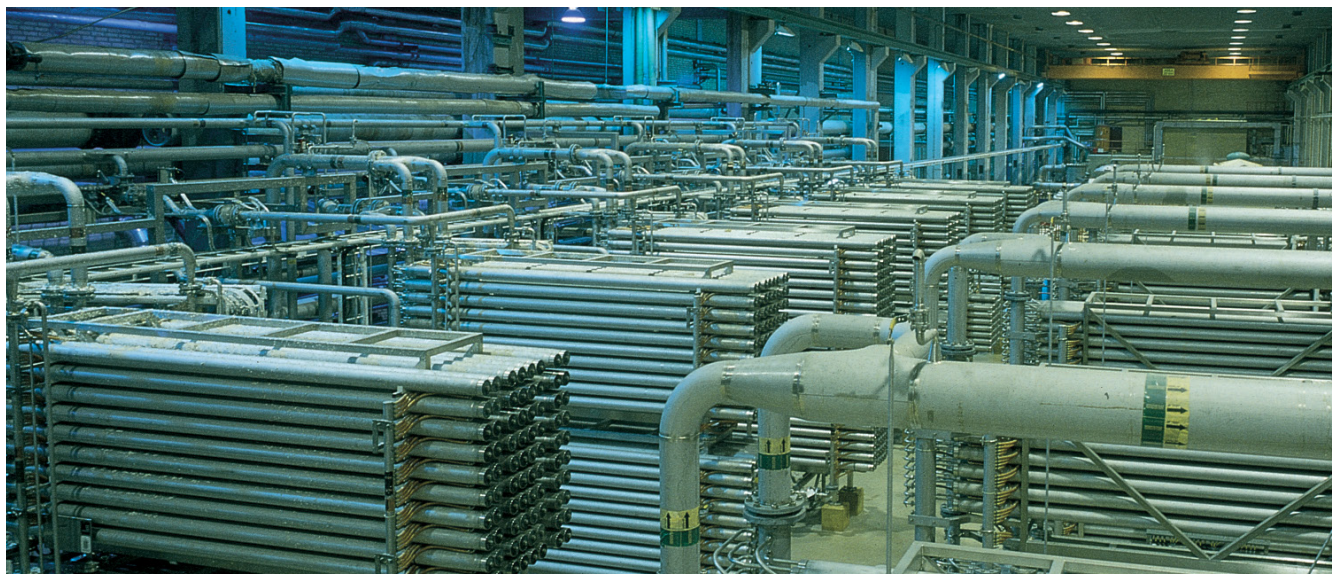


PCI Membranes

Effluent Treatment Plant



The World's Largest Tubular Membrane Effluent Treatment Plant B1 Series Modules and ES404 (Softwood) & EM006 (Hardwood) Membranes

the mill's capacity is 300,000 tonnes per year, of which 200,000 tonnes is used by Stora Nymölla for the manufacture of high quality printing paper. The remaining pulp is sold to other paper mills. Two types of pulp are produced, Nymölla Red, which is a short fibre pulp made from beech and birch, and Nymölla Green, a long fibre pulp made from pine and spruce.

From the oxygen bleach stage of the pulping process, 300 tonnes per hour of effluent is produced (made up of 135 tonnes per hour from hardwoods and 165 tonnes per hour from softwoods). The average COD of this effluent is approximately 10gm/litre, therefore a total of about 3 tonnes of COD is produced every hour. Due to stricter legislation, and the need to be "green", it became necessary for Stora Nymölla to obtain the "Swan" mark for their products.

This is an independently awarded symbol indicating commitment to protecting the environment. The mill was already chlorine-free, but they needed to reduce COD emissions to achieve the "Swan" mark.

The target was a 50% reduction in the total mass of COD discharged from the oxygen bleach stage. The retained 50% of the COD was to be contained in 2% of the original liquid volume so that it could be incinerated.

TRIALS

Stora Nymölla approached MoDo Chemetics who came to PCI Membranes, where we were invited to carry out trials. These were started in May 1993 using a multistage recycle pilot plant. The initial results indicated that Nymölla's bleach effluent was treatable with membranes, but that further work was required. In October 1993, PCI returned to site with an ultrafiltration (UF) pilot plant. This was a two-stage plant fitted with three modules per stage, giving a total of 15.6m² membrane area. The plant could be operated in batch or continuous mode and at a stable concentration or VCF (volumetric concentration factor) within each stage.

Stora Nymölla AB, Sweden

INTRODUCTION

Stora Nymölla AB is one of the world's largest manufacturers of bleached magnifite pulp.

Production of pulp started in 1962 at Nymölla, and actual paper manufacture began in 1972. At present,

Production Plant	
System	13 recirculation stages (7 for soft wood and 6 for hardwood)
Process	300m ³ /hr of effluent and producing 6m ³ /hr of concentrate
Modules	1784 B1 Modules in total Softwood stage contains 1064 modules Hardwood stage contains 720 modules
Filtration Area	4650m ²

CASE STUDY

PCI Membranes Effluent Treatment Plant

The trials in May indicated the need for a 4,000 Dalton cut-off membrane, and so PCI's ES404 polyethersulphone membrane was fitted in the pilot plant. The two streams of effluent (hardwood and softwood) needed to be treated separately in order that the retentate stream could be reused.

One target was to design a plant that could operate at low cross-flow velocities in order to keep energy consumption down. This proved to be possible for the softwood stream, and a total of about three months of continuous trials, operating 24 hours per day, were carried out on the softwood effluent using ES404 membranes.



View of feed end of softwood stages. Note: Small diameter pipework – a feature of operating at low cross-flow rates.

During this time a number of different cleaning regimes were tested, and it was determined that a variable cleaning frequency was needed. Earlier stages were found to require more frequent cleaning, approximately once daily, and later stages could be run continuously for four days or more.

During the early part of the trials, hardwood effluent was also trialled using ES404 membranes. However, this stream proved to be far more fouling than the softwood effluent for these membranes even when a high crossflow was employed. Therefore a smaller pilot plant was then taken to site, and various other membranes were trialled for the hardwood using this plant, whilst the main pilot plant continued to produce data on the softwood effluent. It became clear that none of PCI's existing membranes was suitable and so a new membrane had to be developed. This was achieved in less than two months, so trials with the two-stage UF pilot plant were able to continue uninterrupted.

The new membranes worked exactly as anticipated; it was also discovered that all hardwood stages of the projected full-scale plant should be able to be operated for two days between cleans.

PRODUCTION PLANT

Once MoDo Chemetics had secured the order from Nymölla, the production plant was designed and built jointly by MoDo Chemetics and PCI Membrane Systems. Installation and commissioning was also carried out jointly, with engineers from PCI spending time working together with MoDo engineers in Sweden.

The final design was for two lines with a total of thirteen recirculation stages (7 for softwood and 6 for hardwood). Each softwood stage contains 152 modules and each hardwood stage 120 modules. The lines are designed such that they never have to stop. Any stage can be taken off line to enable it to be cleaned without interrupting the effluent processing.

CONCLUSION

Since January, 1995, the plant has met the required specification for both COD reduction and capacity, processing more than 300m³/hr of effluent and producing 6m³/hr of concentrate. Membrane life has been longer than forecast, with both power and cleaning chemical consumption also within the guaranteed limits.

In all PCI:

- Carried out close to 1000 hours of trial work
- Developed a new membrane in only two months
- Tailored two different cleaning regimes to the two feed types
- Designed a plant that successfully processes 300m³/hr of bleach effluent

The plant has enabled Sora Nymölla to achieve the sought-after "Swan" mark.



View of feed end of sixth stage of hardwood line. Note: Larger diameter feed pipework



13 stages of PCI 3.6 m long B1 modules. A total membrane area of 4650m². Note: Stages are staggered to make space for re-membrating. Now using ESP04 for improved ph tolerated.