

Membrane technology makes 'zero discharge' a reality for MDF plant

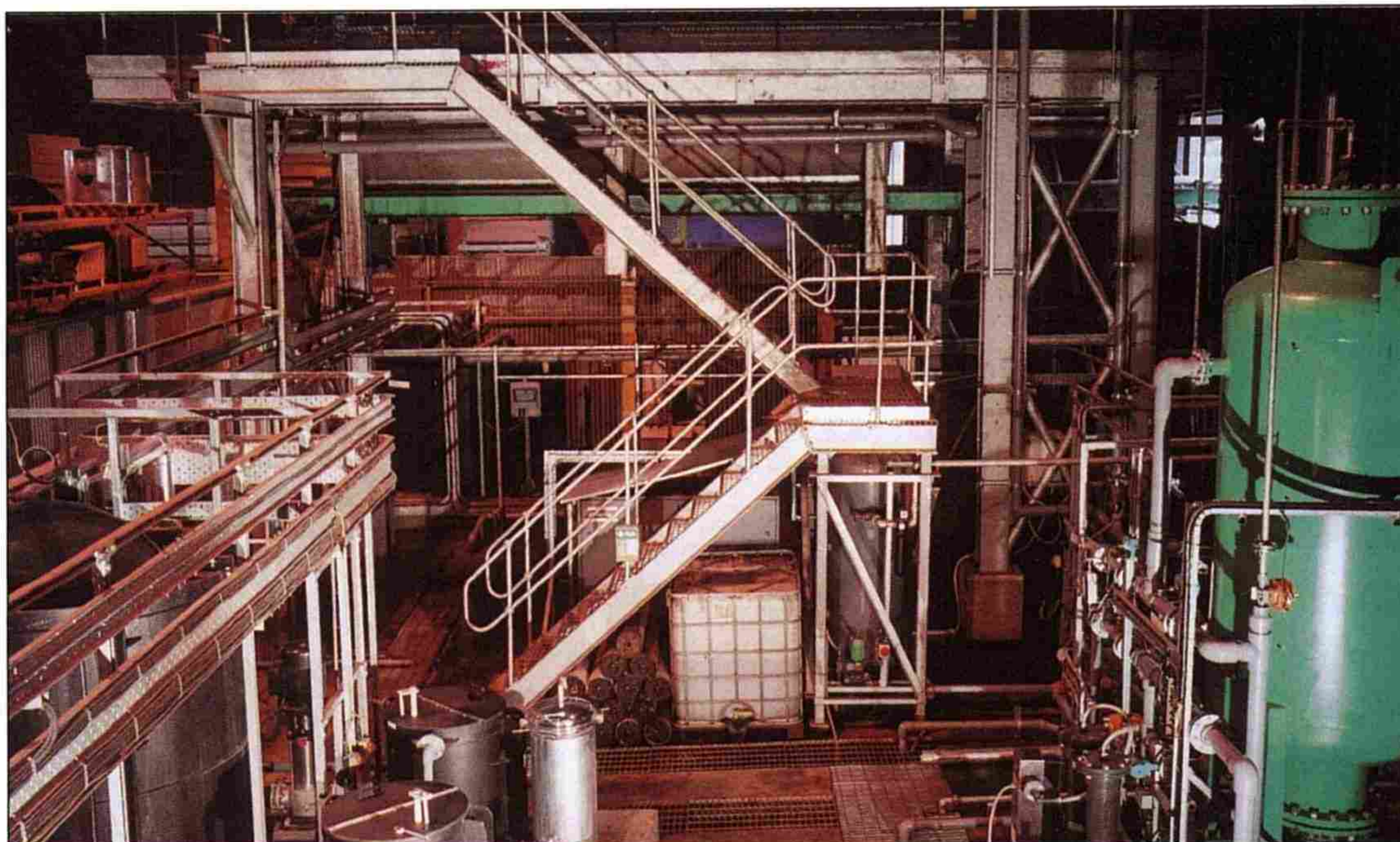
Esmil Process Systems is leading the drive for total environmental cost recovery with the development of 'zero discharge' treatment and recovery systems for niche industrial markets. Financial payback is generated through low capital cost 'lease-purchase' schemes, product recovery, water recovery and reduced environmental liability.

Angela Himus reports.

The first Esmil 'zero discharge' plant, designed specifically for the treatment of effluent generated during the manufacture of wood pulp, was installed at the Kronospan plant at Chirk, North Wales. One of 15 privately owned plants operating throughout Europe, Kronospan UK manufactures chipboard (1,500m³/day), medium density fibreboard (MDF) (450m³/day), melamine-faced boards and sawn timber. Prior to installing the Esmil plant, effluent was tankered off site for treatment at a monthly cost of £30,000-£40,000.

Tony Hackney, Kronospan's works director, wanted a 'fit and forget solution': "a technology," he said, "which would give me peace of mind as an effective closed loop solution, but would also be sustainable in the long term."

The plant installed at Kronospan's Chirk site in June 1995 was the result of an eighteen month research and development programme. According to Esmil marketing manager Steve Finnemore, customer feedback had indicated that conventional biological systems were coming to the end of their product life cycle. The



The Esmil plant provides Kronospan with a sustainable solution to effluent treatment, product recovery and water re-use.

need to dispose of waste activated sludge and limitations in treating high strength wastes, variable loads and odour were just a few of the factors weighing in favour of designing a new, smaller footprint

treatment process which would meet the following criteria:

- low capital cost/rapid investment payback
- optimum product/resource recover

- effluent reduction, recycle and re-use
- long-term environmental compliance
- easy-to-upgrade modular systems.

MDF Effluent Treatment and Fibre Recovery Plant
Design and Historical operating data April - October 1996

	Unit	MDF Feed Effluent		Treated Effluent	
		Range	Average	Average	% Removal
Plant design data					
Flow	m ³ /d	200		160	
COD	mg/l	15,000 - 30,000		150	>99%
Suspended solids	mg/l	5,000 - 25,000		n/d	>99.9%
TDS	mg/l	100 - 25		<10.0	
Fatty acids	mg/l	5 - 7%		n/a	
Lignins	mg/l	30 - 35%		n/a	
Pectins	mg/l	30 - 35%		n/a	
Resin acids	mg/l	20 - 25%		n/a	
Celluloses	mg/l	20 - 30%		n/a	
Historical Operating Data					
Flow	m ³ /d	15 - 193	75		
COD	mg/l	1,900 - > 30,000	20,000	153	>99%
Suspended solids	mg/l	570 - 38,000	6,000	n/d	>99.9%

n/d = concentration not detectable n/a = results not available

The resulting Esmil plant combines the advantages of conventional physico-chemical treatment processes with those of proven membrane technology. By a process known as 'cross flow' filtration and separation, the membrane acts as a fixed physical barrier which selectively separates specific ionic and/or non-ionic species from the solvent. Effluent is fed into the membrane filters so that it flows parallel to the membrane surface. While in contact with the membrane surface, a percentage of the effluent filters through the membrane (known as the permeate) and the balance, containing the pollutant species, discharges out of the system (known as concentrate).

Esmil worked closely with Desalination Systems Inc of the USA, one of the world's largest suppliers of speciality membranes, in

developing the reverse osmosis (RO) membrane plant, and also formulated a new polyelectrolyte especially for the cheap and efficient flocculation of wood pulp effluent.

Construction and commissioning was completed in seven months and since then a second plant has been installed at Kronospan's new development at Sanem, Luxembourg.

Operating around the clock, the Chirk plant treats all the MDF effluent generated on site. Excess MDF effluent leaving the processing line is initially stored in a balancing tank prior to being pumped into the Esmil plant where it is dosed with polyelectrolyte, mixed and then flocculated in a dedicated tank. Flocculated effluent is then pumped into a plate-type filter press which produces a cake with over 50% dry solids content. Filtrate is fed to a holding tank from where it is then pumped through a dual media sand filter. Concentrate from the RO membrane is stored in a dedicated holding tank prior to recycling. All dirty backwash/cleaning waters from the filter press, dual media filter and RO membrane system are recovered and returned to the head of the works where it is combined with the incoming MDF effluent. All solid and liquid phase outputs can be recovered.

Twelve months operating data from the Chirk plant confirms that the Esmil MDF product recovery and effluent treatment plant is achieving:

- 90-95% process water recovery for re-use as chip wash water, boiler feed or general process water
- RO concentrate recovery (remaining 5-10% of flow) and re-use as make up water for the resin binder
- 100% solids recovery, incinerated on-site for steam production.

While the plant can be substantially automated and an operator trained within a matter of weeks, Kronospan has chosen to give Esmil full responsibility for running the plant under a lease purchase contract.

Under the contract, Esmil owns the plant and is responsible for:

- employment and training of the site operators
- day-to-day operation of the plant
- chemical and maintenance costs
- treatment of all effluent up to a pre-agreed maximum daily



volume

- ensuring the plant meets Kronospan's 'water quality objectives'.

For this, Esmil receives a percentage of the initial capital cost and a monthly service fee which covers all costs and allows a margin for profit. When the lease purchase contract expires, it can either be renegotiated or Kronospan can purchase the plant at a pre-arranged price corresponding to the outstanding capital cost.

A member of the Dee Valley Waste Minimisation project, Kronospan is gradually identifying a range of opportunities for process optimisation some of which include new ideas for water re-use. A new MDF processing line is also due to come onstream within the next year making flexibility an essential aspect of the effluent treatment plant design.

According to Steve Finnemore, the modular design of the plant combined with the lease purchase concept enables Esmil to respond quickly to customer needs. "Being on-site 24 hours per day, Esmil becomes integrated in the daily operation of the factory," he said. "This enables us to accumulate detailed knowledge on issues such as process water demand variations and the effect of production cycles and process shutdowns.

"We can proactively participate in manufacturing trials in terms of continued optimisation of the effluent treatment and recovery plant to mirror changes in effluent composition and water quality requirements for recycled process water."

In addition to the advantages of outsourcing effluent treatment, the use of membranes is opening up new opportunities in product recovery and water re-use which were not technically feasible a few years ago. Esmil says that membranes, used in conjunction with advances in coagulation chemistry, can be used in the treatment and recovery of organic and high strength organic effluents from a range of manufacturing industries.