

# P. Pulp and environment



## Happi Otsoni

*At Kaskinen, Finnish Pulp and Board producer Metsä-Botnia recently inaugurated the world's largest ozone bleaching plant.*

*It is capable of producing up to 1.450 tonnes per day of high quality fully bleached pulp, while meeting the highest standards of environmental protection. A noteworthy success also for Air Liquide and its daughter company Ozonia.*

*Kaskinen's site.*

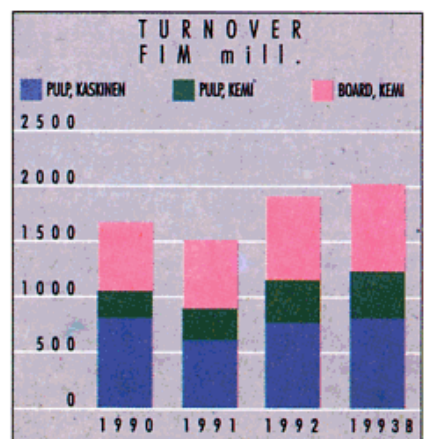
In Finnish "Happi" means oxygen and "Otsoni", of course, ozone. But from what follows, translating this to "Happy Ozonia" is indeed well justified.

### KASKINEN : US\$ 16 MILLION FOR OZONE BLEACHING

Located on the West coast of Finland, the Kaskinen mill is part of the Oy Metsä-Botnia Ab Group, "MB". Together with its Kemi site, further to the North, MB has a production capacity of 950,000 t/year of pulp and 330,000 t/year of board.

The company also operates three sawmills producing 350,000 m<sup>3</sup>/year of timber. The 1993 turnover at Kaskinen and Kemi was about 2.1 Billion Finnish Markka, that is about US\$ 380 million. The mills typically export 60 % of their production, which is detailed in the graph. MB is part of the Metsä-Serla Group.

In 1991, Kaskinen started TCF (totally chlorine free) pulp production using oxygen and hydrogen peroxide. A research program amounting to 15 million FIM (US\$ 2.7 million) was initiated in collabo-



ration with Metsä-Serla and trials were carried out in several European research centers, including CTP (the French P&P Technical Center) in Grenoble, France. The project to convert to ozone-based TCF bleaching progressed rapidly : in 1992 the decision was taken to implement ozone on industrial scale, and start-up took place in November 1993. Investment for the ozone bleaching plant amounted to 90 million FIM (US\$ 16 million). Ozone is produced on-site using

generators with a capacity of 300 kg/h of ozone at 10 % by weight in oxygen, sufficient to bleach 1.450 t/day of pulp. Bleaching is carried out at medium consistency using mixing equipment supplied by Ahlstrom. The ozone generation system was supplied by Ozonia, a daughter company of Air Liquide and Degrémont, a worldwide company specializing in water-treatment engineering and construction. Today Kaskinen alternates between :

- ECF bleaching using two-stage oxygen delignification, an ozone stage, a hydrogen peroxide stage, and two chlorine dioxide stages ;
- TCF bleaching with two-stage oxygen delignification, metals elimination, an ozone stage, and two hydrogen peroxide stages.

Three billion Finnish Markka (FIM) at Rauma for an effluent-free mill : with as major shareholders United Paper Mills, Metsä-Serla and Metsäliitto, the final green light has been given for the construction of a new TCF-bleached softwood kraft mill, to be built at Rauma, about 150 km South of Kaskinen. Including about 1.000 forest workers, the mill will provide employment for 1.550 people. As the aim is to eliminate liquid effluents, the mill will most likely utilize oxygen, ozone and hydrogen peroxide as bleaching agents.

The aim of incorporating ozone bleaching was to produce TCF pulp having 85 % ISO brightness for softwood and 88 % for hardwood. In fact, after only two months of operation 87 % ISO brightness was reached for softwood and 88 % for hardwood, while the objectives of brightness stability and preservation of mechanical properties were also met. Liquid effluents were substantially reduced, AOX has been practically eliminated and chemicals expenditures have diminished.

Kaskinen continues to progress towards recirculation of the waste waters, thereby substantially reducing effluent volumes and the associated color- and phosphorous rejects.

## OZONE " ON TAP "

One of the noteworthy features of the agreement signed between MB and Air Liquide is that it provides for "on tap" ozone supply. The ozone production system, designed and installed by Ozonia, is owned and operated by Air

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Liquide's 1993- born Finnish subsidiary. The contract calls for a supply of 300 kg/h of ozone at a concentration of 10 % by weight in oxygen, at a pressure of 10 bar.

## METSÄ-BOTNIA WITHDRAWS FROM FINNCELL

Metsä-Botnia and Metsä-Serla, daughter companies of Metsä-Sellu Oy, have, since July 1993, decided to withdraw from Finncell and to market their production through their own organization. It was the diversity of the product range, which will add up to a total of 1.9 million tonnes/year by 1996, which prompted this decision. The new organization will become effective January 1, 1995.



Mr Juhani Yli-Paavola, Managing Director of Oy Metsä-Botnia AB (at the left) and Mr Kaj Bärlund, Director General of the National Board for Water and Environment (at the right) in front of one of the Ozonia generators.

The system installed by Ozonia includes six ozone generators of 50 kg/h capacity each, and three compressors. It is fully automated so as to adapt ozone production to the requirements of the bleaching process. The gas stream at the exit of the bleaching stage is fed through a residual-ozone destruct unit to avoid any toxicity risks, and is recovered to be used for oxygen delignification.

The industrial use of ozone at 10 % concentration is witness to major technological progress : only a few years ago, the highest ozone concentrations that could in practice be reached in oxygen were of the order of 6 or 7 %. Thanks to substantial R&D efforts, in particular regarding the dielectric material that stabilizes the electrical discharge in which ozone is created, Ozonia's Advanced Technology generators are able to increase concentration by about 70 % at

the same specific power consumption. Among other improvements are the increased capacity of the individual generators and lower dependence on cooling water temperature.

## 92 YEARS OF DYNAMISM

Even at the end of 1993, a gloomy year for industry in most parts of the world, the major French daily newspaper "Le Figaro" wrote about Air Liquide : "The worldwide leader in industrial gases, a shareholders' favorite, is resisting the crisis and maintains a net profit of 8 %". Founded in 1902, the Company had to face an inherent handicap : its products cannot be economically transported over long distances. One of its forces was to turn this situation into an advantage, by, from the start, establishing itself throughout the world at close proximity to its customers. As early as 1907 a subsidiary was created in Japan. Today, Air Liquide has industrial presence in 60 countries, of which Finland is the latest addition.

To improve understanding of individual customer needs and provide economically competitive solutions and services, the Group recently put into place an ambitious decentralization program throughout its subsidiaries.

## Air Liquide key figures (1993)

- Sales : US\$ 5.361 million
- Net earnings : US\$ 393 million
- Cash Flow : US\$ 913 million
- Over 1 million customers
- 300,000 shareholders
- Industrial presence in 60 countries
- 7 major research centers
- More than 550 production plants
- 6.700 km pipelines
- 800 patent applications concerning new production technologies and new product applications.

## A WORLD-WIDE STRATEGY FOR THE PULP AND PAPER INDUSTRY

The Pulp and Paper industry has been singled out as a customer segment where Air Liquide's approach is coordinated at the Group level. Dr. Thomas Govers, who heads the Pulp and Paper Division, and his collaborators worldwide, focus on understanding customer expectations and the implications of rapidly changing market requirements and environmental regulations. The challenge : to mobilize the Group's global resources and its experience in the appli-

cation of the three environmental-friendly bleaching agents : oxygen, ozone and hydrogen peroxide. From research centers to international conferences, from project studies in North America to industrial start-ups in Finland, the Pulp and Paper team is dedicated to proposing technically and economically competitive solutions that meet even the most stringent environmental requirements. One of its most significant successes was to have won Metsä-Botnia's confidence, allowing Air Liquide's young Finnish subsidiary to become the pioneer of over-the-fence ozone supply services.

For Air Liquide, North America stands out as a major potential market for oxygen and ozone applications. Today, all chemical pulp mills in Sweden have implemented oxygen delignification, and in Finland about 80 % of the mills have done so. In North America, the ratio stands at about 30 %. This contrast reflects a difference in the approach to environmental concerns and legislation. Confronted by the necessity to reduce AOX levels in bleach plant effluents, Swedish mills reacted by implementing oxygen and full chlorine dioxide substitu-



Dr. Thomas Govers heads the Air Liquide Group's Pulp and Paper Division.

tion. American mills were more concerned by reducing COD and BOD levels (Chemical and Biological Oxygen Demand), and adopted effluent treatment plants to meet this requirement. Today, the new "cluster rules" proposed by the US Environmental Protection Agency (EPA) include, among others, stringent limits on AOX, the implementation of which will require significant process changes and investments in many American mills.

With the notable exception of Union Camp at Franklin, Va, USA, industrial-scale ozone bleaching is so far limited to Europe. As a means to produce TCF pulp, ozone bleaching is giving mills that have adopted the process a marketing advantage, in particular in German-

speaking countries. For Thomas Govers, the objective is "to collaborate with pulp and paper mills in their effort to meet market demand and increasingly stringent regulations. Combining oxygen, ozone and hydrogen peroxide is one of the most attractive bleaching solutions, as it allows very substantial reductions in undesirable effluents". For him, the ECF vs. TCF debate as such will rapidly become obsolete : the real issue is how these options can contribute to making the TEF (Totally Effluent Free) mill a reality. Such a mill not only meets the highest standards of environmental protection. It can also be an economically attractive solution : in the case of a new bleach line, up to 10 % reduction in investment costs has been estimated and even more significant savings in operating expenses.

### WELL AHEAD OF THE FIELD

Air Liquide has taken a clear competitive lead in regard to ozone bleaching technology. It is today the only industrial-gases producer that has an affiliate specializing in the design and construction of ozone production systems. Founded in 1990, as a Joint-Venture with Degremont (part of the Lyonnaise des Eaux-Dumez Group), Ozonia rapidly established itself as the market leader for large capacity ozone systems.

At time of writing, nine pulp mills have adopted industrial-scale ozone bleaching. Of these, five have chosen Ozonia systems. Air Liquide and its partner Degremont also collaborated in co-financing the bleaching pilot plant at CTP

Air Liquide also progresses in oxygen applications. The company was recently awarded a long-term contract by Sappi-Saiccor, who are increasing capacity at their dissolving pulp mill at Unkomaas, South Africa.

There too, supply is "on-tap", oxygen being produced by a 20 T/day COMPACT VSA, owned and operated by Air Liquide's South-African subsidiary. Sappi and Air Liquide have a long record of collaboration ; the first industrial application of oxygen delignification was implemented at Sappi's Enstra mill in 1970 following joint development by Sappi, Air Liquide and Kamyr.

in Grenoble. This facility is equipped for ozone-bleaching both at high (30-35 %) and medium (10-12 %) consistency. A wide variety of other bleaching agents can also be used, to test ECF or TCF sequences. An increasing number of mills from all over the world are making use of these possibilities, both for virgin and recycled pulp. Recently, successful pilot trials were carried out for a major recycled-pulp producer, as part of a collaborative project with Air Liquide's Chicago Research Center.

With this first Finnish success, Air Liquide marks a further step in the industrial application of ozone for pulp bleaching. Thanks to its unique experience in the production and application of the three powerful bleaching agents, O<sub>2</sub>, O<sub>3</sub> and H<sub>2</sub>O<sub>2</sub>, the Group is well positioned to be a major contributor to the development of environmental-friendly bleaching technology.

G.-G. B.

### FIVE OUT OF NINE OZONE BLEACHING PLANTS HAVE CHOSEN OZONIA SYSTEMS

Compagny	Site	O <sub>3</sub> capacity	S/up	Comments
Union Camp	Franklin Va USA	280 kg/h	1992	1.000 t/d softwood kraft ; H.C.
Stora Billerud	Skoghall Sweden	42 kg/h*	1992	200 t/d softwood kraft ; M.C.
MoDo Paper	Husum Sweden	200 kg/h*	1993	850 t/d birch kraft ; M.C.
Metsä-Botnia	Kaskinen Finland	300 kg/h*	1993	1.450 t/d hardwood and softwood kraft ; M.C.
S. C. A.	Östrand Sweden	>> 100 kg/h*	1995	900 t/d hardwood and softwood kraft ; H.C.

The asterisk (\*) designates high-concentration ozone : 10 % by weight in oxygen, or more. H.C. stands for high consistency ozone bleaching, and M.C. for medium consistency.

For further reading, see also the following technical articles in La Papeterie :

- L'ozone s'attaque aussi aux vieux papiers (Ozone also tackles recycled fibers) n° 176, Feb. 1994
- Pulp bleaching : Ozone is "in" ! n° 179, May 1994