

Mills seek added value from product suppliers

In converting to alkaline and refining their processes, two Swedish paper mills have enlisted the talents of their suppliers.

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Editor's note: Times change, as do business relations and customer expectations. A trend in recent years has been the effort of suppliers to form partnering relations with their customers. Another is the expectation that suppliers do more than deliver a product. In the following article, we've singled out one supplier and two mills in Europe to illustrate those ideas. We could as easily have picked from a dozen other suppliers and mills, but we believe Cerestar and the mills of MoDo and SCA are representative.

In good times or bad, partnerships can offer advantages to suppliers and mills. Whether good times or bad, mills have come to expect more of suppliers by way of technical expertise and product support. Lean years can put a strain on the relations, and currency devaluations, as in Finland and Sweden, can further test the value added to a product by a good supplier.

In the past few years, two Swedish paper mills have called on their suppliers to help in converting their papermaking processes from acid-based to alkaline. One of the companies that participated in those conversions and has been a supplier to both mills is Cerestar.

Cerestar, the largest manufacturer of starches and starch derivatives in Europe, is an example of a "value-added" supplier. In selling its products including cationic wet-end starches, surface sizing, coating starches, and cookers, the company emphasizes that it provides more than just a finely ground powder. Along with the basic product comes research and trouble-shooting capabilities, a sophisticated transportation and customer service operation, and a commitment to helping the customer get optimal results from the starch and equipment.

Olle Dahlin, general manager for production at SCA's Wifsta paper mill



Hans Engman, manager of process and quality at Wifsta



Technocenters

The science and technology of transforming wheat, potatoes, and corn/maize from produce into products, and the application of those products, is the concern of Cerestar's R&D centers in Vilvoorde, Belgium, and Krefeld, Germany.

Research and development activities are orchestrated from Vilvoorde, not only for paper use, but also for food and other industrial applications. There is direct

cooperation with the company's "Euro Centres," applications centers for paper, corrugating, and food industries, explained Helmut Koch, director of R&D at Vilvoorde. Those are basically "small, technical development departments for the adaptation of R&D research and for implementation," Koch said. They also serve "as a focal point to collect problems and translate them to R&D and to translate solutions from R&D to the plants."

Projects of potential commercial importance or that involve a substantial investment are steered by a committee of marketing and sales, manufacturing, and strategic planning representatives at Brussels.

"We are trying to avoid developing local solutions to European problems and trying to make sure that we operate in a European framework, on a European scale, even if that work is done in France or Germany," said Karl-Heinz Bahr, research area manager at Vilvoorde.

At its simplest, the researchers are looking at ways to modify starch rheology and interactions to best suit customer needs, Bahr suggested. That may start with the choice of starch source: potato, corn, high-amylose corn, waxy maize, etc. High amylose content, for example, implies low viscosity and a tendency to set back; high amylopectin content, as in waxy maize, implies ready solubility

I. General application property profiles of different cationic types in neutral papermaking

	<u>Corn</u>	<u>Waxy Corn</u>	<u>Potato</u>
Drainage	-	+	++
Filler Retention	+	++	+++
Size Retention/ Sizing efficiency	+	++	+++
Strength	+++	+++	+++

II. The influence of the main papermaking additions on paper properties

	<u>Internal + surface strength</u>	<u>Retention</u>	<u>Sizing</u>	<u>Opacity</u>
Cationic starch	++	+	++	0/-
Pigment	--	-	-	+++
Sizing Agent	0	0	+++	0
Retention Aid	0/-	+++	++	+

+ improvement
0 no direct influence
- negative influence

III. Functionalities of the principal additives in papermaking

<u>Additive</u>	<u>Paper Grade</u>	<u>Desired Functionality</u>	<u>Additive Involved</u>
Starch	Newsprint	Improve strength	Starch
Starch Filler	Improved Newsprint	Improve opacity (retention) maintain strength	Filler(Starch), Starch
Starch Filler Retention/Dewatering	Improved Newsprint SC PaperLWC base	Improve capacity (retention) Improve strength Improve dewatering	Ret. Aid, Filler, (Starch) Starch Retention/Dewater, Aid
Starch Filler Retention/ Dewatering Aid	Woodfree Coating Base	Retain filler (fresh, ex broke) Increase internal bond Improve strength (coater runnability) High dewatering at good formation	Ret. Aid, Filler, (Starch) Starch Starch Ret./Dewat. Aid, (Starch)
Starch Filler Retention/ Dewatering Aid Size	Book Printing Paper	Improve opacity (retention) Maintain strength Retain resin/med. rosin	Ret. Aid, Filler, (Starch) Starch Retention Aid, Starch
Starch Filler Retention/ Dewatering Aid Size	Printing & Writing Grades	Achieve highest possible filler level Improve strength (machine runnability). Hard sizing at low AKD/ASA dosage. High dewatering at good formation	Ret. Aid, Filler, (Starch) Starch Ret. Aid, Size, Starch Ret./Dew. Aid, Starch

and higher storage stability, among other characteristics. The general applications are illustrated in Table I. The inherent properties may then be modified through acid, enzyme, or chemical treatment and further through oxidation, esterification, etherification, or in-mill treatment.

In North America, where Cerestar is a recent player, companies such as Penford Products have identified three basic reasons for an increased demand for modified starches:

- Higher operating costs at paper mills
- Conversion of paper mills from acid to alkaline systems
- Conversion from commodity-type starches to higher-performance modified starches.

Like Cerestar, Penford emphasizes the value-added characteristics of its products and its technical services. The company predicts that "essentially all domestic (United States) uncoated freesheet will be alkaline based" by 1997. Almost all coated freesheet papers in the United States are already alkaline, they note.

According to Penford, "the alkaline process improves the quality of the sheet, reduces costs by replacing wood fiber, and produces fewer effluents, (thus) reducing the waste stream from mills." Both hydroxyethylated and cationic starches "contribute to sheet strength and good printing performance," the company reports.

Other additives also affect paper properties, of course, as seen in Tables II and III, and the influence of starch on those properties and in combination with other additives must be considered.

Cerestar conducts paper application studies in Krefeld, the site

of its Euro Centre Paper. The facility, which opened in 1966, is used by European and North American paper manufacturers for problem-solving, product development, and training. An essential tool for doing that is the facility's pilot coater. The machine "can coat almost any grade of paper or board with virtually any formulation," the company states.

The pilot coater runs at speeds of 50–2000 m/min and can handle a sheet trim width of 520 mm. Starch can be prepared in three separate ways: by conventional cooker, by thermochemical converter, or by enzyme converter. The test sheet can pass through a size press (one- or two-sided), film press (one- or two-sided) or gate roll (one-sided). A short dwell coater is available with blade, roll blade, or hydrobar, as is a roll applicator. Other options include a metering bar coater, an air-knife coater, and a 12-roll supercalender. Both infrared heaters and air floater dryers are available.

A well-equipped industrial laboratory and experienced lab staff at Krefeld support the pilot machine and field technicians. The lab is used for preparing starch adhesives and coating colors, measurement of flow properties, wet-end evaluation, materials and print testing, diagnostic investigations, and other tasks.

Cerestar also maintains close links and collaborates with a variety of universities, research centers, independent mills, consultants, and government agencies.

Both MoDo and SCA have made use of those resources and the resources of other suppliers to develop and refine papermaking and coating processes and to assist in converting some of their paper mills in Sweden to the alkaline process.

The mill at Husum

Five years ago, MoDo decided to switch the Husum paper mill, near Örnköldsvik, from acid to neutral, primarily as a means to improve the whiteness of the copy paper it produces and to reduce costs through increased filler content, according to Jan Åström, paper mill manager. To accomplish that change, they took "a very professional approach," said Lars Ölander, managing director of Cerestar Scandinavia. They assembled a group of technical experts from the chemical suppliers they were using—Cerestar for starch, OMYA for pigments, Nalco for retention aids, and Hercules for sizing—gathered them in a room and had them solve the problem together.

"You had to cooperate," Ölander said. "You had to show your cards and share what you knew and how you could make a contribution," he said.

Mill representatives met with the suppliers group twice a day for a progress check and to answer questions. It led to "very good discussions and you put pressure on everybody," Ölander noted. Trials were conducted on one machine, then another, with the goal of changing all three paper machines to neutral at the same time.

Once the date for the change was set, MoDo gave the suppliers roughly three months to prepare the mill staff. "This was also a responsibility that we thought was very refreshing and good," Ölander said. "You could educate the people how to act in different circumstances, the reasons for starch use, and why it's necessary to control this or that and so on."

Finally, with little more than an overnight shutdown, during

which the machines were cleaned and pH increased, the mill went alkaline.

"And then you start the real work," Ölander added. "Now you have to follow up: what kind of starch is the optimum in combination with their retention aids and the filler and the sizing? So before you talked about it and after you had to figure out if it was really working."

A portion of the paper now produced at Husum is sent to the Silverdalen mill as a base for coating. The mill management wondered if there might be a technical and economic advantage to precoating the paper before shipping it south. Cerestar thought that might be the case and adapted a special starch for the precoating. A lot of trial and error and discussion went into the development, but both sides are pleased with the final result.

"And we have kept quiet about what we have done with the starch," Ölander pointed out. "We have not approached any other company with this because we think it is fair that MoDo get the lead time."

The mill near Sundsvall

SCA's decision to convert the Wifsta paper mill to alkaline was market driven, with two main goals: greater brightness and aging stability, according to Olle Dahlin, general manager of production at Wifsta. One reason for the increase in brightness is the filler itself, the ability to use calcium carbonate. The mill is conducting tests using different grades of calcium carbonate to optimize its results. Dahlin noted that the mill has opted for "pigments with very small particles," but for some grades it may be able to use coarser grades to increase filler content where brightness is less of a concern.

Before making the switch, the mill ran some trials, Dahlin said. The data supported the change, so a project organization was set up, headed by Dahlin and Lars Wägberg, head of the paper chemistry department at SCA Research AB. The team set a target date of January 1992.

The team listed the various chemicals used for sizing, retention, filler, and starch and then identified roughly three suppliers for each group. Those suppliers interested in participating in the project with the SCA Research Company were asked to submit references, background information on their companies, and their bids. The companies that passed the screening process then joined in the project.

Some of the trials were then conducted at SCA Research, some at the individual supplier laboratories, and some jointly. By autumn of 1991, the team had conceived a "total concept" for the alkaline system, Dahlin recalled. It was reviewed with the suppliers and potential problems were worked out.

The broke system was a particular area of concern. As a one-machine mill, Wifsta could be particularly susceptible to fluctuations in the percentage of broke being mixed in with the pulp, Dahlin explained. About 20% of the fiber furnish consists of broke, he said.

Ölander noted that SCA chose not to use starch in the wet end, so the starch that comes into the system is from the surface sizing off the broke. It took several trials and much discussion to settle on

Partnering

Jan Åström (left), paper mill manager at MoDo's Husum mills in Sweden



A starch container being loaded at Sas van Gent, The Netherlands



how to regulate the broke and treat the system, said Nils-Olaf Bergh, head of Cerestar's Euro Centre Paper.

A related question was how the mixture might affect the size press, because "you have more or less fully sized paper coming into the rewetting in the size press or speed-sizer," Ölander said. "We tried to get as much information as possible from our experience with the equipment at the mill, from our own laboratory equipment, and other machines with regard to speed, concentration, how the starch must behave, the stability of the starch, and so on to try to minimize the risk."

Another concern was the impact the switch might have on effluent from the mill, which was operating near the COD limits allowed for Wifsta.

"Normally, if you're comparing native starch and traditional oxidized starch with the cationic starch, by changing to cationic starch you can normally reduce your COD up to 50%," Ölander said. A mill like Wifsta, however, which is more sensitive to fluctuations in the broke and the impact on the retention system, has to balance effluent requirements against production requirements, he said.

"We did a lot of research on the retention system and ran a lot of trials with all types of retention aids to find out what would work best for Wifsta," said Hans Engman, manager for process quality at the mill.

Process changes also involved equipment changes. The size and filler systems were rebuilt and storage capacity was increased to minimize variations in the broke.

A starch container loaded for transport



Educating the mill staff was another important component of the change to alkaline, "which was the basis for the success here in production," Dahlin said. It wasn't something just left to a few engineers, "everybody took part." Each of the mill's five shifts was considered a group, to which remaining staff were assigned, and then a full day was spent educating each group. They learned about why the mill was shifting to alkaline, what work was done during the project, what changes needed to be made in the process, what chemicals would be used, and how to properly handle and use the chemicals.

Another aspect to the training was planning for the shutdown of the acid-based system, cleaning of the entire system, and restart-

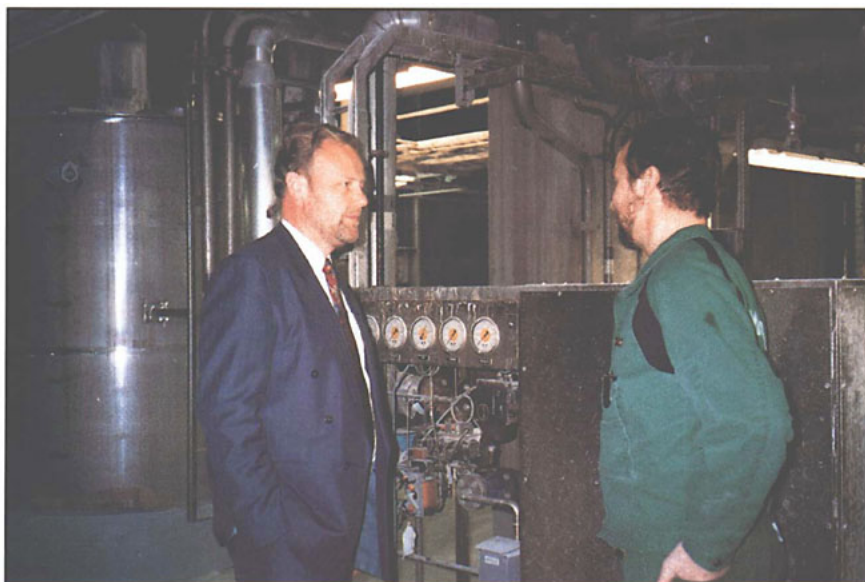
Nils-Olaf Bergh, head of department at Cerestar's Euro Centre Paper, Krefeld, Germany



Helmut Koch (left), director, and **Karl-Heinz Bahr**, research area manager at Cerestar Research & Development, Vilvoorde, Belgium



Lars Ölander, managing director, Cerestar Scandinavia (left)



ing as alkaline. Mill staff were told what they would need to do during the cleaning process and how to do it.

The cleaning was critical to the success of the conversion, Dahlin said, as were the pretrials and problem-solving that took place beforehand. "We had a schedule for startup where we had people from the research department, and engineers, and people from suppliers who were scheduled for the first week to work around the clock," Dahlin said. "But everything was running so good that after a week we went back to a day shift and normal staffing."

possible on the contract. "But when we have set that, we have to work hard with the suppliers" on the technical aspects and production of the product, and the transportation from factory to mill. "We try to find solutions that fit our system best, and if we can help a supplier with the logistics, that's a benefit for us, also," he said.

Keeping customers supplied can be a bit like juggling: at any point in time you have to have sufficient supplies in transit, a sufficient stock pile on site, and a sufficient number of empty containers en route back to the plant to be refilled, Ölander explained. That also implies a considerable investment in shipping containers.

Delivering the product

No matter how good the technical services, a company must also be concerned with the logistics of keeping customers supplied. Part of that is making sure customers don't forget to reorder and that they're happy with the product they receive.

When a contract is signed, Cerestar staff begin monitoring use for variations or delays in scheduled reorders that could lead to an unexpected shortage at a mill, then make reminder calls as needed.

A logistical arrangement that works well for Cerestar and MoDo is for the starch supplier to transport some of its containers to Sweden on MoDo ships returning from delivering paper to the European continent.

Åström explained that the first consideration is simply to make the best deal

Partnering

Cerestar uses specially designed containers. Its standard 20-ft container has 1300-ft³ capacity and is equipped with a pump to blow the starch product in storage silos. The containers are generally transported by truck and, in a few cases, have been equipped with special mixers to convert the dry starch to slurry on site.

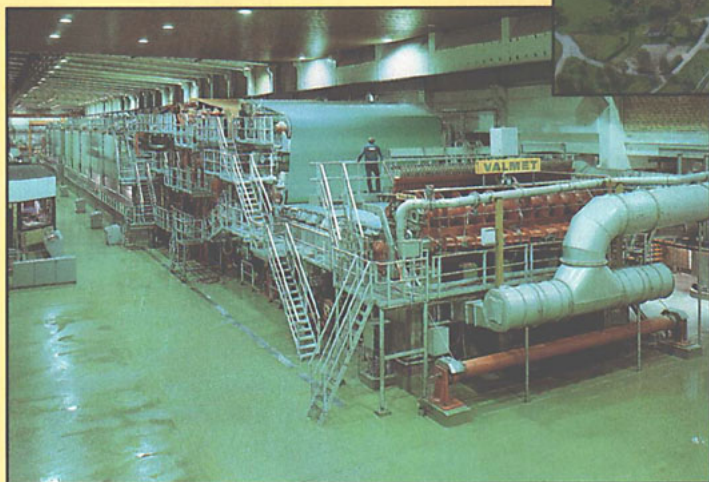
Although Cerestar has refrained from becoming an equipment

manufacturer, it does assist in the design, contracting, construction, and installation of cookers for its customers. "We like to make starch in the region where they are used," Bergh said. The company has 150–200 cookers installed worldwide, though most are in Scandinavia.

The Husum paper mill is equipped with starch, the first

MoDo Husum

Just north of Örnsköldsvik, on the Bothnian coast of Sweden, sit MoDo's Husum sulfate pulp and fine paper mills. Production capacity at the pulp mill hit 690,000 metric tons in 1991. The fine paper mill has the capacity to produce 475,000 metric tons of paper annually, of which 200,000 metric tons can be converted into A3 and A4 sheet stock.



Top: MoDo's pulp and paper mill in Husum, Sweden
Left: PM 8 at Husum

The three paper machines at Husum each have a wire width of 7.2 m and produce about 150,000 tpa each at speeds of 800–1000 m/min. The oldest of the machines, PM6, started in July 1972. PM7 came on line in October 1976 and PM8 started in September 1985. PM6 is used to produce 80–200 g/m² paper, PM7 produces 70–80 g/m² paper (mostly copy paper), and PM8 produces 40–70 g/m² paper.

The pulp mill, which started in 1919, is slated to convert its hardwood kraft line to ozone-bleached, totally chlorine free by summer. The birch hardwood line has a capacity of 350 tpa; the bleached softwood line has a capacity of 340 tpa.

A precoater was installed on one of the paper machines during 1991. The mills also became ISO 9001 certified that summer.

supplied in 1972. As with any mill, Husum had specific qualities it was looking for in its cookers, such as reliability. So certain safety features were built in to handle a sudden loss of power or water, for example. And automatic systems to handle excess demands for surface sizing were included.

And as a customer makes demands on a supplier's products, the

supplier learns from those changes and can improve its products and services. "We have always tried to comply and it has improved our overall knowledge of the starch for the size press," Ölander said. ■

Meadows is editor of Tappi Journal.

SCA Wifsta-Östrand

At the end of a narrow peninsula, just up the road from Sundsvall in Sweden, SCA's Wifsta fine paper mill produces 150,000 metric tons of 60–90 g/m² printing and copy paper a year.

The mill was rebuilt and converted from a maker of kraft paper to fine paper in 1982.

In 1988, work began to integrate the pulp mill at Östrand with Wifsta. Pipelines to carry pulp and steam to the paper mill were built along the shore and



Top: SCA's Wifsta paper mill near Sundsvall, Sweden
Left: The paper machine at Wifsta



under the bay. The electricity generated by the pulp process satisfies most of the paper mill's energy requirements.

The pulp mill has an annual capacity of 320,000 metric tons of bleached kraft pulp, about a third of which is hardwood pulp. Pulp passes through an oxygen delignification stage before going on to the bleach plant. The pulp is considered elemental chlorine free.

A CTMP plant, which started in 1982, produces an additional 80,000 metric tons of pulp a year.

The Valmet paper machine has a trim width of 5.3 m and runs at a speed of 900–1000 m/min. It's equipped with a twin-wire former, and a speed-sizer in the dryer section.

Cut-size is produced on two Will-Pemco lines with a total capacity of 90,000 metric tons a year.