

Fiber for fabrics ... and the future

Oji Paper is one of the leading paper company's in Japan, and has considerable global reach. Oji's long tradition of innovation in pulp and papermaking now includes a quality alternative to cotton for clothing – dissolving pulp for rayon textile production. The Yonago mill began commercial production of dissolving pulp in early 2014 after ANDRITZ technology was utilized for the conversion. It is another step in securing the future and sustaining the economic momentum of the company.



▲ Shinji Doigaki, Oji Yonago's Pulp Section Manager

The Yonago mill is located 200 km west of Kyoto, between the famous Daisen Mountain to the east and the Hino River to the west. The fiberline at the mill was retrofitted in late 2013 for continuous dissolving kraft pulp (DKP) production. "This smaller line was well suited for conversion to DKP because our traditional products are facing a declining market," says Shinji Doigaki, Pulp Section Manager. "Our 1,200 t/d pulping line will continue to produce bleached pulp for coated base paper as before."

ANDRITZ assisted in modifying the original liquor-phase digester (ANDRITZ technology installed in the late 1990's) to a vapor-phase design with a new TurboFeed chip feeding system and a Diamondback pre-steaming vessel. An ANDRITZ pre-hydrolysis vessel (PHV), necessary for the production of high-quality viscose pulp, was installed. The DKP is now fed to a new 2.4 meter wide ANDRITZ pulp drying plant, producing both rolls and sheets for Asian markets with a design capacity of 300 adt/d.



"Wood pulp for textiles is an important strategic product for us," says Masaki Chiba, who leads dissolving pulp development at Oji Paper. "Also, the conversion of hemicelluloses, by-products from the pre-hydrolysis process, into furfural (a high-value solvent) creates another revenue stream."

Diversification yet with things in common

Oji's management and R&D team saw the potential for diversification from their pulp and paper base, but with much in common from a manufacturing standpoint. The new pulping process uses eucalyptus chips as the fiber source and centers on the addition of the PHV for high-purity pulp.

"Clothing is often made from a blend of materials, such as cotton, rayon, and polyester," Chiba explains. "Designers want a certain feel to the touch and a look to the eye. Our wood-based fibers are ideal to help achieve the desired functionality – especially for coats and jackets which keep you warm, but are lighter weight."

Taketo Okutani, also part of the dissolving pulp team with Oji Paper comments, "Textile consumption will grow as the population increases. That's why we have confidence in dissolving pulp as a strategic offering for the future."

"When Oji Paper first called us to discuss the production of dissolving pulp with our continuous cooking technology, they made us aware of the strategic importance that this conversion has for them," says Chiaki Kawakami, President of ANDRITZ Japan. "They set high expectations for quality and efficiency right from the start. This is an important order for us and allows us to support Oji in their innovations. It is a great opportunity for us and we enjoy the challenge of working with their team to meet the demanding requirements of their customers."

▲ The pre-hydrolysis vessel (PHV) from ANDRITZ enables the production of high-purity pulp by isolating the hemicelluloses. These hemicellulose by-products serve as a new revenue stream as they are converted to furfural, an oil refining solvent, at the mill's pilot plant.



▲ Oji Paper top managers feel scarves with high rayon content in Ginza, Tokyo, where Oji Paper's headquarters is located. Left to right: Taketo Okutani, Masaki Chiba, Chiaki Kawakami (ANDRITZ), Tsukasa Watanabe and Motohiro Matsumura

Removing hemicelluloses the continuous way

Dissolving pulp has high cellulose content (> 92-97% compared to 85-90% for paper pulp). The pulp gets its name from the fact that the cellulose fiber is dissolved in a caustic solution to form viscose, which is extruded through spinners to form rayon filaments.

The production processes for dissolving pulp and paper pulp are quite similar as both use wood chips as the raw material. But for the production of dissolving pulp, a pre-treatment step is added to remove most of the hemicelluloses in the wood to achieve extreme pulp purity. Otherwise, the hemicelluloses will precipitate during the rayon production process, plugging up the filament spinners.

ANDRITZ technology for the production of dissolving pulp is based on many years of experience with chemical pulp fiberlines and intensive R&D in the area of hemicellulose removal. The key to dissolving pulp production is efficient removal and recovery of hemicelluloses from the fiber source. In earlier systems, which were usually batch-processed, it was difficult to achieve high efficiency, plus the ability to precipitate the by-products from hydrolysis was cumbersome.

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Masaki Chiba
Director, Dissolving Pulp Development
Oji Paper

All that changed with the introduction of the PHV – the pre-hydrolysis vessel – a new technology developed by ANDRITZ for hemicellulose removal with continuous cooking. "ANDRITZ re-designed the cooking process to include auto-hydrolysis for efficient hemicellulose removal," says Ryo Yoshida, ANDRITZ Project Leader. "With the PHV, the instability issues are gone and the operating costs are lower compared to the batch process. In addition, the

development of our chip feeding system (Diamondback and TurboFeed) contributes to stable operations."

Adds Doigaki of Oji, "The PHV helps to provide a new future for the Yonago mill. With better selectivity of the hydrolysis reactions and a purer stream of hemicellulose by-products, we can make a higher quality product."



▲ Left to right: Hidekazu Yamamoto, ANDRITZ and Suguru Nakamura, Oji Yonago

The Diamondback vessel maintains a steady flow of pre-steamed chips to the cooking system. The efficient removal of air around and within the chips enables fast and efficient impregnation. There are no moving parts in the Diamondback bin.



▲ Katsuhisa Iizuka (left) and Shinji Doigaki from Oji Paper next to the new 300 t/d drying machine for dissolving pulp.

Creating the hemicellulose value stream

The hemicelluloses in wood chips are decomposed and isolated in the pre-hydrolysis process. The chips in the PHV are subjected to high heat and pressure. After isolating the hemicelluloses, the wood fiber is made into pulp in traditional chemical pulping equipment. The only difference is that the dissolving pulp has extremely high cellulose purity.

The hemicellulose hydrosate isolated in pre-hydrolysis process undergoes further processing into furfural at a pilot plant in the mill, and can also be sold as an oil refining solvent. Oji has high expectations for this important potential value stream.

"We could burn the hemicelluloses in our recovery boiler," Doigaki says, "but producing furfural holds greater economic benefits for us."

ANDRITZ delivered the entire pulp drying system, including a twin wire press, two-nip heavy duty presses, an airborne dryer, cutter layboy, baling line, and the reel and winder. Design production rate is 300 t/d. Trim width is 2.4 m. Either bales or rolls can be produced, based on customer needs. ▶



◀ Oji's Masao Fujiwara inspects a dried sheet of dissolving pulp. High-purity pulp is a must for yarn producers, whose processes are impacted by the slightest level of contaminants. Sight inspection and a series of lab test are conducted for all production.

the top of the cooking reactor without the need for a high-pressure feeder. A special impeller arrangement inside the chip pump does not degrade the fiber and preserves strength.

Says Oji's Doigaki, "Simpler is almost always better. The ANDRITZ chip feeding has a simpler design. We have had some challenges stabilizing the chip flow to the DKP line, but we have good collaboration with ANDRITZ to arrive at solutions."

Yoshida of ANDRITZ comments, "Oji Yonago has a great approach to problem solving. They worked closely with us to fully optimize the continuous pulping system,



which is pioneering technology. This mill is only the second in the world using continuous pre-hydrolysis with hardwood fiber."

Pulp drying smooth from the start

As part of the conversion project at Yonago, ANDRITZ delivered the pulp drying plant which includes a twin wire machine with two-nip heavy-duty presses, an airborne sheet dryer, the cutter/layboy, a baling line, and the reel and winder. Design capacity is 300 t/d. Trim width is 2.4 m.

One grade of the dissolving pulp is shipped in bales, while the high-grade product is shipped in rolls. Of course, the Yonago mill's target is to produce as much high-grade product as possible.

According to Katsuhisa Iizuka, Oji Yonago's Chief Engineer in the Engineering Department, "There have been several challenges in starting up this line, but we are working through them in a good way. Oji and ANDRITZ are working cooperatively to resolve the small issues. None of these issues affect the quality of our product. It is good and getting better."

Adds Yoshida of ANDRITZ, "There has been a steady flow of pulp into the drying machine and the cutter. The dryer is equipped with automatic tail feeding and sequencing systems, so any downtime is minimized in case of a disturbance."

Naoki Hasegawa, Pulp Department Manager at Oji Yonago emphasizes Oji Paper's commitment. "These new capabilities reinforce our commitment to sustainability through innovation, providing good jobs, and ensuring safe operations," he says. "Sustainable and green manufacturing practices are key to the future."



“This is an important order for us and allows us to support Oji in their innovations.”

Chiaki Kawakami
President
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▼ (Left to right): Katsuhisa Iizuka, Oji Yonago;
Naoki Hasegawa, Oji Yonago; Ryo Yoshida,
ANDRITZ; and Shinji Doigaki, Oji Yonago

