NIPPON KUSHIRO

diversifying with rayon pulp

Nippon Paper Group, one of Japan's largest paper producers, has 20 mills in Japan and extensive overseas operations. For years, dissolving pulp was produced only at the Gotsu Mill, using a batch process. The decision to employ a continuous process for dissolving pulp at the Kushiro Mill was a bold decision. ANDRITZ aided in the pulping line conversion.

Nippon's Kushiro Mill, located on Japan's scenic north island, has a long tradition in pulp and papermaking. Since 1920, it has been a leading newsprint supplier. From 1970 to 1990, pulp production and pulp sheet capabilities were expanded. The most recent investment centers around modifications to the continuous cooking line so it can swing between producing softwood kraft and dissolving pulp. The key to Nippon Paper's strategy for long-term sustainable growth is diversity, which production of another pulp grade provides and which also includes energy generation for the local community.

"Producing dissolving pulp from softwood makes sense for us because we were already producing bleached kraft pulp in a continuous digester," says Kazufumi Yamasaki, Executive Director of Technology in the R&D Division of Nippon Paper. "Working closely with ANDRITZ, we decided to be the pioneers in a swing system. The twin vessels (an ANDRITZ pre-hydrolysis vessel and the continuous digester vessel), plus a streamlined chip feeding system, make this possible."

Kazufumi Yamasaki, Executive Director of Technology in the R&D Division of Nippon Paper (left) with Chiaki Kawakami, President of ANDRITZ Japan, near Nippon Paper's headquarters ▶

Nippon Paper's Hisashi Ochiai, Technical Manager, Production Department (left) and Takuya (Tak) Yamamoto, Pulp Engineering Manager, played important roles in optimizing the new dissolving pulp system. ▼

Examining ladies garments made from dissolving pulp rayon blended with cotton and polyester are Takehiro Kojima (left) and Takaoki Yanagiya (center) of Nippon Paper with Sawada Reiko of ANDRITZ Japan.▼

Kushiro's digester was the world's first vapor-phase upgrade back in 1996. It was modified to run Lo-Solids Cooking almost two decades ago. The pre-hydrolysis vessel (PHV) and supporting systems were installed in 2012.

Removing the hemis

For the production of dissolving pulp, a pre-treatment step is required 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.

Takuya (Tak) Yamamoto, Pulp Engineering Manager at the mill, says, "Dissolving pulp can only achieve high purity when the hemicelluloses are effectively removed. At our mill, this begins in the PHV by adding hot water to softwood chips under high temperature and pressure. This starts the auto-hydrolysis reaction and most of the hemicelluloses are removed."

Smooth feed with TurboFeed

The ANDRITZ TurboFeed system is considered ideal for integration with the pre-hydrolysis vessel as it helps stabilize the flow of chips to the process. Chips are heated and deaerated in the chip bin, then pumped to the PHV with three TurboFeed pumps. To help reduce energy costs, the process steam for chip heating comes from a reboiler.

"One of our biggest challenges was to stabilize the chip level in the PHV," comments Hisashi Ochiai, Technical Manager in Nippon's Production Department. "The flow of chips impacts the chip retention time, which impacts the quality of our pulp. That is why we worked closely with ANDRITZ to focus on keeping the chip flow and production rates constant. We are still adjusting the system, and coming much closer to the desired objectives."

"Whenever you do something entirely new, there are some surprises," says Tatsuo Ishii, Project Engineer with ANDRITZ. "The good surprise is that softwood pulp is versatile and can meet Nippon Paper's needs for entirely different products. The challenging surprise has been regulating the movement of chips within very tight specifications. This called for some mechanical and instrument refinements."

Swing finesse

Swing production between kraft and dissolving is facilitated by the PHV bypass line at the third chip pump outlet. In order to avoid mixing softwood kraft and dissolving pulps, drain lines are switchable for both acidic and alkali conditions. Kushiro's process control system activates the bypass. Everything is under control and relatively easy to manage, since the modified digester and other equipment operate nearly the same as before when the mill was producing only kraft pulp.

"Smooth transitions are essential to a mill's productivity and efficiency," notes Chiaki Kawakami, President of ANDRITZ Japan. "The PHV integrates well with the existing line. The beauty is that the same softwood pulp is handled in different ways to meet entirely different objectives. Nippon Paper has the flexibility to adapt to the marketplace to satisfy their customers. We are proud to have helped pioneer this system."

PHV made in Japan

The PHV technology was developed by ANDRITZ for hemicellulose removal in a continuous cooking process. The PHV ensures more stable production and pulp quality at a lower operating cost than a comparable batch process. For the Kushiro Mill, the PHV was built in the far south of Japan in Yatsushiro City, Kumamoto Prefecture. It was delivered to the mill in five sections. Erection of the 35 m high vessel went smoothly from start to finish.

Due to space limitations at the mill, Kushiro's PHV is located 40 meters away from the existing digester vessel. For this reason, a booster chip pump was installed between the PHV and the digester.

Operational status

Erection and mechanical construction was completed in September 2012, and chips began feeding for kraft pulp production in October 2012. The first dissolving pulp was shipped to customers in March 2013 after test runs and fine-tuning. Consistently good efficiency has been achieved ever since.

Says Hisashi Ochiai of Nippon, "In our early evaluation, we were concerned about possible scaling, but these issues have essentially been resolved. During the downstream processes, we pay attention to chemical additions to keep the pulp viscosity at a targeted level. Other than that, nothing has occurred that changes runnability significantly compared to the production of kraft."

Long-term sustainability

Nippon Paper is approaching the 100-year milestone in pulp and papermaking. Daily operations are viewed in context of a bigger picture. As Tak Yamamoto puts it, "Situated in a seaside city, we are conscious of fishermen and ocean life. We support the well being of rare red-crowned cranes, which migrate to and from the largest wetlands in Japan. We have high standards for logging and transport of local softwood from managed forests. We sponsor many community environmental programs in our region. Our name itself shows support of the Nippon Cranes professional hockey team, and we are big supporters of youth hockey. We are part of the community, and always seek ways to be job providers and good citizens for the long-term."

From a corporate viewpoint Kazufumi Yamasaki concludes, "Nippon Paper uses its resources in increasingly diverse ways, exploring all the possibilities of wood and creating new value to meet the needs of society."

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▲ Referred to as the "Dinosaur," the Lo-Solids digester is an icon in the Kushiro landscape.