

Super TMP: Creating SCA Quality Pulp Without Kraft.

How Alliance Donnacona uses Andritz refiners and a unique coarse fiber refining technology to produce high strength, kraft-free SC sheets.

WHEN THE MARKET CHANGED, SO DID THE MILL.

What do you do when your newsprint mill no longer has the production capacity to remain competitive in a cutthroat commodity marketplace? For many, the choice would be elemental: either shut the mill down, or risk millions on increasing capacity - which could still leave the mill at a competitive disadvantage against the newsprint mega-mills.

However, Alliance Forest Products took a very different route with their aging newsprint mill in Donnacona, PQ. They invested in - and developed - advanced technologies that transformed the Donnacona site into a mill that produces specialty and SC grades that have higher margins and more promising market demand than newsprint grades.

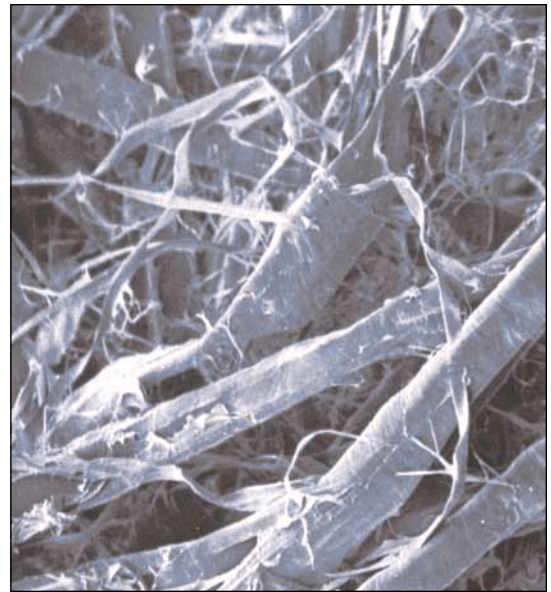
The latest stage of this modernization is the PM4 project - an SC production line with an annual capacity of 152,000 metric tons. While the paper machine for PM4 is a brand new Voith machine, the refining line for PM4 is an Andritz-engineered upgrade for the Hymac HSD-60, similar to several machines in the mill's existing four refiner lines. Even more notable is the technology used on this re-engineered refining line:

The process can be summed up as applying the proper energy to the proper fibers in the proper manner.

a proprietary TMP technology that isolates and further develops certain fibers to produce a kraft-free

pulp that provides excellent appearance, printing and strength qualities.

Serge Beaulieu, Alliance's Corporate Technical Head, refers to this process as coarse fiber refining. And although it was in development for nearly ten years, he says the process



can be summed up in simple terms: "It's applying the proper energy to the proper fibers in the proper manner."

THE QUEST TO ELIMINATE KRAFT.

Initial research into the coarse fiber refining process began at Domtar in the early 1990's. But the project took on a greater urgency when Alliance acquired Donnacona and three other mills from Domtar in 1994.

It became obvious that smaller newsprint mills like Donnacona, which had an 160,000 metric ton annual capacity, would be operating at a competitive disadvantage. At the same time, Alliance management was aware of the growing market for supercalendared grades that had higher added values and margins.

So the commitment was made to convert the obsolescent newsprint facilities over to the pro-

duction of a full range of SC grades. But rather than use conventional pulping and machine technologies to produce supercalendared grades, Alliance made a commitment to SC sheets that had all the strength, appearance and printability qualities of standard SC grades, but were produced with little or no kraft pulp.

There were several reasons for eliminating kraft. The first, of course, was the high relative cost of kraft pulps. The second was that Alliance had no kraft production capabilities of their own. Therefore, they would have to purchase on the open market, and be subject to the fluctuations and unpredictable vagaries of the marketplace.

Finally, while kraft adds strength, it deteriorates formation, light scattering and printability. (Alliance's Beaulieu goes so far as to call kraft "an expensive contaminant in terms of printability" for SC grades.) The only way to regain formation and opacity, then is through the addition of clay fillers - which paradoxically, reduce sheet strength, and increase the need for strength-enhancing kraft. The result is what Beaulieu describes as a "clay/kraft spiral": more kraft is added for strength, but then more clay is required to restore appearance, which weakens the sheet, so that more kraft is needed ...and so on, until equilibrium is finally (and expensively) achieved.

Many at Alliance believed the key to producing kraft-free SC grades lay in the coarse fiber refining technology then under initial development. The promise that coarse fiber refining offered was its ability to maintain maximum long fiber length and fiber strength throughout the refining process. Therefore, if it could be developed into a commercially viable technology, it would give the SC sheets all the strength required, without the costs and complications of kraft addition.

ENGINEERING THE PULP.

As stated earlier, coarse fiber refining has a very simple premise: each fiber receives the amount of energy required to achieve proper development. However, an incredible amount of research, testing, modeling and trials were required. New processes, technologies and systems were needed that could selectively isolate the different fibers in the process stream - and then, just as precisely, apply the exact energy necessary to each group of fibers.

Therefore, most of the research, testing, modeling, development and trials centered on the

fractionation and refining processes. Proprietary fractionation methods were developed to effectively separate different fiber types - not only on the basis of length and width, but also by surface characteristics such as flexibility and collapsibility. The result was a fractionation system that could effectively and selectively remove coarse fibers, while accepting higher specific surface and flexible fibers.

However, effective fiber separation was only the first challenge that needed to be over-

come. New approaches to refining were also required that could enhance bonding strength and fiber surface area, while maintaining flexible long fibers for tear strength and stiffness.

To preserve the flexible, collapsible long fibers - and properly develop the other fibers in the process stream - Beaulieu and his team at Alliance began experimenting with the all the parameters of the TMP process. Different consistencies, refiner stages, refiner speeds, retention times and energy levels were evaluated. "Through mathematical modeling, we determined just how far we could go on certain parameters, such as when we had to go from a single refining stage to a second stage. And while we were discovering just how much energy we had to put onto some fibers, we discovered just how little energy other fibers needed to reach the same stage of development."

With the basics of the process determined theoretically, it was time to test the assumption in trials. For this, they turned to the Andritz Research and Development Lab in Springfield, Ohio. In the summer of 1998, the first fiber samples from the refiner line at Donnacona

Coarse fiber refining offered the promise of maintaining maximum long fiber length and fiber network consolidation throughout the refining process.



were shipped to the Springfield Lab, where Andritz researchers were able to duplicate the mill's existing refining conditions - and the proposed coarse fiber refining process.

Alliance Forest Products' SC sheets have all the strength, appearance and printability qualities of standard SC grades - but are produced with no kraft pulp.

Beaulieu believes that the Springfield lab was the only resource available that could accurately replicate the

real-world conditions at Donnacona.

Under these highly realistic pilot plant replications, the Alliance team could see that the coarse fiber refining process not only met expectations, but in several important respects, exceeded them.

BASING A NEW PROCESS ON PROVEN EQUIPMENT.

While the coarse fiber refining process was under development, Alliance moved forward with their conversion away from newsprint grades. New paper machines were installed at the Alliance sister mill in Dolbeau, PQ, which began producing SC-C and SC-B grades (marketed under the Eminence and Eminence Plus brands) beginning in 1997. Meanwhile, at Donnacona, the PM3 paper machine started turning out a variety of book publishing and high brightness papers.

After the trials at Springfield proved the viability of coarse fiber refining - now called Super TMP or S-TMP - a refining line and paper machine had to be developed for Donnacona that could replicate trial results on a continuous production-level basis. If successful, PM4 would be able to produce SC-A grades - and allow Alliance to offer the full range of kraft-free SC grades.

A Voith paper machine with on-machine calendaring was chosen for PM4, because, as Beaulieu says, "there was simply no way we could accomplish our goals with equipment that had been originally installed in 1968."

Brand-new state-of-the-art forming, press, dryer, calendar and reel equipment was all specified. The changes to refining capabilities were equally sweeping. Totally new refining for coarse fiber, based on new Andritz HSD-60 refiners, would produce the S-TMP pulp.

Over the previous 25 years, four separate Andritz refiner lines had been installed at Donnacona. "They had been good machines for us, and had performed well over the years," Beaulieu explains. "Plus, Andritz had done an excellent job for us with their pilot plant, and they had lots of good references on single disc 60" refiners. They're proven in their field. When we looked at their proposal, we felt that it would work. And it did."

At the heart of the Andritz system were two HSD-60 single disc refiners. The HSD-60 refiners were both equipped with 14,000 HP (10 MW) motors. The refiners, configured for spruce and fir, and a combined capacity of over 200 BDMT/D. Rounding out the Andritz-sourced refining system were screw presses, transfer conveyors, a pulp diffuser, and chests for refined and unrefined long fibers.

The two refiners were set up to run in either parallel or series operation. Since parallel refining was a simpler, more basic process - with a faster learning curve - than series refining, it was used during the refining system's start-up. But within a month, experiments began with series refining - which offered far more suitable refining for the critical long fibers.



Series refining reduces refining intensity by distributing the total specific energy throughout several refining stages. In this way, up to 25% more energy can be applied to the fibers to develop greater bonding strength – without the reduction in fiber length or tear strength that occurs when more energy is applied during a single stage. Thanks to the higher burst, tensile, and tear strength produced by series refining, the need for kraft reinforcement pulp is greatly reduced or eliminated. So shortly after the refiner line was up and operating smoothly, the mill was using series refining for all S-TMP processes and paper grades.

While the Andritz system was being installed, PM4 was being constructed in a new building so as not to disrupt existing newsprint operations at Donnacona. In fact, the newsprint lines Donnacona's old PM1 and PM2 were not shut down until Nov. 16, 2000 – nearly three weeks after PM4 was up and running its first marketable rolls.

In addition to the refining lines, the mill also chose Andritz high consistency (HC) bleaching technology. In other SC applications in Canada and Europe, Andritz HC bleaching has produced high brightness along with impressive strength and optical qualities –while reducing the chemical consumption, bleach plant operating costs, paper machine downtime and environmental impact of medium consistency bleaching systems.

THE UNIQUE APPROACH PRODUCES SINGULARLY IMPRESSIVE RESULTS.

Starting in late October 2000, Donnacona PM4 began producing supercalendared grades using the S-TMP coarse fiber refining process. Initially SC-C grades were produced. But as the process and the machine became more optimized, the line began running SC-B grades, and by Spring 2001, Donnacona was turning out the first suc-

cessful SC-A grades ever made without kraft. Since then, Donnacona has been producing a range of SC grades – and with the exception of a few lightweight sheets, all are totally kraft-free

This is an unprecedented achievement. While some European mills are producing SC grades without added kraft, their processes rely heavily on recycled furnish that already has high kraft contents.

Best of all, the S-TMP-produced SC grades are of exceptional quality. "This allows us to compete with the best supercalendared producers worldwide," asserts Jean-Marc Simard, the Donnacona mill's General Manager. "Owing to Alliance's unique pulping process – and the advanced paper machine and finishing equipment design – we have the best technology for manufacturing high-quality products at competitive prices."

Light scattering, opacity and ink holdout numbers are high, along with sheet strength. Pierre Monahan, Alliance's President and CEO, states that "these papers have proven ideal for offset and rotogravure printing processes. Serge Beaulieu is even more enthusiastic. "From an ink holdout perspective, we have the best sheet on the market," he claims.

Alliance SC grades have found a ready market among some of the largest users of SC sheets in North America. These sheets have found their way into catalogs, flyers, inserts and magazines.

Perhaps most significantly, S-TMP and the PM4 installation allow Alliance to offer a full range of SC grades. Thanks to advanced fractionation, refining and paper-making technologies, Alliance Forest Products has achieved its goal of transforming itself from a newsprint manufacturer to the third-largest North American supplier of SC papers, with an annual capacity of over 280,000 metric tons.

This is an unprecedented achievement.

