

Alberta Newsprint and Alberta Research Council bring deinking pilot plant on-stream

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Through a joint venture with the Alberta Research Council, Alberta Newsprint constructed a deinking pilot plant that produces 60 metric tons/day of deinked pulp.

Alberta Newsprint came on-stream in 1990 producing approximately 600 metric tons/day of newsprint from 100% thermomechanical pulp (TMP). The CAD 400 million mill, 11 km north of the Whitecourt city limits, exports much of its product to the United States. In August, two-thirds of its newsprint crossed the Canadian-U.S. border.

While newsprint recycling programs vary throughout the United States, 15 states and the District of Columbia have either mandatory or voluntary programs specifying the type of secondary fiber in their newsprint purchases.

Canadian communities are also becoming concerned with the cradle-to-grave approach to using resources responsibly. Many communities have established local recycling programs.

"The old newsprint should be considered a resource to the province to augment the forestry resource," says Gary Smith, Alberta Newsprint's technical director. "The recycling programs also provide a source of employment."

"To get into various markets in North America, more and more, legislation is asking for recycled content in your sheet," points out Bill Newcombe, Alberta Newsprint's manager of projects.

Driven by the market

On April 15, driven by market demand, Alberta Newsprint embarked on a joint venture with the Alberta Research Council (ARC) to construct a 60 metric tons/day deinking pilot plant (see p. 51).

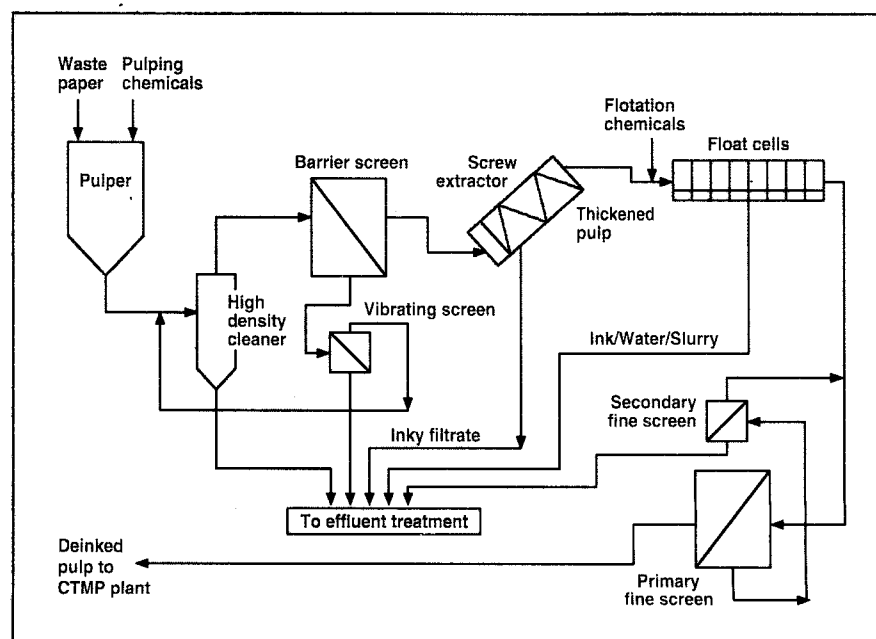
"We were looking at, in the future, having to expand the deink operation, but we saw the benefits of having a deink pilot process that we could go ahead and learn

from," says Smith. The hope is that from the pilot plant, Alberta Newsprint will gain expertise in every phase of deinking, from collection to chemistry.

"A lot of people are further ahead than we are as far as waste paper supply and knowing the ins and outs of that market," says Smith, "but we are learning on that side and we are also learning how to manage waste paper in terms of process design: what streams to purge at what amounts, both on screening and also on ink removal. The pilot process will allow us to gain the technology know-how both on securing waste paper supply and on processing waste paper."

Expansion plans for the mill over the next few years include doubling newsprint production capacity by building a full-scale 300 metric tons/day deinking plant and purchasing a second paper machine to produce value-added newspaper grades.

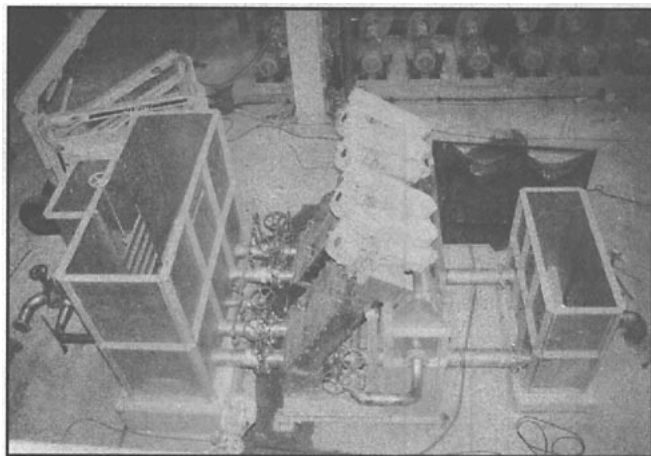
In September, before the pilot plant came onstream, Alberta Newsprint received the 1992 Gannett Quality Award for produc-



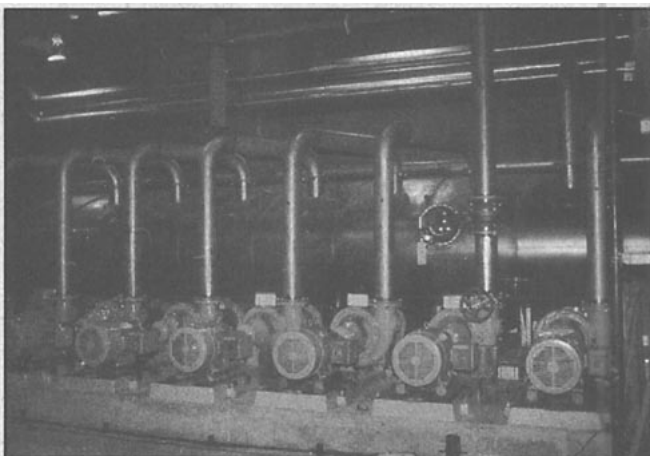
¹Newsprint Association of America, 1992.

At Right: Alberta Newsprint pilot scale deinking plant process schematic

Screw extractors remove fine particle dispersed inks with filtrate.



Flotation cells, six primary and two secondary, remove larger particle inks.



ing newsprint with 60% ISO brightness and high opacity. So how would secondary fiber factor into the mill's award-winning TMP equation?

According to Smith, adding recycled fiber to the TMP as nearly 10% of the total furnish can increase the sheet strength, and since the plant came on-stream in October, there have been no customer reports of degradation in sheet performance.

The mill buys old newspapers (ONP) locally from Edmonton, Calgary, Red Deer, and other communities in Alberta.

"We're trying to coordinate with local communities," says Smith. "Some of them don't even have balers for compacting, so we're seeing what we can do as far as approaches for receiving paper."

The pilot plant's furnish makeup is 100% ONP; it will eventually shift to 30% old magazines and 70% ONP.

The deinking process incorporates washing and flotation, coarse screening, fine screening, and cleaning.

"Then this 60 tons is added to our TMP system...and it goes through all the screening and cleaning along with the TMP stock, and then through five stages of cleaning on the paper machine, and the three stages of screening again into the headbox of the machine," says Newcombe.

"A lot of suppliers would go ahead and add the amount of recycled we are, just put it in the beater, process it hardly at all," says Smith. "Our commitment to maintain quality has led us to go ahead with all our pilot steps even for this amount of wastepaper."

Smith notes that Alberta Newsprint's deinking plant incorporates some equipment and lab work unprecedented in the paper industry. "That was the reason for the marriage with Alberta Research Council and ourselves."

A joint venture

"The relationship with Alberta Newsprint came about in a general sense over the last couple of years," says Randy Alex, analytical research scientist in ARC's Oil Sands Department and project manager of the joint research venture with Alberta Newsprint.

"The market was driving them to have recycled content in their

newsprint sheet," says Alex. "It was crucial for them that if they were going to produce their own recycled fiber, that the negative impact be as minimal as possible on the high quality of their existing sheet."

"That's what they were really looking for from us," he continues. "They were looking to add some *science*...to the deinking process."

"Most of the work that we'd been doing in the area was...separating heavy oil from tar sand. And a lot of the kinds of things that we've learnt over the years are...strongly related to the multiphase separation problem in deinking. So the match was really good."

For ANC, Alex notes, the pilot plant provided an opportunity to develop a fundamental understanding, through colloidal principles, to rationally manipulate the chemistry and to study the principles of flotation as applied to deinking.

"We wanted to use our generic skills in colloid and interfacial chemistry to develop a deep and fundamental understanding of the properties that we're controlling: the dispersion and coagulation, and all the other processes that are going on in the deink stream and thus be able to optimize the efficiency of separation."

"We also have a considerable amount of expertise here in separations technology and separation science, in analytical chemistry and process chemistry, and they all seem to be the kinds of skills that were needed to get a fundamental understanding of the deinking process."

"This joint research venture represents a 60 tons/day deinking pilot plant...that essentially will be a large-scale research facility for the next two years. We will be applying a number of the skills we have at the Research Council and technical skills that Alberta Newsprint people have...to study a wide variety of facets of the deinking process and to come up with the...optimized design parameters for the full-scale, 300 tons/day deinking plant that Alberta Newsprint inevitably wants to build."

"If you're going to incorporate recycled content into a newsprint or a higher quality sheet, then you've got to do a reasonable job at removing the ink and contaminants," says Alex. "As the demands for recycled fiber content in higher value-added grades



The headquarters and main laboratories of the Alberta Research Council, Edmonton, AL

Alberta Research Council

The Alberta Research Council (ARC) was established in 1921 to foster economic growth in the Province of Alberta. The oldest and largest of the eight provincial research organizations, ARC is a crown corporation and employs the largest number of scientists and engineers; it has more than 550 employees. The research council focuses on technology transfer and provides technical support and advice for science and technology ventures of commercial value. Oil Sands and Hydrocarbon Recovery is one of ARC's areas of research and testing.

The ARC's Joint Research Venture (JRV) Program, established in 1983, provides Alberta's small- to medium-size firms an opportunity to pool research expertise, management, and capital to develop products and processes which will have a recognized market. Under the JRV, a firm can share costs, facilities, and research expertise with the ARC.

becomes greater, the need for highly efficient deinking of recycled fiber is going to be crucial.

According to Alex, even though processes exist in the paper industry to remove ink and contaminants, "a lot of it has been trial-and-error at the mill technical bench.

"Some of the Scandinavians are doing some excellent work and some of the Germans as well," he says, but overall in the industry, "there didn't seem to be much of an effort to look at the fundamental principles involved in deinking."

Understanding the chemistry

"We have a very strong capability in colloid and interfacial chemistry here at the Research Council," says Alex, "and some world-class scientists working in the area, and it seemed to us that...the colloidal properties of the ink and the fibers and the contaminants are really what control the deinking process.

"If you can control the things like particle size distribution, things like the surface charge of the ink and the fibers and the contaminants separately, then you can rationally, in our opinion, manipulate the chemistry and manipulate what's going on to be able to optimize the separation of the ink from the stock," says Alex. "And that was the fundamental philosophy that we wanted

to bring to bear in this whole joint research venture."

The furnish that the pilot plant handles contains primarily canola oil-based inks. There are also a number of different semiheat-set and full-heat-set inks on the inserts and lightweight-coated glossies.

"We are convinced from the preliminary work that we have done that the 10% recycled content will not impact negatively on the properties of ANC's final sheet," says Alex.

"We have a very large lab-scale, small pilot-scale, dissolved air flotation (DAF) unit that we will be taking up to the pilot plant and interfacing with some valves up there." The team plans to do this before the end of the year when they will use the DAF unit to optimize the pilot plant's combined wash-float circuit.

"We have been involved with flotation, as I indicated, for the oil sand industry for quite some time, and we've developed a detailed understanding of the various parameters and control of the parameters that we hope will optimize the flotation process in a much more sophisticated way than is currently done by...the people who are currently making flotation units for deinking.

"We're hoping by the end of the two-year project to come up with...a design for a new kind of flotation that will be very flexible and will be controlled by a variety of different sensors.

"We're hoping along the way to develop on-line capabilities for

monitoring some of the more important parameters in a deinking process. For example, ink particle size.

"There's a very standard graph that you see printed in a lot of the deinking literature which shows ink removal efficiency for the various techniques, for washing, for flotation, for screening and cleaning, and each one of them has a particle size where you get maximum ink removal efficiency.

"Knowing the on-line ink particle size would be very valuable to being able to fine-tune the chemistry, fine-tune some of the unit processes to optimize the overall deinking process. If your particle size is a little bit large as the feed is going into the flotation cell, add a few more chemicals, change a process parameter up front in an iterative fashion, to be able to, let's say, reduce that particle size a little bit to match the optimum removal efficiency for the flotation unit operation. So we're hoping to develop these kinds of on-line monitoring techniques to be able to control both the chemistry and the other physical parameters."

Sludge as a positive resource

The joint research venture between the Alberta Research Council to Alberta Newsprint also focuses on the sludge by-product of the pilot plant's deinking process.

"There hasn't been a lot of work done on the impact of the deinking filtrate on the effluent treatment system and on the sludge that's generated from an activated sludge treatment system that's running partially on deink filtrate," says Alex.

A group in the ARC's Environmental Research and Engineering Department currently researches alternate methods for utilizing various sludges and wastes.

"They've done a lot of this kind of work in the oil and gas industry, and the biological sludge generated from an activated sludge effluent treatment system, while it may be different, is not that much different from a lot of the things we've worked with."

The group is conducting a two-year study on the pilot plant's sludge. The study includes fundamental analysis of the sludge from the treatment plant both before and after the deink filtrate is added. Based on that work and on both greenhouse and column leaching studies that are done inside, the group plans to move out into both an agricultural setting and a cut-block setting and apply this deinked sludge, or sludge from the effluent treatment system that has seen the deink filtrate.

Alex says the ARC hopes to extend this research outside the joint research venture to three or four years, to study the effect of the sludge on growth rates and on the environment of both the cut-block and agricultural sites.

During the spring of 1993, the group hopes to do a long-term study on land-spreading using the sludge "as a positive resource rather than thinking of it as a waste to be disposed of," says Alex.

"The way the joint research venture works, Alberta Newsprint and Alberta Research Council will jointly own the technology. We're hoping to spin off a company that will continue that development and turn it into a marketable product. We'll see how far we get," he said. ■

Clites is associate editor of Tappi Journal.