



STICKIES Still a Critical Concern for Today's Recycling Plants

Increased fiber recovery rates and the trend toward single-stream recycling in recent years are causing an influx of stickies contaminants in wastepaper streams across the U.S. (Photo courtesy of Stora Enso)

As the U.S. paper industry closes in on its 55% fiber recovery goal, contaminants in wastepaper streams are on the rise, making the need for effective stickies control more urgent than ever.

By Ken Patrick

Effective control of stickies in recycled furnishes continues to be elusive despite some fairly significant technological advancements in recent years. To a large extent, this is due to progressively degrading wastepaper streams that keep targets moving and just beyond the control of developing technologies. Today's contaminants that originate from a variety of sophisticated pressure sensitive adhesives, coating binders, waxes, and hot melt glues are proliferating as recovery rates climb and especially as single-stream recycling becomes more widely practiced.

Still, recovered paper furnishes being used in today's paper mills are generally of much better quality than their counterparts of the early 1990s when fiber recycling, at least

in regard to certain grade sectors, was more or less in its infancy. Thanks to the capabilities, determination, and perseverance of paper scientists on both the supplier and production sides of the industry, U.S. paper companies are rapidly closing in on the goal of 55% recovery by 2012, in fact reaching 51.5% last year, with projections of 52%-plus for 2006.

To examine the current state of stickies control, which will be a critical key to closing the remaining 3% recovery gap during the next six years, *PaperAge* discussed some of the industry's more recent technological breakthroughs with several major players in the paper recycling arena, and explored what new approaches will be needed to meet the challenges of an escalating demand for secondary fiber worldwide.

Participating in the discussions were: **Dr. Ken Keegan**, product manager, deposit control, *Kemira Chemical*; **David Jones**, industry specialist, *Buckman Laboratories of Canada*; **Danny Haynes**, senior technical specialist, *Eka Chemicals*; **Dr. Paul Knight**, contaminant control and pulp mill applications team manager (Europe), and **Kevin Brennan**, senior applications development specialist, *Hercules*; **Bjorn Kamlin**, technical consultant, and **Rick Lyons**, senior consultant, *Nalco*; and **Pierre Mouyal**, president, *Omniklir*.

STATE OF STICKIES CONTROL

Keegan explains, most mills today live with stickies at some level, but all desire improved control. If anything, though, he says, stickies control has taken “a downward slide” in the past few years. He relates this to several factors, including the deteriorating quality of wastepaper streams. “While there have been some improvements in screening and flotation for stickies removal, these have been overshadowed by the raw material quality,” he says.

Another factor affecting stickies control has been increased water closure in paper mills, Keegan continues. Mills in North America, he says, have generally been more open than those in Europe, but the rapid rise in energy costs is changing that. In Europe, typical SC-newsprint mills are using 10 m³ of water/ton, and any further reduction has stalled due to severe deposition problems. North American mills average between 30 and 55 m³/ton and face a challenging learning curve if they are to reduce any further without running into major stickies problems.

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Knight and Brennan point out that in addition to higher recycling rates that degrade the streams, the recent trend of shredding wastepaper such as MOW is allowing contaminants to more easily enter the waste stream. Jones adds that with the increase in single-stream recycling, there is more mixing of wastepaper and board types. “For example,” he says, “in North America, newsprint recyclers have seen an increase in out-throws in ONP streams. The OCC now coming in with ONP can have 10 times more stickies than the ONP itself,” he says.

According to Haynes, several R&D projects are currently underway to better understand stickies from the macro scale to below the colloidal scale. “Most earlier research focused on macro-stickies since this was a significant factor limiting recycled fiber usage when introduced into the papermaking



The recent trend of shredding recovered papers, such as mixed office paper, is allowing contaminants, especially stickies, to more easily enter the recycling process.

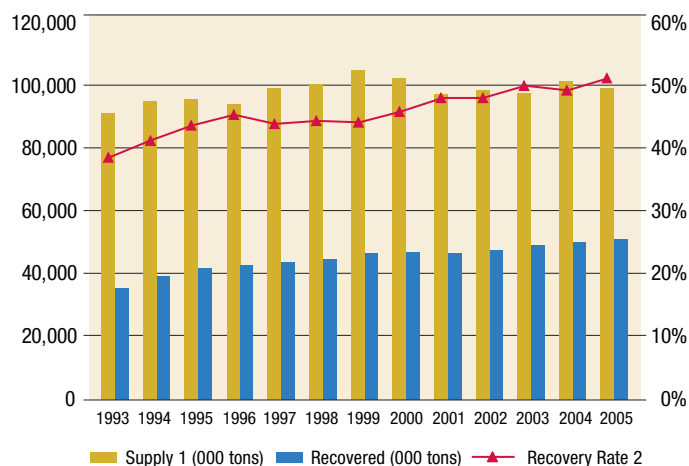
process in the early 1990s on a larger scale. The top three solutions employed for macro-stickies were better furnish control to limit contaminants, better cleaners, and better fine screens,” he explains.

During the past three to four years, significant progress has been made in measuring and tracking micro-stickies, Haynes continues, pointing out that to increase the usage of recycled fiber at the paper machine, the industry is going to have to better understand this class of stickies. Stickies that currently pass through fine screens, less than 150 microns, are causing runnability problems due to deposits, holes, and breaks from the headbox to the reel, and are even building up on the scanners in contact with the sheet. “The worst thing is when deposit issues are carried to the customer and he sees a buildup in the printing process,” Haynes warns.

Kamlin and Lyons explain that in addition to higher utilization and recovery rates of recycled fibers, the drive toward lower basis weight production is also contributing to the stickies problem. Variability of the incoming raw material sources makes it extremely difficult to achieve a stable process and product quality, since predicting the sources of the contamination is limited,” they say.

THE CULPRITS

There is almost universal agreement that the No.1 stickies problem today is caused by pressure sensitive adhesives. Used in the production of these types of adhesives and as binders in coated paper, the three most unwanted materials in the recycle process, Haynes notes, are contaminants containing polyvinyl acetate, acrylic polymers, and polystyrene polymers such as styrene butadiene rubber. Glues such as hot melts that stay solid in normal deinking temperatures



Since 1993, the first year the U.S. recovered more paper for recycling than it sent to landfills, recovery of wastepaper streams has steadily improved toward the national goal of 55% by 2012, currently approaching 52%. (Source: AF&PA)

can be very effectively removed in cleaning and screening, according to Jones.

Knight and Brennen point out that pressure sensitive adhesives (polyisoprene) and styrene-based binders remain tacky over a wide range of temperatures and soft enough to extrude through most slotted screens. "Some adhesive manufacturers are promoting water dispersible adhesives, although this is at odds with the high consistency and screening approaches to stickies management," Knight says.

The ability of pressure sensitive adhesives to generate stickies, Haynes explains, was recently demonstrated by Hans-Joachim Putz and his co-workers, who added just one adhesive label to a shoe box (packaging board). The label resulted in a 150-fold increase in the macro-stickies count. The push toward 55% recovery and single-stream collection is resulting in a two to six time increase in junk mail and packaging materials that contain these kinds of adhesives, he says, adding that single-stream recovery is also bringing in broken glass and other materials that significantly reduce the life of cleaners and screens "By the time the industry reaches a 55% recovery rate, recycle plants will be facing stickies issues approaching levels seen in the early 1990s."

For the most part, Keegan notes, issues revolving around hot melt adhesives and waxes have declined as OCC mills have had better sorting of waste paper and better temperature control. "But just looking at deposits on a paper machine does not tell the whole story," he says, explaining that some improved test methods are being developed to better quantify the types of stickies coming in with the furnish, especially in the micro-stickies range. "With this new chromatographic technique, we will be able to predict

stickies outbreaks before they occur, allowing papermakers to adjust treatments on the fly."

Mouyal says an image analysis technology has emerged recently, but not yet embraced, that enables the "reading" of stickies on a scanner, both in size and shape, in a matter of seconds. "Imagine being a diabetic and reading glucose levels before and after a meal, which the latest technology now allows, thus determining which foods cause spikes in blood sugar, and avoiding the culprit foods. Scanner based image analysis allows the same sort of analysis with stickies levels and types in paper machine furnishes," he points out.

BEST APPROACHES

There is also general agreement that the ultimate solution to stickies control will have to combine mechanical and chemical treatments. Fine screens, as Jones says, can remove a high percentage of macro stickies, "but as well as they work, there is a small percentage that gets through." Chemicals can be used to maximize the stickies removal efficiency of unit operations in the deinking plant, such as flotation or DAF's, he adds. In addition, chemistry can be used to make the stickies that are not removed less problematic by making them less "sticky," and thus less prone to deposition, Jones explains.

"Enzymes will continue to play a major role in stickies control. The challenge is to develop new enzymes that work in different temperature and pH ranges and on all types of stickies chemistry."

—David Jones, *Buckman Laboratories.*

Knight and Brennan point out that as slotted screens get smaller, the fiber yield is reduced, limiting production. Careful attention should be paid to purge points such as screens, cleaners, flotation and clarification, and machine retention, they advise. Remaining contaminants will then respond in a very positive way to downstream chemical treatments, which currently are most effective against those less than 100 microns in size.

Haynes explains that while many researchers have seen a reduction in micro-stickies between 25 and 150 microns, work with colloidal micro-stickies has shown little to no removal at the clarifiers or at the deinking flotation cells. The best mechanical defense against colloidal stickies has been the creation of water barriers by thickening the pulp and not carrying it forward to the paper machine, he says.

While macro-stickies and the larger components of micro-stickies can be controlled by mechanical treatments, the best solution for these is chemical treatment or management of the process water to maintain a stable concentration.

The nature of colloidal particles, Haynes further explains, is to stay suspended, thus colloidal micro-stickies are not harmful. The problem is when colloidal micro-stickies accumulate above the carry capacity of the process and start to aggregate or form micro-deposits, leading to runnability issues. The ultimate solution for colloidal micro-stickies is first monitoring to ensure the population is stable and then maintaining that stable concentration by changes in the process (purging water, furnish changes, etc) or by chemical treatment., he says.

Keegan doesn't believe there is an "ultimate solution" for stickies control. Each mill is unique, he says, and has to take a system-wide approach to the problem. But there are three keys common in all mills:

- Maximize stickies removal (macro, micro, and colloidal) in the recycle plant
- Stabilize stickies moving forward in the system to prevent agglomeration and deposition
- Direct stabilized stickies to an exit point in the system (can be the sewer but often is the finished sheet).

Listing these three points is easy, but putting them into practice can be very difficult, Keegan says. "For example, stickies can be greatly reduced in a deinking plant by simply increasing reject rates in flotation and washing. However, this may not be feasible due to the resulting decrease in fiber yield," he warns. In relation to the third point, Keegan says that the retention system is a critical component of a stickies control program and should not be overlooked.

On the subject of retention, Mouyal says that in the early 1990s, a novel technology introduced the neutralization of anionic trash (stickies) by cationic polymers (polyamines). The product was sprayed as a diluted polymer onto a moving fourdrinier wire. "The concept, although simple, was brilliant," he notes. "Soon, competing companies were using variations of simple polyamines to circumvent the application patent. This led to neutralization of stickies in repulpers, which was logical but not as efficient as the spraying of cationic polymers on the wire. The next technology was the forming of a barrier surrounding the stickies particle, creating a neutral entity. Although the concept made sense, results were mixed."

Mouyal adds that "in my experience, especially with countries that purchase secondary fibers from the U.S. and

Europe, and where virgin fiber is expensive, the earlier technology, i.e., spraying a cationic product on the wire, is still the most efficient and least expensive."

ENZYME APPROACH

The most recent stickies control technology, Mouyal continues, is the use of enzymes, which cleaves the ester-containing stickies into simpler molecules that are less "sticky" and easier to remove from the system. Some mills have reported spectacular successes with enzymes, he says, adding that some also admit to a high cost. "But state-of-the art technology or new and improved concepts generally come with higher price tags, at least in the beginning."

Buckman launched its Optimize line of enzyme based stickies control a few years ago, and Jones reports that today the technology is working well at mills around the world. He notes, however, that enzymes require a well-controlled system. All enzymes work at a specific temperature and pH range, he points out, so these have to be tightly controlled. In addition, other chemistries can deactivate or interfere with the enzyme action, which is one of the main reasons why enzymes are not always successful. "Enzymes will continue to play a major role in stickies control. The challenge is to develop new enzymes that work in different temperature and pH ranges and on all types of stickies chemistry," Jones says.

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—Danny Haynes, Eka Chemicals

According to Haynes, the problem with all traditional stickies control solutions is the inability to measure stickies content in a timely fashion, so most operations cannot relate their runnability issues to stickies. "This holds true for enzymes and chemical treatments. There is no doubt that enzymes have the ability to interact with the materials generating deposits, but it can be difficult to control or predict how well they will work on a given process. I have also seen how over-dosage or use of the wrong enzyme can actually increase the amount of deposits seen. Enzymes have a future in stickies control if their cost-in-use can be reduced, better application technology is developed, and if a more traditional chemistry cannot do the job," Haynes explains. ■