Process control for stickies

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Giles Dorris


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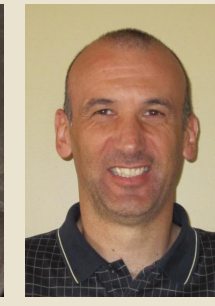
Daniel Haynes


Jean Morin

A panel discussion on stickies was held during the TAPPI PEERS conference, October 2-5, 2011, in Portland, OR. The task of moderating this panel was easy, as the four panel members — Gilles Dorris, FPInnovations, Canada; Shisei Goto, Nippon Paper Industries, Japan; R. Daniel Haynes, EKA Chemicals, USA; and Jean Morin, Cascades, Canada — each have more than ten years of experience in dealing with various aspects of stickies. Panel members were instructed to give a brief presentation of their views on the subject of stickies, as this special feature describes.

Analyzing macrostickies and microstickies

Dorris was the first panelist to speak, offering a title that sums up the difficulty involved in dealing with stickies: "Stickies monitoring and control – The long winding road." Those who have dealt with stickies in the laboratory or in the mill will agree that getting a handle on stickies is indeed a challenging and often frustrating journey. Success in dealing with stickies is as illusive as acquiring a consistent quality and quantity of relatively stickies-free recovered paper.

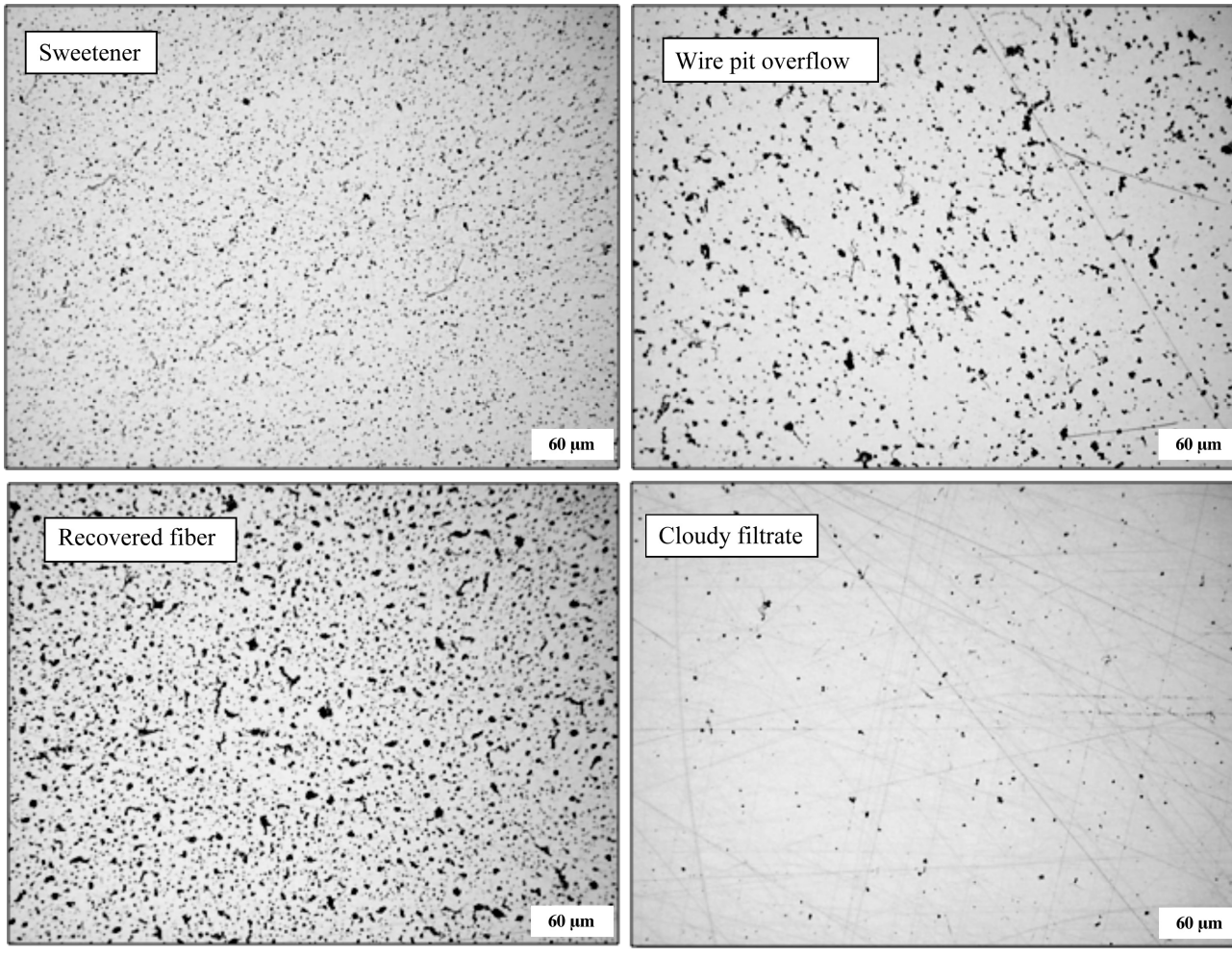
Dorris subsequently reviewed methods developed at FPInnovations for measuring macrostickies and microstickies. He also noted that FPInnovations is working on measuring wet and dry tackiness of stickies at different temperatures. Lessons learned over the years in dealing with stickies were distilled in the last slide:

- Online analyzers like the one FPInnovations developed for macrostickies [1] are necessary for research, as well as for mills, because a large number of samples require evaluation.
- Fine screens are necessary for the removal of the macrostickies.
- Properly tuned forward and reverse cleaners (or throughflow cleaners or rotating body cleaners) may also be helpful. The emphasis here is on "properly tuned," as many mills have installed these cleaners but they are either plugged, shut off, or have poor stickies removal efficiency.
- Froth flotation is not very effective in removing macrostickies but could be useful in removing microstickies.
- Microstickies in the size range of 5 µm to 150 µm account for 50% to 80% of the stickies population after the stock has gone through screening, cleaning, and flotation treatment.
- The best approach is to screen macrostickies and float microstickies.

Stickies deposits

Goto relied on his previous two presentations at the Research Forum on Recycling [2,3] to elucidate stickies behavior once deinked pulp (DIP) and thermomechanical pulp (TMP) are delivered to the paper machine. He used photomicrographs of stickies deposited on the surface of quartz crystal to drive home some important points:

- Deposits from the paper machine and paper using deinked pulp consist of fines, fillers, and adhesive. Contrary to what one would think, Goto observed that fines and fillers are the major components of deposits. Adhesive is only a minor component of deposits on a crystal surface.
- Stickies end up as deposits on various parts of paper



1. Photomicrographs of the quartz crystal microbalance (QCM) sensor surfaces after measurements of samples from the sweetener, wire pit overflow, recovered fiber, and cloudy filtrate in the white water and the fiber recovery system of a newsprint paper machine.

machine or in the finished paper.

- A large number of the small particles in deposits from DIP were observed by Goto in deposits from a newsprint machine's headbox sample, as opposed to a smaller number of larger particles, leading to the conclusion that stickies morphology changed during the papermaking process. It appears that the accumulation of stickies in circulated white water leads to agglomeration.
- The examination of deposits in a sweetener stock, wire pit overflow, recovered fiber stock, and cloudy filtrate, as **Fig. 1** shows, revealed that agglomerated stickies are retained in the recovered stock. The wire pit overflow clearly contains larger stickies than the sweetener stock, and these larger stickies end up in the recovered fiber stock and not in the cloudy filtrate.
- The retention of microstickies, along with the pacification of stickies using enzymes and/or inorganic additives, is critical to preventing the deposition of stickies [3].

Haynes in essence agreed with Dorris that majority of stickies population after fine screening is smaller than 150 µm. Haynes reviewed some of the work done using total organic carbon (TOC) measurement. He observed that when pulp with a consistency less than 3% is dewatered, colloidal solids content is dominated by free water or white water. However, for pulps with consistency above 3%, microstickies associated with fibers or bound water come into play. Thus, he is in agreement with the photomicrographs provided by Goto (Fig. 1).

INGEDE Method 17

Haynes elaborated on the application of INGEDE Method 17, "Assessment of microsticky test methods" (http://www.ingede.com/ingindxe/methods/ingede-method-17-2011.pdf). The purpose of INGEDE Method 17 is to lay down a step by step procedure to evaluate the effectiveness of a microsticky test method:

- Evaluate method by mixing sticky loaded pulp with

wood-free, virgin fiber-based copy paper/bleached short fiber chemical pulp.
- As microstickies loaded pulp is reduced, the test should show a decrease.
- The ideal result is a linear decrease.
- Results showing a clear decrease, even if it is curved, are acceptable.
- Results that show no change or an increasing concentration are not suitable.
- Stickies contaminant pulp should be process stock, not model stickies.
- Test should have enough stickies to be detectable with the method used.
- Stocks should be at 1% consistency and mixed at room temperature.
- Five sample batches are used by mixing two pulps in 25% increments.
- Difference between measured and calculated values should be less than 25%.

Haynes is in general agreement with the INGEDE Method 17 with a few exceptions. Dilution water or white water may have significant effect when sample consistency is 1%. Also, room temperature may not be realistic when compared to a mill situation and may miss the pass/fail test for some methods. Haynes concluded that even though results of TOC values pass the test in all experiments, this was not always the case for the colloidal stickies or EMMA (effective measurement of micro-organic accumulation) potential.

Controlling stickies at Cascades mills

Morin noted that out of 27 paper machines in North American Cascades mills, 17 are tissue machines, three produce corrugating medium, two each make linerboard and boxboard, one makes printing and writing grades, while two paper machines make other paper products, but not newsprint. Furnish for these paper machines come from 12 old corrugated container (OCC) stock prep lines and 10 mixed office waste (MOW) deinking lines. Overall, more than 75% of furnish is derived from recycled fibers.

Once recycled stock is supplied by the stock prep line, stickies may deposit on a paper machine, accumulate in white water, or end up in the paper product. Some of the strategies employed by Cascades to control stickies include:
- *Monitor recovered paper quality and follow with proper blending.* No matter how well the stock prep system is designed, if more contaminants are entering via recovered paper, then more will go to the paper machine. In other words, as Morin quoted the well-known phrase, "garbage in – garbage out."
- *Monitor and maintain screens, froth flotation cells and dissolved air flotation (DAF) units* to make sure that they are running at their peak efficiency.
- *Manage water carefully.* Water management is very important, and Morin specifically emphasized the use of countercurrent flow. In other words, use excess paper machine white water in the deinking operation, but not vice versa.
- *Avoid accumulation of contaminants in white water* by maintaining wet end stability and increasing retention.
- *Watch for and avoid deposits on rolls and doctor blades.*
- *Be aware that there is a lag time between poor pulp quality and paper defects or deposit formation* due to accumulation of stickies in the water system.

Stickies agglomeration in storage chests

A question was raised about the possible agglomeration of stickies in a storage chest where stocks from different sources (e.g., DIP, broke, TMP, and virgin) are mixed. In a similar vein, a question was raised about the mechanism of agglomeration and the impact of changes in parameters like pH, temperature, conductivity, etc.

Dorris responded that stickies are in general hydrophobic and want to get away from water. In some cases, stickies accumulate in white water foam and agglomerate when the foam collapses, in agreement with the patent by Doshi et al. [4]. Changes in parameters like pH and temperature can certainly have an impact on tackiness of stickies, as Haynes observed earlier. Based on his many experiments, Haynes also noted that pulp mixing can certainly lead to formation of more secondary stickies.

Sudden surges of stickies deposits

Another question raised was how to help an operator who experiences a sudden surge in paper machine stickies deposits. Morin opined that he would sit down with the operator and ask some pointed questions as to what has changed recently with respect to wet end chemistry, furnish grade, fresh water usage, breakdown of screens, changes in reject ratios or operating consistency, etc. Those answers will help the operator in assessing the situation before proceeding further.

Goto would try to evaluate whether the problem is due to macrostickies or microstickies by examining the deposits. A macrostickies-related problem needs to be addressed in the stock prep area, where one needs to check the operation of screens, cleaners, froth flotation, and dissolved air flotation (DAF), as suggested by Morin. On the other hand, a microstickies-related issue needs to be handled in the paper machine area.

Dorris pointed out that the removal of microstickies from process water by the use of column flotation [5,6] practiced by four to five mills needs to be considered. Haynes stated that once the stickies are deposited, it is too late to do anything. He pointed out the usefulness of a suitable online monitoring method like the one Eka has developed based on TOC measurements that correlates well with stickies-related

problems on the paper machine [7]. In the future, increasing the dosage of pacifying additives and discharge of white water may have to be considered to avoid stickies deposition on paper machines.

A long journey

In short, stickies control is a long and arduous journey that requires knowledge of many facets of stock prep, wet end chemistry, and paper machine operations. Strategies for the control of stickies may be summarized as:

- Accurate, quick, reliable method for measuring macrostickies and microstickies.
- Recovered paper quality control
- Gentle pulping
- Effective screening and cleaning
- Efficient froth flotation
- Water clarification by DAF
- Pacifying additives to stabilize microstickies and colloidal stickies
- Compatibility of wet end chemistry. **TJ**

LITERATURE CITED

1. Ricard, M., Dorris, G., Gendron, S., et al., *TAPPI PEERS Conf.*, TAPPI Press, Atlanta, GA, USA, 2010, paper 15.1.
2. Goto, S., Tsuji, H., and Iimori, T., *Res. Forum Recycl., 8th, Proc.*, TAPPI Press, Atlanta, 2007, p. 212.
3. Goto, S., Ooka, Y., and Okamoto, K., *TAPPI PEERS Conf.*, TAPPI Press, Atlanta, 2010, paper 15.3.
4. Doshi, M., de Jong, R., and Aziz, S., U.S. Patent 7,674,355 B2 (May 2010).
5. Ben, Y., Dorris, G., Page, N., et al., *PAPTAC Annu. Meet., 94th*, PAPTAC Press, Montreal, QC, Canada, 2008, p. A317.
6. Ben, Y., Dorris, G., and Page, N., *Res. Forum Recycl., 7th, Proc.*, PAPTAC Press, Montreal, 2004, p. 229. Also in Prog. Pap. Recycl. 15(2): 25(2005).
7. Haynes, R.D., *Res. Forum Recycl., 8th*, Proc., TAPPI Press, Atlanta, 2007, p. 344.

ABOUT THE AUTHOR

Doshi

Doshi is a member of the *TAPPI Journal* editorial board and is founder and executive editor of *Progress in Paper Recycling*. He served as moderator of the stickies panel described in this special feature. He has been President of Doshi & Associates Inc. in Appleton, WI, USA, since 1987. Email Doshi at MAHEN@aol.com.

Editor's Note: *Doshi recently contributed a new TAPPI TIP regarding stickies. The Stickies Classification TIP (TIP 0603-02) can help mills differentiate between various types of stickies, including macrostickies, microstickies, dispersed stickies, colloidal stickies, mini-stickies, and DISCO (dissolved and colloidal) stickies. To subscribe to all of TAPPI's Standards,TIPs, and Useful Methods, visit http://www.tappi.org/Bookstore/Standards–TIPs/TIPs/Pulp-Manufacture/Stickies-definition-andclassification.aspx.*