ISSN: 0379-5462
IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association
Vol. 29, E1, 2017, pp.88-92

STICKIES AND PITCH CONTROL WITH SUPERIOR ENZYMATIC FORMULATIONS

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SUMMARY

The road to finally controlling the problem of stickies at paper mills is paved with a host of exciting technologies new and old. Recycled fibers are ripe with stickies coming from glues and coatings, more so even virgin fibers contribute to the issue with tacky natural wood pitch. Stickies are tacky, hydrophobic, pliable organic materials with a broad range of melting points and different degrees of tackiness depending upon the specific composition of the stickies.The key to solving this nagging problem is to understand the chemistry involved and the right combination of chemistries to free the paper and board mills from stickies once and for all. These chemistries also must be used in the correct order and location regarding the other additives used and the mechanical equipment processes in the mill system. The road to controlling stickies starts with the breakdown reactions from an enzymatic formulation, combined with mechanical shear elements, followed by targeted additives to keep the stickies small, dispersed, non-tacky, and anchored into the outgoing sheet of paper or board.

No surprise that enzymatic formulations will lead the way to solve this problem as these are very fast reacting biocatalyst proteins that are extremely specific so as to only interact with the targeted ester bonds of the stickies. Yet, only those understanding what these formulations need to be for each unique paper mill system will win the war against stickies. So, these amazing enzymatic formulations must be specifically designed and aimed towards satisfying the unique requirements of each mill stickies scenario. Not only for what they do directly, but also for how they are interdependent with the other additives and equipment in the mill system. These other players include the retention aid polymers, microparticles, fillers, dispersants and key equipment such as the pulper, hot dispersers, deflakers and even the formers, presses and dryer temperature profiles.

This paper focuses on one such successful application, at a linerboard mill, where stickies related sheet breaks and downtime were reduced significantly. Our patented Optimyze® Plus 727 specifically designed enzymatic formulation (1, Buckman) replaced diatomaceous earth for positive savings while reducing hemocytometer measurements by 61.3% leading to an 11% increase in production per machine for an overall ROI of $890,000 per year. The application used a simple pump-n-go feed system at a dosage of 0.4 kg/ton and was applied to all three machines at this board mill complex. There are 53 similar successful applications of this type of formulation worldwide, and many other similar yet uniquely different formulations have been equally successful all over the world and are ready to help solve your stickies dilemma.

Recovered paper is a major source of raw materials for packaging production in the United States. Unfortunately, recovered paper is not a clean, trouble-free raw material. Significant levels of adhesives, glues, tapes, and waxes contaminate this fiber supply, and so become part of the papermaking process along with the recycled fiber. Due to their tacky properties, these contaminants are usually called “stickies”. Key constituents of stickies are polyvinyl acetate (PVAc) and similar resins. Even rosin size added at the wet end, coating binders coming back with the broke and wood pitch from virgin pulp will exacerbate the stickies problem.

Stickies reduce product quality when they cause spots or holes in the paper or board. They invariably lead to issues with paper manufacturing equipment and cause sheet breaks and downtime. Constant changing of dryer doctor blades and dryer fabric cleaning are unfortunately common when stickies go unchecked. And problems from stickies are not confined to the paper mill. Holes or weak spots in the paper cause problems in the converting process. By

sticking together pre-cut sheets of paper, stickies can cause paper to double-feed through printers. Stickies can transfer from the sheet to the equipment in the converting operation, and downtime may be required for cleaning. All of this leads to added costs for the papermaker; a solution is gravely needed. We have one: Optimyze® Plus 727.

As can be seen in the Figure – 1: The Road to Solving Stickies, the first chemical action on the road to solving stickies is to break them down into smaller (hopefully non-visible) globules. Then the rest of the road focuses on keeping the stickies dispersed and non-tacky and finally retained in the sheet to be purged (via the paper) from the paper machine system.

The Optimyze® Plus 727 formulation takes care of this in two ways:

1. Cleaves ester bonds to reduce the size of the stickies, Figure – 2: Optimyze mechanism
2. Converts the surfaces of the stickies and pitch into alcohol groups to make them less tacky

FIGURE 1 : The Road to Solving Stickies

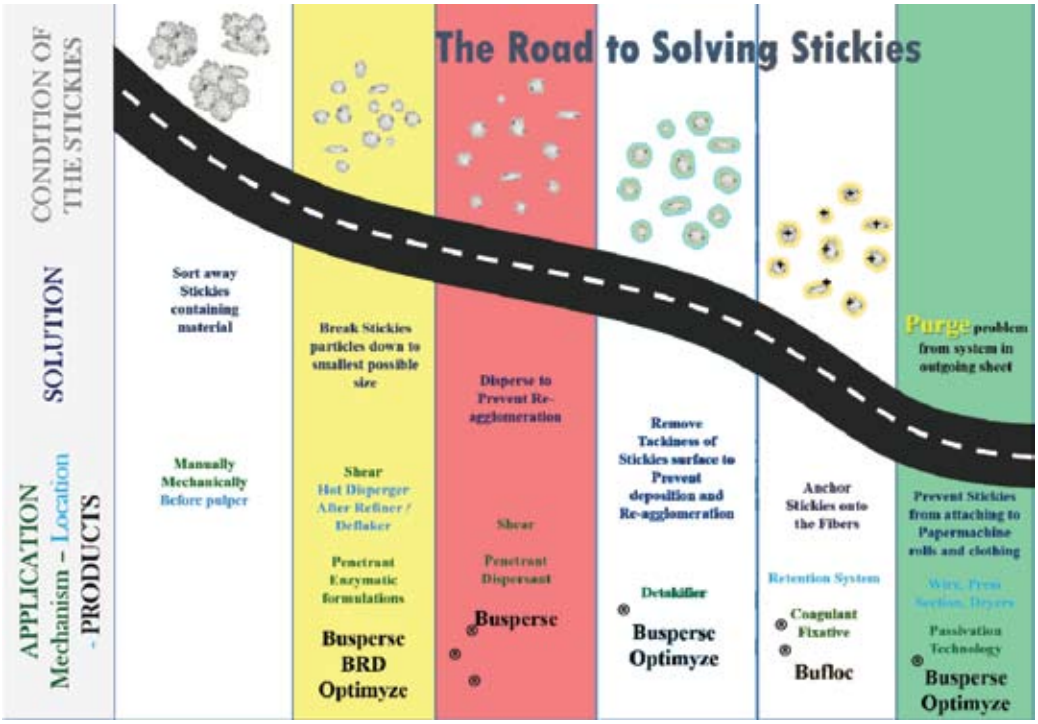


FIGURE 2 : Optimyze® Mechanism

Less tacky means less likely to stick to surfaces.Alcohol groups are also polar, which allows for polymer fixation in the sheet or removal in DAFs (flotation) and washing.And it prevents agglomeration of any hydrophobic particles.

When observed under a high-powered microscope, as in Figure 3a – Micrograph: Optimyze®Effect on Size, we can see the breakdown of the stickies size. Looking even closer, as in Figure 3b – Micrograph: Optimyze Effect on Surface, we can note the striking change in the surface of the once tacky stickies particles. The product formulation has a dual approach, to be sure to address any stickies surfaces not affected by the cleaving mechanism. Once all are rendered less tacky, there is much less tendency to re-agglomerate and to stick to piping, equipment, fabrics and paper surfaces. This leads to fewer holes, fewer breaks, and less overall downtime usually spent cleaning and removing the annoying deposition on the paper machines.

The savings and cost avoidance always returns a great ROI (Return on Investment) from the cost of the chemical product used in the treatment. This was clearly

FIGURE 3a : Micrographs: Optimyze®Effect on Size

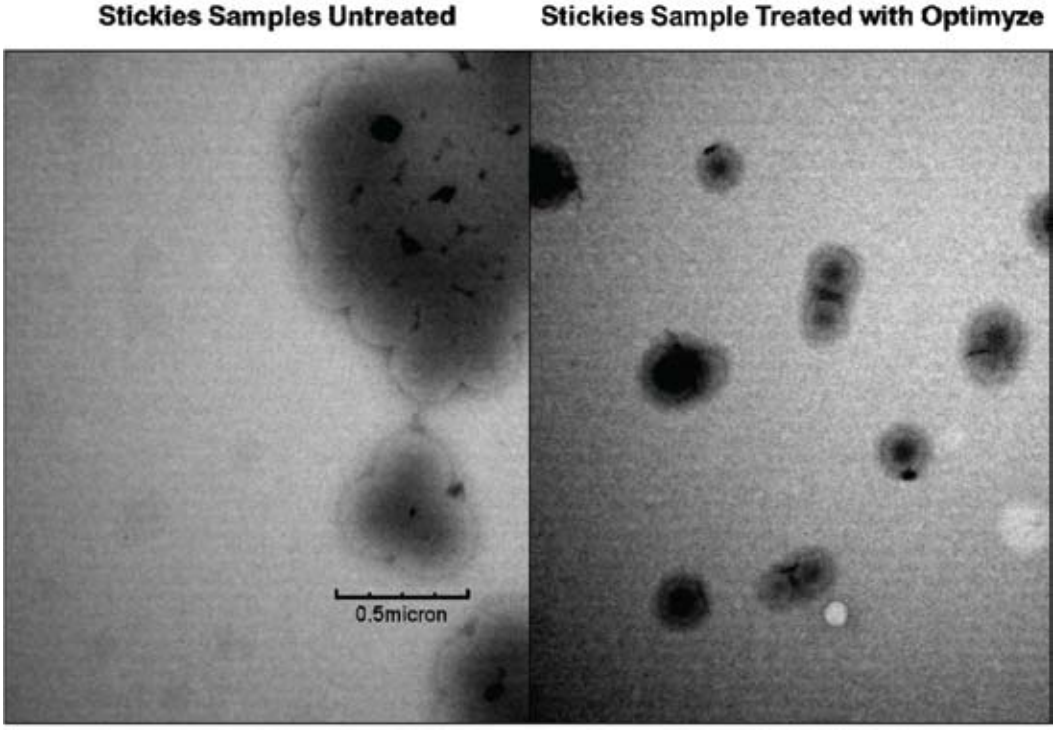
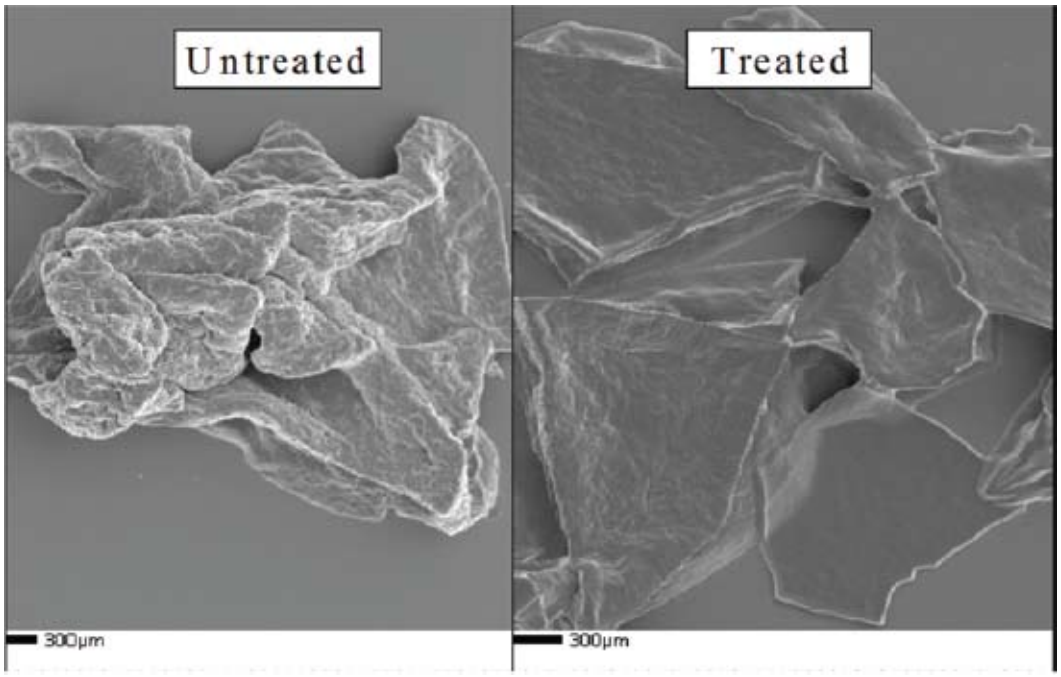


FIGURE 3b : Micrographs: Optimyze®Effect on Size



the case in this paper mill example being reviewed here.The following are several of the key areas that were considered when calculating the potential ROI.

- Improved Machine Efficiency – FewerBreaks
- Improved Sheet Quality – FewerHoles/Picking
- Reduced Downtime
- Reduced Wash-up Time
- Reduction in Overall Chemical Treatment Spend
- Reduction in Chemical Treatment Complexity – no chemical makedown

Literature

1- Patent Title: Methods To Control Organic Contaminants In Fibers; Patent number: US 20130180677 A1; Publication Date: July 18, 2013; Inventors: George S. Thomas, Dexter B. Monroe, David Heird; Original Assignee: Buckman Laboratories International, Inc.; http://www.google.com/patents/US20130180677

RESULTS AND DISCUSSION

A Kraft/Recycled linerboard mill suffered from severe issues with stickies, causing holes, breaks and lots of costly downtime to regularly wash up. A specific enzymatic formulation product was used to solve this problem for immense benefits, including:

- Cleaner system, reduction in hemocytometer (pitch/stickies) test measurements
- Increased production, less stoppage due to breaks and forced downtime for washups
- Significant ROI per year = $890,240 per year

The Optimyze® Plus 727 point of application treated the stock that goes to the three paper machines PM#A, PM#B and PM#C, as shown in the diagram of Figure 4: Mill Flow Diagram. The basic paper mill conditions are listed in Table 1: Paper Mill Conditions. For all machines, the costs were reduced with the enzymatic technology over the diatomaceous earth program. The monitoring technique practiced by the mill was to monitor hemocytometer counts exiting the Stock Tower 4. The hemocytometer counts were reduced by 61.3%, indicating a statistically significant reduction in stickies, as analyzed in Figure 5: Hemocytometer Trends.

This translated directly into increased production on two of the three machines. The new stickies control program increased production on PM#A and PM#B, as can be seen in before and after monthly production trends in Figure 6a: Production Trends PM#A and Figure

FIGURE 4 : Mill Flow Diagram

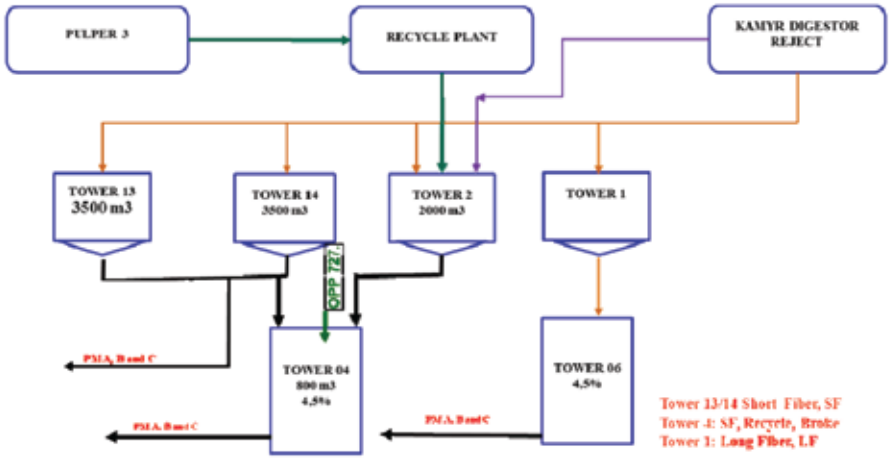


FIGURE 5 : Hemocytometer Trends

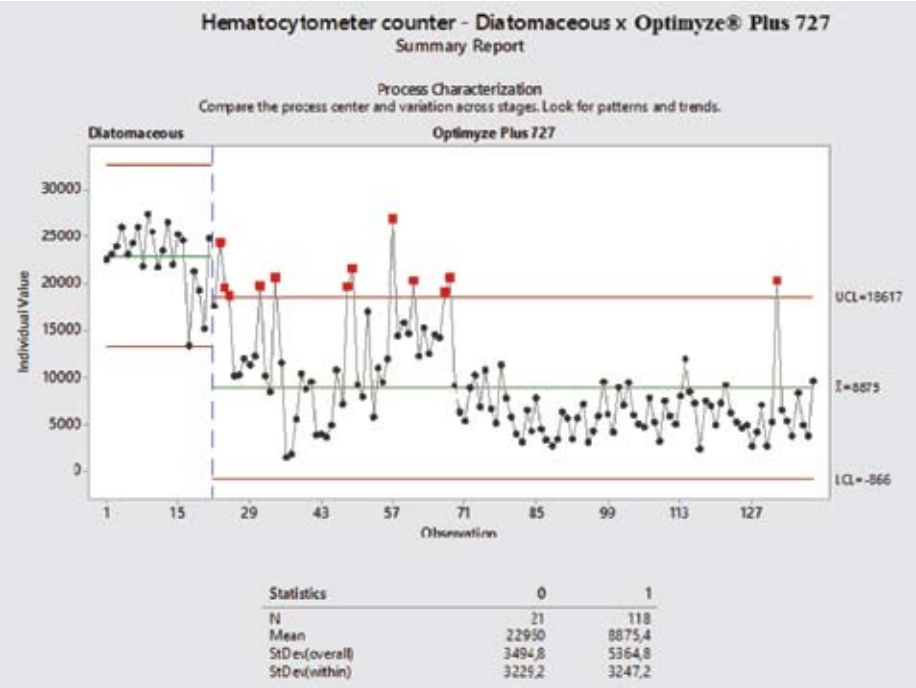


FIGURE 6a : Production Increase PM#A

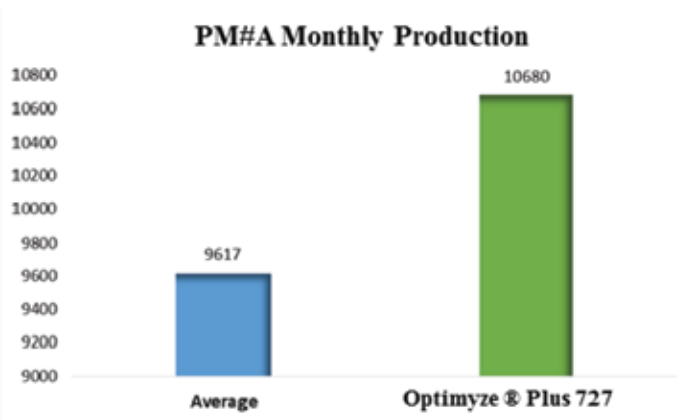
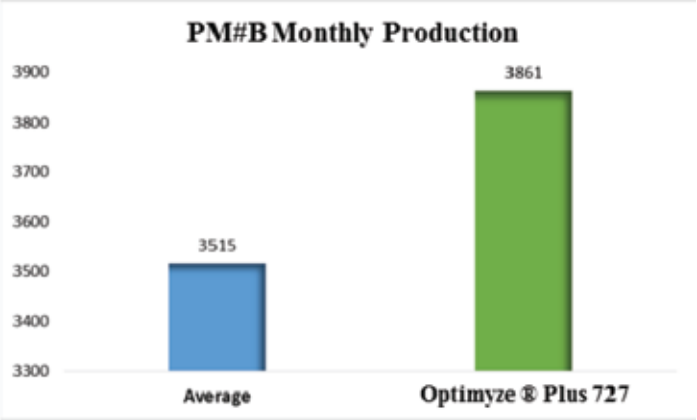


FIGURE 6b : Production Increase PM#B



6b: Production Trends PM#B. The new program increased the production at PM#B by 11% (1063 ton/month) and at PM#B by 9.8% (346 ton/month). These were mainly due to less breaks and no forced washups due to stickies. The ROI totaled $890,240 per year; full calculations in TABLE 2: ROI Calculations. Aside from great savings, the mill personnel were very happy to not have to be cleaning up and threading up the machine so often. The Optimyze program worked very well.

The Optimyze® Plus 727 stickies control product is delivered in 1 m3 tote bins. The product requires a pump for higher viscosity liquids. No dilution was used in the application of this formulated product.

ACKNOWLEDGEMENTS

The text and information in this article are proprietary from Buckman company presentations, training manuals and case study data.

TABLE 1 : Paper Mill Conditions

Paper machine:	
Grade	Kraft liner (recycled content)
Furnish	60% mix of SF + recycle (variation of 20-80% from each) and 40% mix 75% SF + 25% LF
Former	Fourdrinier with top former
Production rate	1372 tpd
Application point pH	9.2
Headbox pH	6.3
Headbox temperature	50°C
Additives:	
Diatomaceous earth	2.0 kg/ton, to stock tower
Coagulant cationic	1.7kg/ton, blend chest outlet
Cationic starch	4.5 kg/ton, blend chest inlet
PAC	2.0 kg/ton, fan pump suction
Rosin emulsified size	2.0 kg/ton, before screen
Silica	4.0 kg/ton, after screen
Alum	9.0 kg/ton, white water
MB control (Busperse 2454)	0.6 kg/ton, water system
Optimyze® Plus 727	**0.4 kg/ton, to stock tower (tower 4 inlet)**

TABLE 2 : ROI Calculations

RETURN ON INVESTMENT CALCULATION			
item	**Diatomaceous cost ($/month)**	**Increased production after Optimyze® Plus 727 ($/month)**	**Optimyze® Plus 727 cost ($/month)**
PM#A	29,789.62	12,533.12	17,429.76
PM#B	10,888.06	4,047.36	6,301.15
PM#C	85,936.72	0.00	45,276.58
TOTAL	126,614.40	16,580.48	69,007.49
ROI $/month	74,187		
ROI $/year	**890,249**		