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USE OF A DUAL POLYMER SYSTEM TO IMPROVE BROWN PAPER STRENGTH AND MACHINE EFFICIENCY

Abstract

The recycled paperboard industry has grown significantly in the past ten years, largely due to economic growth in developing countries. The use of recycled fibers meets both economic and environmental needs, but the increased recycling rate of fibers has resulted in a decrease in strength properties required for corrugated packaging. To compensate loss of strength, numerous wet end and dry end additives have been used but high costs of chemicals sometimes may not be economically viable. To meet stringent environmental regulations, there is also an increase in water closure, which is difficult for maintaining paper machine efficiency.

This paper talks about use of a dual polymer system to address the challenges of poorer quality of pulp and decreased machine efficiency. The system consists of two products - an engineered polyvinlyamine (PVAm) and a micro polymer. The PVAm is used to enhance fiber-fiber bonding for better strength while improving first pass retention and drainage for improved machine efficiency; the micro polymer is used to further enhance paper strength properties and machine efficiency while reducing overall treatment costs. Several case stories are included to demonstrate how the dual polymer system is applied to meet the challenges that today recycled paperboard producers are all facing.

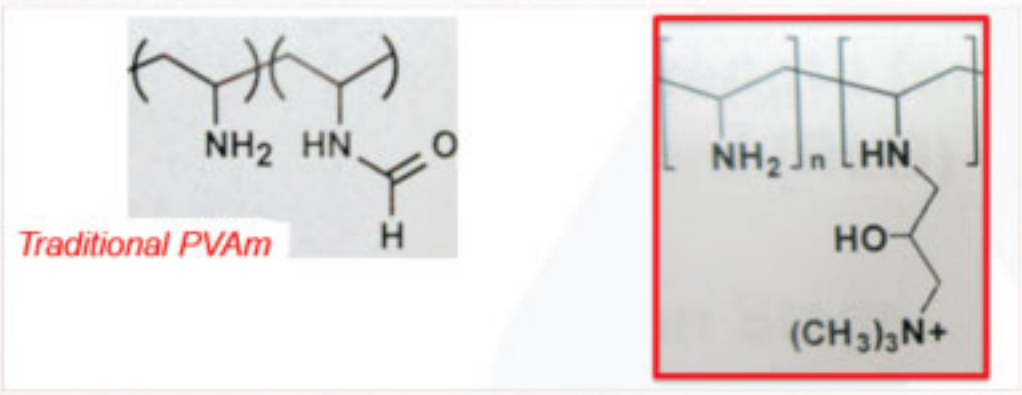
Introduction

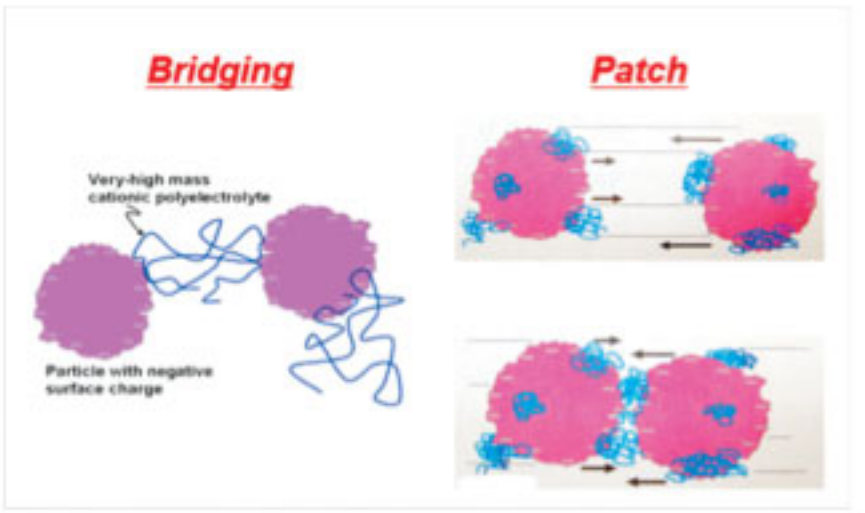
Traditionally brown paper machines use little or no functional and process chemicals. As corrugated packaging industry rapidly expands, there is a growing demand in strength of paper as well as improving brown paper machine efficiency. The need of strength improvement is particularly significant as recycle fibers quality continue deteriorating. Mills have used starch, retention, drainage and synthetic strength aids (like anionic and cationic PAM) to improve strength of paperand production requirements. Nonetheless, some inherent constraints associated with conventional wet-endchemicals often run out of steam in meeting ever-increasing demand of strength and improvement in machine efficiency. This paper illustrates a new technology where a dual polymer system can outperform conventional wet-end chemicals in both strength properties and production efficiency.

Mechanism of the dual polymer system

One of the biggest challenges to improve efficiency of a recycle linerboard or medium machine is to balance drainage, retention, and formation. The conventional drainage and retention aids often consist of a bridging-type of polymer. Such a polymer can be very effective in retention but a slightly higher dosage can result in over-flocculation, i.e., poor formation which can negatively impact strength properties. For this reason, mill typically have to compromise retention for a more sellable formation. But such a compromise result in poor efficiency of strength polymers and poorer machine efficiency. Use of a dual-polymer system can overcome such a compromise.

The first polymer of the dual polymer system is a uniquely designed PVAm. This uniquely engineered PVAm has comb-like structure that allows for a higher charge density as well as more H-bonding sites than that of traditional PVAm.

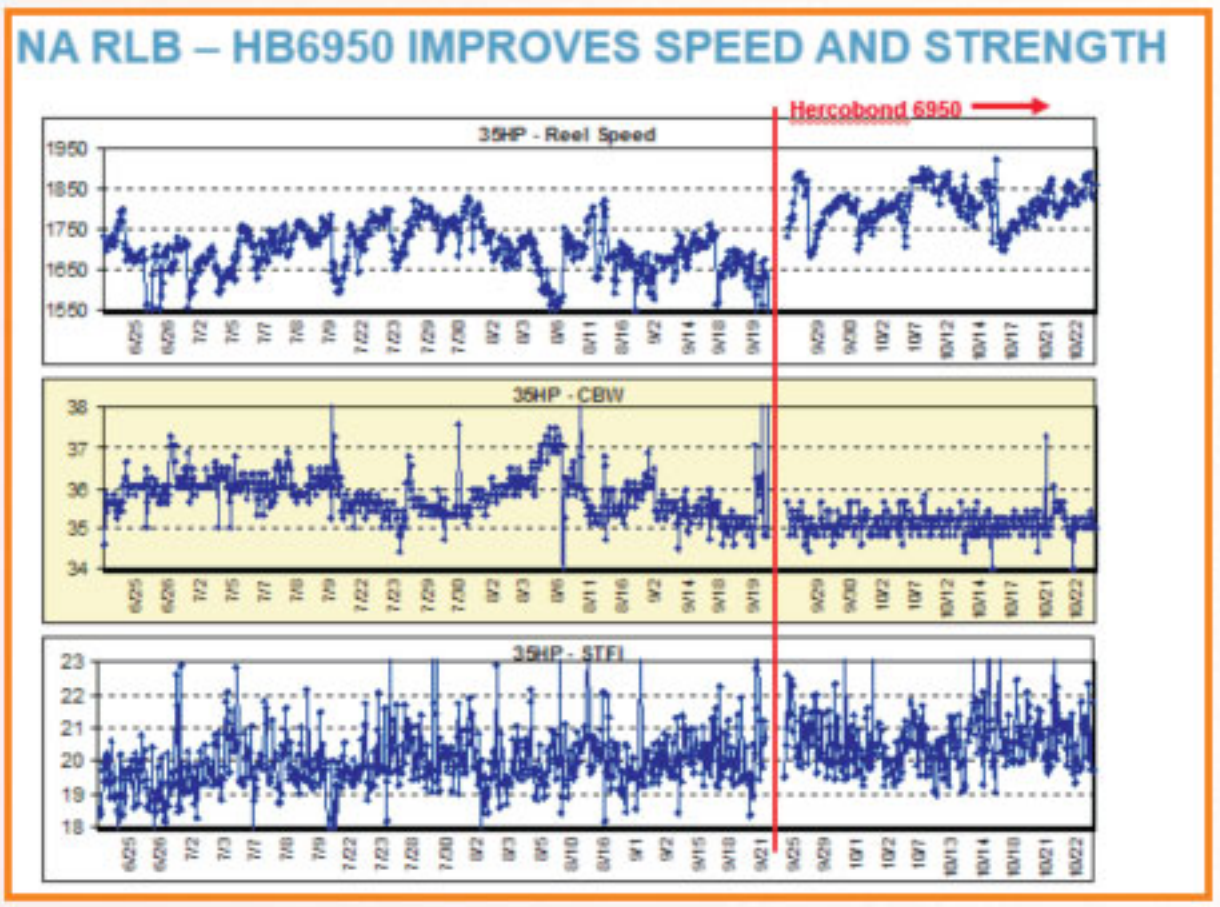




PVAm, a patching–type of polymer, can significantly minimize the negative effect of over-flocculation as its molecular weight is much lower than that of bridging-type of polymer. Instead of promoting retention using a higher molecular weight bridging-type polymer, a low molecular weight patching-type of polymer improves retention using a high charge density. The flocs promoted by patching-type of polymer is typically much smaller. In addition, it can be easily breakdown under shear which minimize the risks of over-flocculation. The re-flocculation of the patching-type of polymer can quickly occur when shear is removed. This means the overall retention can be improved without compromising with the concern of poor formation.

As shown in below several case histories, with the addition of PVAm alone, machine can experience significantly improved drainage, retention, and strength.

Case History-1: North America Recycle Linerboard



Case Story-2: Taiwan Recycle Linerboard

- **Mill location :** TAIWAN
- **System Data :** Machine type : Vat
  Grade : Recycle linerboard @ 150~310 g/m^2
  Furnish : OCC and DIP
  Production : 200~220 t/d
  Speed : 200~250 m/min

  Mill Issue : Improved waste water treatment ,production (speed), strength.
  Reduce chemical additives cost, DSR.
- **Solenis** : Hercobond 6950
- **Results** : Reduced Alum / PAC by 40~ 70 %
  Size 30 %
  DSR 20~ 40 %
  Defoamer 20~ 50 %
  RDC 30~ 50 %

Speed increased by up to 7.5 %. FPR 10~20 % Ash content 5 ~15 % .
Overall chemical cost saving is above1.5 USD/t

The second polymer used in the dual polymer system is a micro polymer consisting of high molecular weight polymer precipitated in cationic coagulant. Such a polymer by itself can provide excellent retention and drainage. When used along with PVAm, it provides synergistic benefits in further improving drainage and strength. This synergistic effect help optimize overall treatment costs in obtaining the best strength and machine efficiency, as can be seen below several case histories.

Case History-3: North America Recycle Linerboard

DELIVERED BENEFITS

- Increased strength allowing
  - 25% reduction in PVAM usage
  - Improved ability to meet HP targets at lower PVAM dosage
- FPR maintained while eliminating VOC containing polymer
- Reduced polymer costs
- Overall savings of $1 million/year

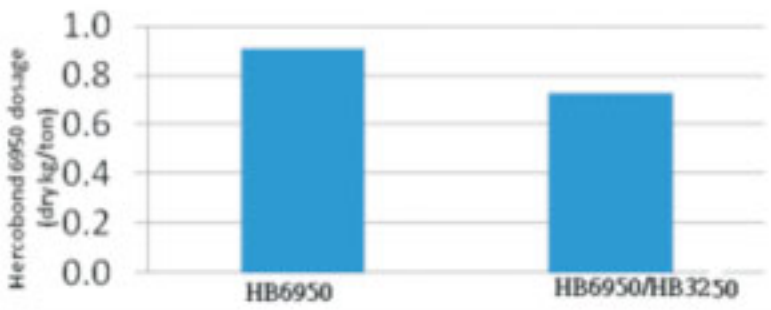
NA CASE HISTORY: HB6950 + HB3250

Customer Challenges:

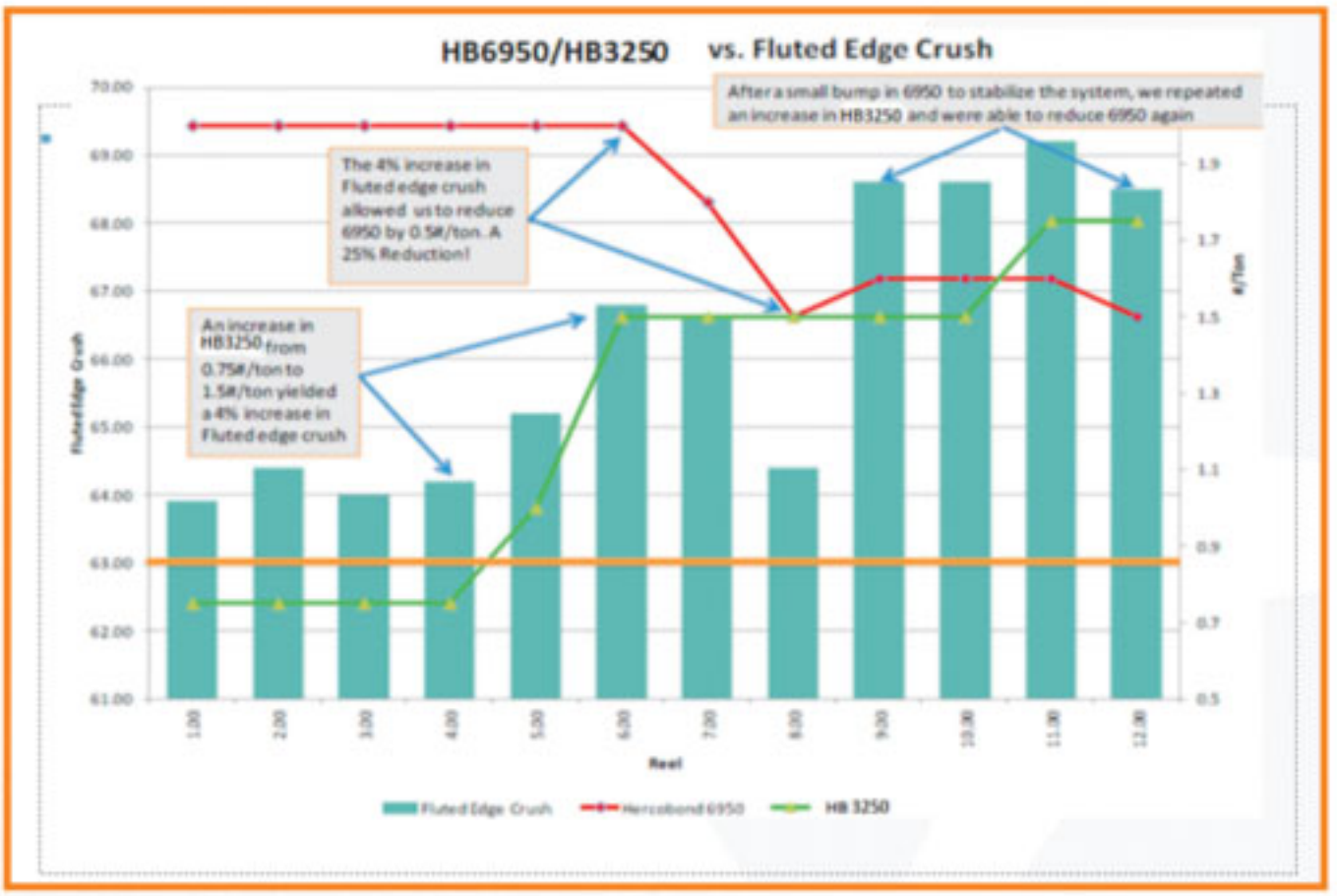
- 850 TPD North-American RLB, 100% OCC, 3000 Conductivity
- *Mill is challenged to reduce VOC and increase strength*

Solenis Solution & Results

- Solenis team proposed synergistic combination
  - Hercobond 6950 added to thin stock
  - Hercobond 3250 added to thin stock



Case History-4: North America Recycle Medium



Case History-5: North America Recycle Linerboard

DELIVERED BENEFITS

- Significant weight reduction
  - 5-15 grams
- More room to improve
  - Ring crush over spec still on some grades
- 30% AKD dosage reduction
- 20% reduction in dry strength dosage
- Estimated savings and value
  - $650,000 per year

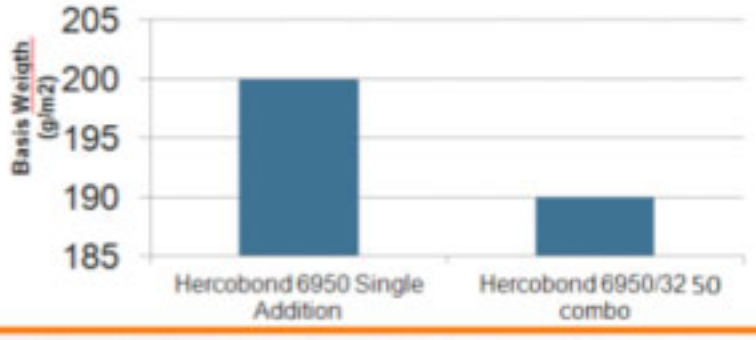
CASE STORY: HB6950+HB3250

Customer Challenges:

- 420 TPD **Recycled Liner**, 100% OCC, 1600 Conductivity
  - Runs overweight to meet ring crush
- *Mill is challenged to increase ring crush and reduce overall costs*

Solenis Solution & Results

- Solenis team proposed synergistic combination
  - Hercobond 6950 added to thin stock
  - Hercobond 3250 added to thick stock



Summary

In brown paper production, the dual polymer system significantly outperform conventional wet-end retention and strength chemicals by providing the following:

- **Lower overall cost: Reduce wet-end additive dosage (DSR, size, internal starch, retention aids…)**
- **Increased strength: Lower basis weight and increase speed and/or reduce steam**
- **Improved colloidal control**
- **Reduce waste**