



Balancing Dry Strength and Softness in Today's Market

Published:
Paper Technology | Autumn 2017



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Presented at Tissue World Europe Conference, Milan, 11 April 2017.

Solenis' new dry strength product — Hercobond™ 7550EU — is unique in the marketplace as it enables the tissue producer to improve sheet softness while maintaining/increasing dry strength of the final product. Additionally, it can give energy savings and a cleaner, more balanced wet-end system.

Two key parameters for tissue producers today is dry strength and sheet softness; however, achieving these two parameters together is not straightforward. Dry strength in tissue is achieved in many ways, including selection of fibre, degree of refining and addition of wet-end chemicals, and the tissue maker has to balance these in terms of cost and effect. On the other hand, process and furnish conditions needed to maximise softness are often in conflict with the ones needed to improve dry strength.

Dry-strength Additives

Dry-strength additives are used to improve paper strength under different conditions by assisting the formation of internal bonds between fibres. Typical additives are natural or semi-synthetic polymers, such as starch or carboxy methyl cellulose, or synthetic products, such as polyamines, polyamides, polyacrylamide and glyoxylated polyacrylamides. In more recent times, enzymes have also been used. While all of these products deliver dry strength, they often have an impact on the softness of the tissue and can lead to process issues, such as deposition, wet-end imbalance and excess fines generation.

Strength without Rigidity

Solenis challenged its R&D department to develop a new product that would impart dry strength without affecting the tissue rigidity and softness. Research scientist Dr. Joseph Mahoney first investigated why synthetic and natural dry strength aids give rigidity to the tissue. He found that stable and rigid bonds between fibres led to a stiffer tissue. Starch, for example, interacts with the z-direction of the sheet surface, giving rise to an I-beam effect; GPAMs, instead, forms covalent bonds. Using the pilot paper machine, a variety of developmental products were assessed in terms of the strength/softness correlation and their impact on stiffness, elongation at break and correlation to the creped sheet. After three years of investigation, Hercobond™ 7550EU emerged as a new and unique product that is able to break the connection between strength gain and softness loss because it can form flexible bonds with fibres.

Hercobond™ 7550EU dry strength polymer is mildly cationic, does not disrupt the charge balance of the wet-end system and has a wide operating window in terms of pH, conductivity and hardness. It does not need any make-down facility and can be simply added to the stock system. Additionally, it can be used in conjunction with all commonly used paper additives and has been found to work in synergy with wet-strength resins, enabling improvements in wet tensile.

Case History 1: Reduce Refining While Improving Strength and Softness

The first case study examines an American light dry crepe machine (45 t/day). The customer objectives were to reduce refining while maintaining or improving the strength and softness of bath tissue. The use of the Hercobond™ 7550EU enabled one refiner to be shut down while maintaining dry tensile (GMT *Figure 1*) and gaining a four-point improvement in softness (*Figure 2*) measured by the tissue softness analyser (TSA). Other benefits included improvement in retention, drainage and clarification (RDC), allowing the machine speed to increase by 75 m/min, and hood temperature reduction, leading to cost savings.

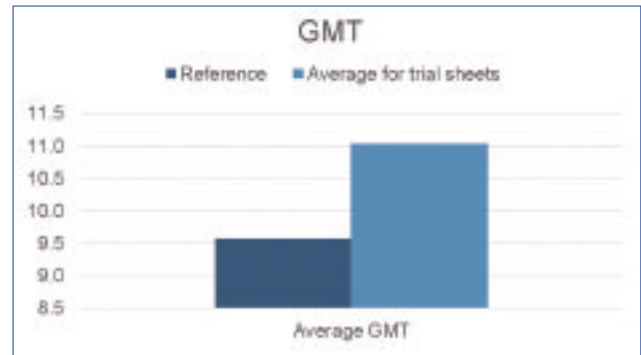


Figure 1: Dry Strength Improvement with Hercobond™ 7550EU dry strength

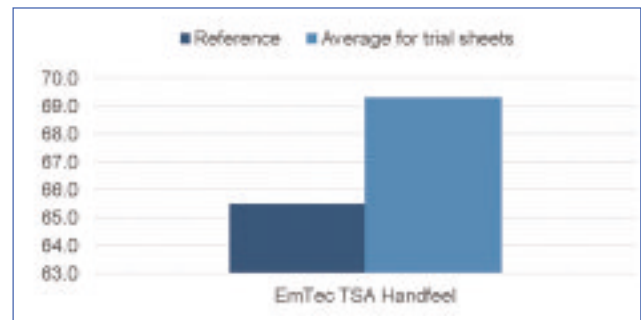


Figure 2: TSA Handfeel Improvement with Hercobond™ 7550EU dry strength

The tissue maker also evaluated Hercobond™ 7550EU on a through-air dryer (TAD) machine using 100% virgin softwood/eucalyptus blend fibre to produce premium bath tissue. Here, too, the final goal was to improve softness through reduced refining. Results showed a five-point gain in softness measured by TSA and refiner energy savings of 350 kW. Tissue strength increased by 5 to 10%, even with the reduced refining, and head box fines content decreased to less than 10%.

Case History 2: Starch Replacement

In this evaluation, a papermaker used Hercobond™ 7550EU to replace starch (4–6 kg/t) in virgin fibre kitchen towel production on a LDC machine. Additional benefits included an increase in retention (73–85%), improvement of the system charge balance and a seven percent reduction in hood temperature.

Often, when cationic dry-strength products are used in towel grades, the performance of the wet-strength agent is compromised. However, replacing starch with Hercobond™ 7550EU reduced how much wet-strength resin was required by 20% while still maintaining the target wet-tensile specification (Figure 3).

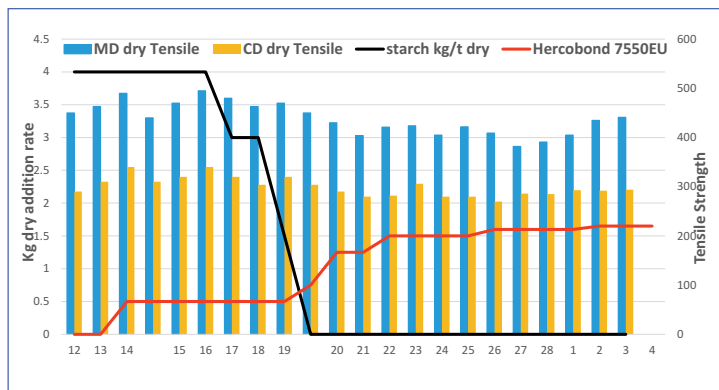


Figure 3: Replacing Starch Whilst Maintaining Dry Strength with Hercobond™ 7550EU dry strength

Case History 3: Eliminate Softwood Fibre

The reduction or elimination of softwood fibre content in bath tissue can lead to cost savings, but it can cause a loss in dry strength. In this case history, the customer was already using enzymes but was not able to reduce the softwood to less than 12%. The addition of Hercobond™ 7550EU dry strength to the mixing chest allowed the papermaker to reduce softwood fibre but still maintain dry tensile within specification. When mill staff stopped adding Hercobond™ 7550EU to the system, the dry strength specification could only be met after several hours downtime and by reintroducing the softwood at 12% and increasing refining (Figure 4). Replacing the long fibre by Hercobond™ 7550EU gave projected fibre/energy savings of approximately €15–18/tonnes and overall cost savings of around €10/tonnes of tissue produced.

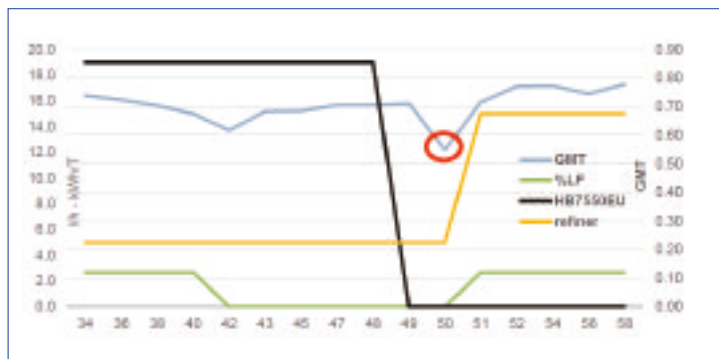


Figure 4: Elimination of softwood fibre with Hercobond™ 7550EU dry strength

Case History 4: Softness Improvements While Maintaining Dry Strength

Customer objectives on this 1800 m/min LDC machine were to improve tissue softness without losing dry tensile. Hercobond™ 7550EU was introduced into the long fibre while initially maintaining all other machine parameters. TSA showed a marked improvement without loss in strength (Figure 5). Long fibre was reduced by around 10%.

The introduction of Hercobond™ 7550EU also had a significant impact on the drainage and drying on the machine (Figure 6), resulting in a 15% reduction in hood temperatures and a 4% reduction in Yankee pressure. Other benefits included a reduction in white water consistency, improved retention, a cleaner, more balanced wet-end system and an increase in blade life.

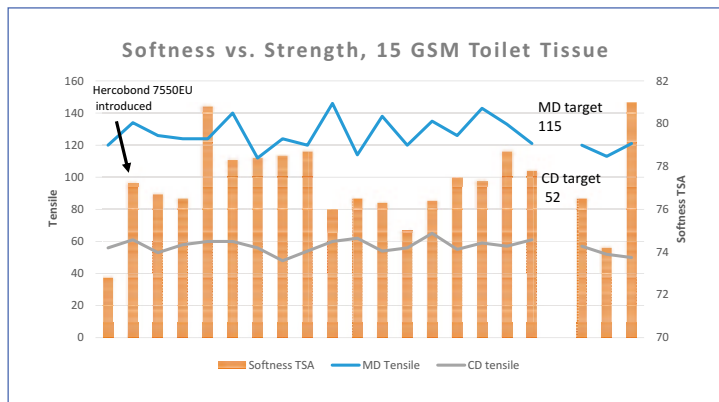


Figure 5: Softness versus Strength

Summary

With Hercobond™ 7550EU dry strength additive, the tissue maker now has a product that can help maintain/increase dry strength and improve the softness of tissue products. Other benefits of using Hercobond™ 7550EU include the reduction of long fibre, reduced refining, improved retention and drainage, decreased energy for drying, and cost savings. Furthermore, the product has been shown to work synergistically with the wet-strength resin during towel production.

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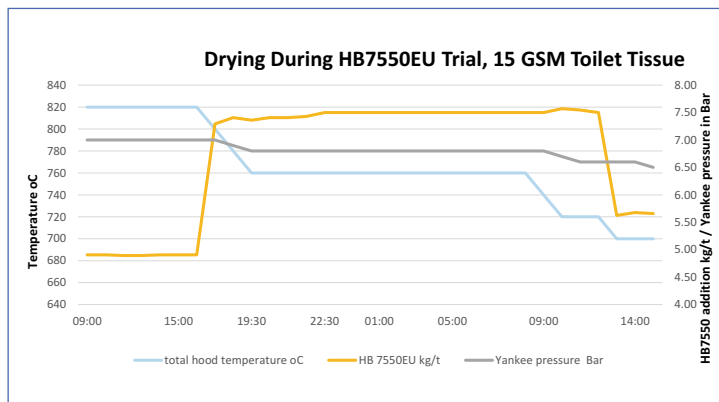


Figure 6: Dry During Trial with Hercobond™ 7550EU dry strength