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TissueMAG

This issue is distributed to Tissue Paper Mills and Tissue Converters in **Europe, Middle East, Africa + bonus countries**

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■ Figure 1. Representation of the fluorescent tagged carbohydrate binding modules attaching to their respective bonding sites on a fiber.

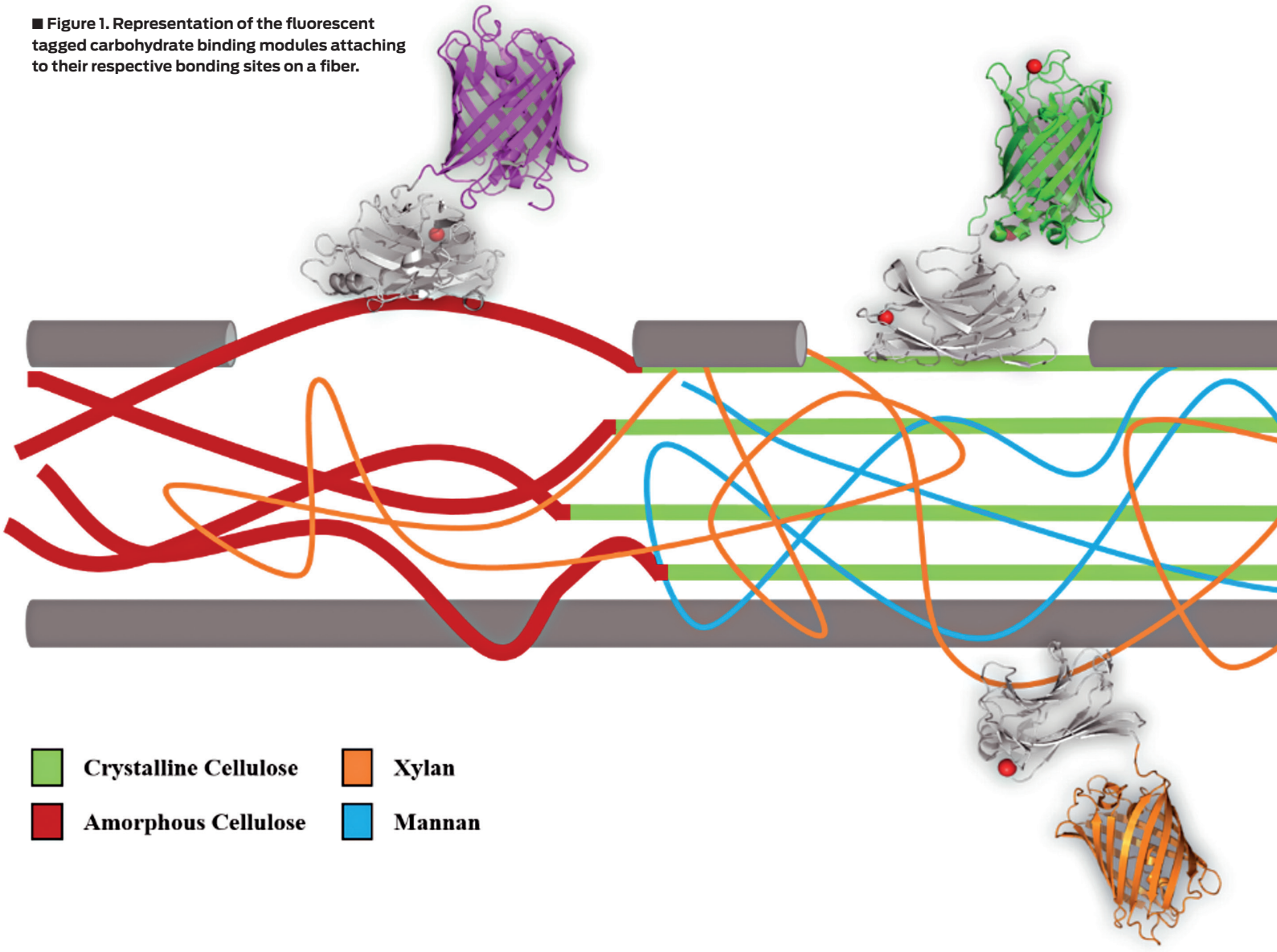
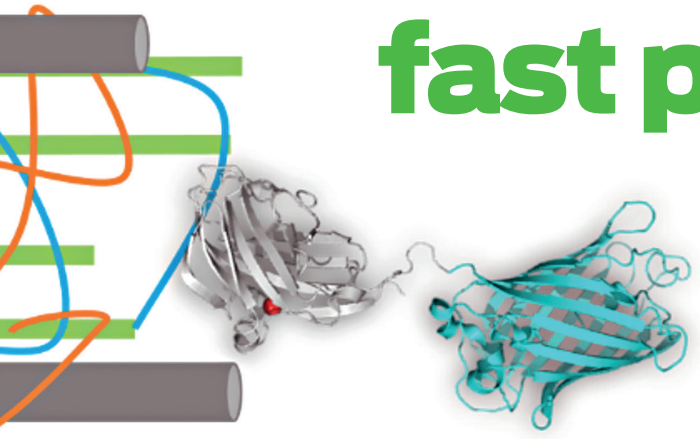


TABLE 1. PROS AND CONS OF VARIOUS STRENGTH APPROACHES

Strength generating approach	Pro	Con
Refining	Simple, responsive, effective	Increases stiffness and dust, reduces bulk, reduces tear
Increase softwood portion	Simple change, increased tea ras well as tensile	More expensive. Increased coarseness reduces softness
Increase creping moisture	Reduces drying cost and increases production rate	Reduced bulk to basis weight. Difficult to preserve softness. May require change of creping package
Dry strength resin	On demand strength	Costly. Increases stiffness

A new technical approach for fast pulp properties assessment



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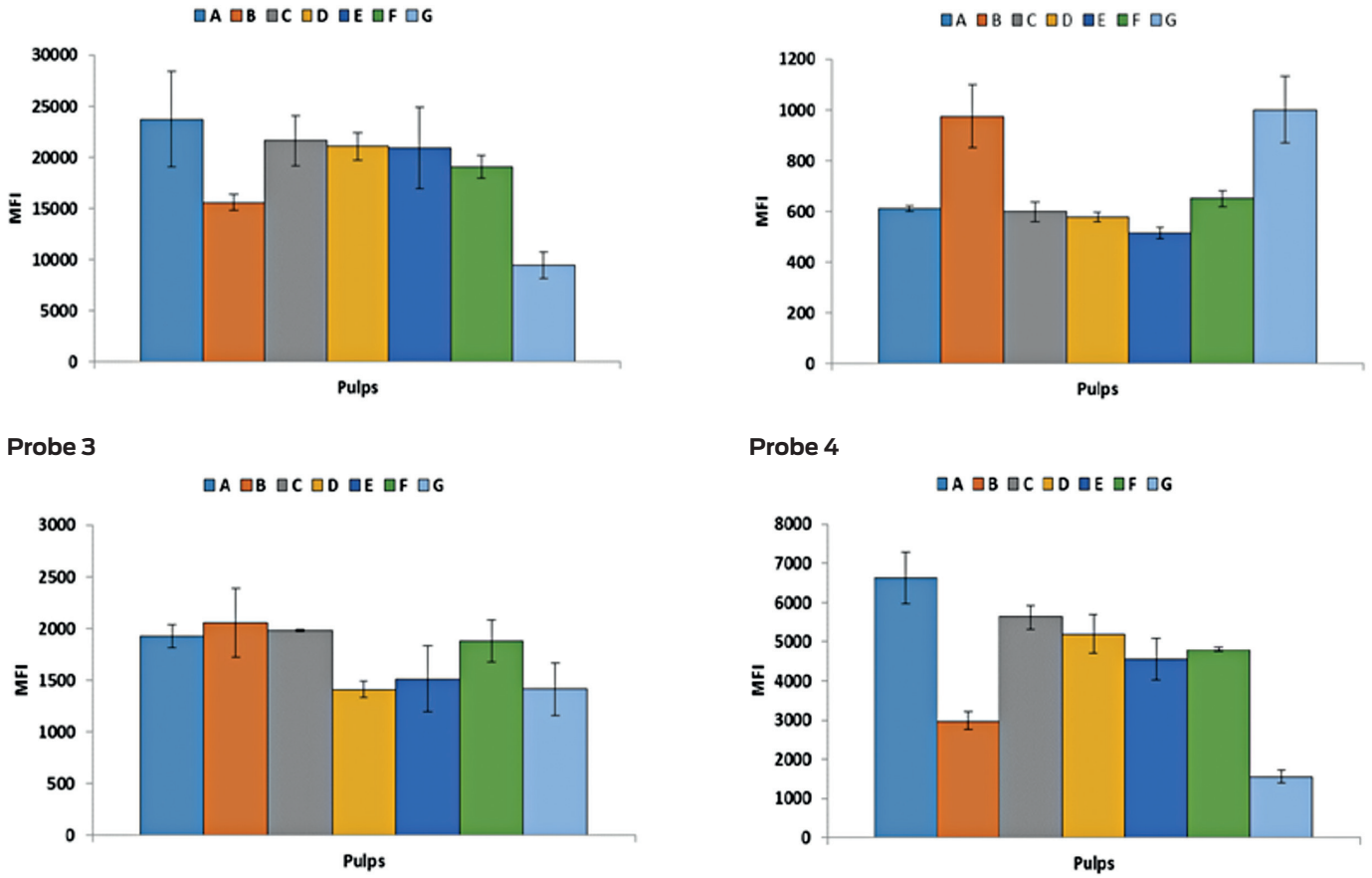
The soft and strong competition

Strength and softness are the key basic product parameters for tissue and towel producers. They must balance these in the creation of their products. There are almost a countless number of ways these parameters can be impacted with varying implications for cost and final product attributes. To complicate things further, strength is almost always inversely proportional to perceived softness unless careful consideration is given to how that strength is developed. Tissue makers and product development staff spend a lot of time determining the right counterbalance between how much strength a tissue product needs and how it is best developed to minimize the negative impact on some other attribute of the product. A few well-known examples of this are shown in *Table 1*.

What knowledge and capability would be a game changer for the industry?

Wood is a complex matrix of many intricately interwoven biopolymers. Fiber surface chemistry plays an integral role in determining the properties of the final products. The impact of fiber chemistry can be tested indirectly using standard TAPPI test methods, or directly at the surface/molecular level. Standard TAPPI methods will show differences in paper properties but will not show how these changes relate to fiber surface chemistry. In contrast, direct measurement of fiber chemistry uses complex methodologies is typically low throughput and prospects small areas of sometimes individual fibers (Ouellet et.al. 2017).

Buckman used a novel biomimicry approach to develop a more rapid testing methodology. This article summarizes the work contained in the original research publication (Ouellet et.al. 2017). Many carbohydrate degrading enzymes comprise three different components: a binding domain-CBM (attaches the enzyme in a specific way to the fiber), a catalytic domain (which breaks the specific bonds) and an interconnecting linker that keeps the two units separated, but together. Utilizing the specificity provided by four different CBMs, we combined them with four different colored fluorescent tags (e.g. a green fluorescent protein found in jellyfish (Voss et. al. 2013). The hybrid probes differentially bind to crystalline cellulose, amorphous cellulose, xylans and mannans, respectively. These chemical structures were chosen as they impact paper properties differentially (Fardim 2018). Simultaneous addition to a handsheet allows for a rapid relative quantification of the specific chemical moieties on the surface of the fibers (*Figure 1*).
Figure 2, next page, demonstrates what this looks like in pulp.



■ **Figure 2. Mean fluorescent intensity (MFI) of the four probes tested against seven different market pulp samples. Data clearly shows that the "ideal" ratios of enzyme binding modules vary significantly.**

> "Smart technologies and a complete portfolio of **chemical products** for the pulp and paper industry"

How will this knowledge be applied to the benefit of the industry?

The method has been successful in supporting papermakers in several ways.

1. The method allows for the rapid analysis of fiber chemistry properties that impact either strength or other required paper properties.
2. It has been used to advise supply chains on the best possible alternate fiber sources that will impact the process and final product characteristic least.
3. The method has been used in collaboration with the customer to recommend certain pulps for new product development.
4. The method can support identifying optimum fiber development.
5. The method can support identifying the best enzyme formulation (process specific) to apply that will complement the final product.

In conclusion the method as shown that it is highly reproducible and provides deeper insights into fiber surface chemistries. The ability to predict final paper properties is becoming more robust as more samples are studied. ●

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