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Improving paper properties using *Clostridium thermocellum* CBM3 glycosylated by *Pichia pastoris*

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The enhancement of the surface/interface properties of cellulose fibers by carbohydrate-binding modules (CBMs) has been shown in several works. Moreover, glycosylation in fungal CBMs has been suggested essential for the modification of paper pulps' properties, by improving fiber hydration, but there are no studies on this subject.

In this work, the CBM3 from *Clostridium thermocellum* CipA scaffolding protein was recombinantly produced in *Pichia pastoris* highly glycosylated to access the importance of the glycans on the properties of cellulose fibers. A non-glycosylated version of CBM3 was also produced in the same yeast to serve as control. Both recombinant CBMs were extracellularly produced in high amounts with the non-glycosylated version exhibiting higher cellulose-binding affinity than the glycosylated version. The two recombinant CBMs did not modify the drainability of *Eucalyptus globulus* pulp, while the non-glycosylated CBM increased significantly the hidrophobicity of cellulose fibers, an effect not observed with the glycosylated CBM. However, both recombinant CBMs were able to improve significantly the mechanical properties of *E. globulus* papersheets, namely the burst (up to 12%) and tensile strength (up to 10%) indexes, resulting in decreased air permeability. These results were dependent on the CBM concentration but not on its glycosylation. This work shows that glycosylated CBM3 can also modify the properties of cellulose fibers, contributing for paper products with higher quality, but the glycosylation pattern tested was not relevant for that effect.

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