

Choline hydroxide as an antagonistic electrolyte in structured hydrotropic co-solvents for enhanced wood swelling

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Choline hydroxide impregnates and swells wood cell wall material, with a similar efficiency than sodium hydroxide.

This electrostatic swelling effect is due to charge separation of the choline which adsorbs on cellulose crystals. Swelling facilitates delignification and further chemical treatment of wood.

We first show how adsorption of a large anion on the crystalline cellulose can induce swelling, in a known microstructure as shown in the figure 1. This charge separation is induced by cation adsorption on the crystalline cellulose via a “Hofmeister” effect.

We show in this contribution for the first time that the wood cell wall material swelling is moreover enhanced when choline hydroxide is impregnating wood, not from a simple basic solution, but from a hydrotropic solution containing ultra-flexible microemulsions. The structuration at nanoscale in solvent-rich and water-rich domains of the external solution in which wood is impregnated enhances the activity of electrolytes and facilitate transfer from solvent to the lignin-hemicellulose gel that is the inter-crystalline ternary gel.

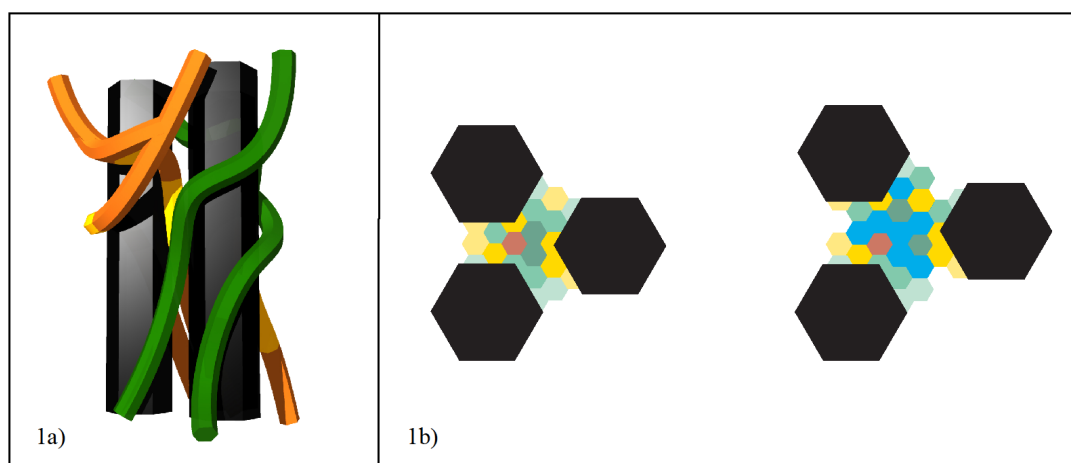


Figure 1 a) side view of a 3D model of the wood structure: crystalline cellulose nanofibers, in black, are embedded in a matrix of hemicellulose (green), lignin (orange) and water. The lighter green and yellow parts of the matrix indicate the contact points with cellulose nanocrystals. b) cross-sectional view: the distance between cellulose fibers increases during hydration.