Polysaccharide nanomaterials and advanced applications

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The potential of nanotechnology in various sectors of research and application is promising and attracting increasing investment. Unexpected and attractive properties can be observed when decreasing the size of a material down to the nanoscale. Cellulose and other polysaccharides (starch, chitin) are no exception to the rule. In addition, due to their abundance, renewability, high strength and stiffness, non-toxicity, low weight and biodegradability, the highly reactive surface of polysaccharides resulting from the high density of hydroxyl groups is exacerbated at the nanoscale.

Although cellulose is the most available natural polymer on Earth, it is only recently that it has gained importance as a nanostructured material thanks to its hierarchical structure. Cellulosic nanomaterials are generally in the form of cellulose nanofibrils (CNF) or cellulose nanocrystals (CNC). The mechanical modulus of crystalline cellulose is the basis of many potential applications. Moreover, the low thermal expansion coefficient caused by the high crystallinity of cellulose nanomaterials and high transparency without the presence of any existing polymer is highly advantageous for flexible display panels and electronic devices. For papermaking, in addition of improving the tensile strength, burst strength, tear, density, smoothness and also increasing the air permeability, the capacity of retaining the filler and the adsorption of a dye are also improved by the nanoparticles. Besides, the inherent high reactivity of cellulose and the pervasive surface hydroxyl groups associated with the nanoscale dimensions of cellulose nanomaterials open up opportunities to develop new functional nanomaterials.