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Regioselective chemical modification of cellulose nanocrystals: tuning of the colloidal interactions and new properties

Native cellulose nanocrystals (CNC-I) and nanocrystals of the allomorph II of cellulose (CNC-II) are biosourced colloidal rods that are very interesting building blocks for the design of innovative materials thanks to their inherent properties (renewable origin, biocompatibility, self-organization and mechanical properties, etc.). In sharp contrast with CNC-I, CNC II have only been discussed in a limited number of paper and their surface derivatization has received very little attention. Additionally, both types of particles exhibit an interesting feature that has only scarcely been exploited yet: aldehyde groups are regioselectively present at one end of the CNC-I and at the two ends of the CNC-II, allowing for a localized chemical modification. In this framework, we investigated strategies to efficiently modify CNC-I and CNC-II with gold nanoparticles or thermosensitive polymers in a regioselective manner in order to generate innovative assemblies (star-like or flower-like complexes, bundles, networks) exhibiting various functional, e.g. rheological, properties. Since the undertaken modifications concern a reduced fraction of the available anhydroglucose units, a quantitative direct characterization of the regioselective derivatization of CNCs remains challenging, even if the use of advanced techniques such as scattering methods gives fruitful information.

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