

# Press release

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## Surface modification of cellulose and nanocelluloses by innovative green processes

On January 28, 2022, Lorelei Douard defended a doctoral thesis from the Université Grenoble Alpes prepared under the supervision of the Professor Naceur Belgacem and of Julien Bras, Associate Professor HDR (Grenoble INP-Pagora / LGP2).

Lorelei Douard presented the results of her research entitled *Surface modification of cellulose and nanocelluloses by innovative green processes*.

Nowadays, nanocelluloses are one of the priorities of the European bioeconomy, as evidenced by the numerous industrial investments in the field and the increase in the number of scientific journals published each year. The grafting of a chemical function on these nano-elements gives them new attractive functions, as shown by the development of anionic nanocelluloses.

However, the preparation of these materials, remains problematic when it comes to moving to an industrial scale for reasons of cost and/or toxicity of reagents and solvents. This is why acidic natural deep eutectic solvents (DES) and the principles of mechanochemistry were studied in this thesis work.

This study confirmed the possibility of extracting one-step functionalized cellulose nanocrystals (CNC) from two deep eutectic solvents composed of choline chloride with citric acid monohydrate or oxalic acid dihydrate with a 1 to 1 molar ratio. A design of experiment enabled the optimization of this process. Moreover, the cellulosic residues could be used to extract cellulose nanofibrils (CNF) in a biorefinery concept, thus transforming more than 95 % of the cellulosic fibres into nanocelluloses.

The impact of mechanochemistry on cellulosic materials has also been confirmed by degradation of crystallinity and degree of polymerization. This solvent-free and catalyst-free process allowed the esterification of cellulose nanocrystals, which has been proven by chemical characterization technics.

Finally, an innovative process made it possible to obtain functional cellulose nanocrystals with a very high yield.

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