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Modified crystalline nanocellulose for the production of hybrid materials for biomedical applications

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The use of nanomaterials extracted from renewable biomass, in a world facing a serious ecological problem resulting from the abuse of petroleum-derived substances, is becoming increasingly popular. In this context, nanocellulose has shown promise in various applications because it is biocompatible, has good mechanical properties, and is easy to functionalize. [1] One possible use of this biomaterial is as a *drug delivery system* of nanoparticles. For this purpose, nanocellulose was functionalized by introducing carboxyl spacers of different lengths. Surface modification of cellulose nanocrystals was performed by TEMPO-catalyzed sodium hypochlorite oxidation, by reaction of primary glucose hydroxyl with monochloroacetic acid and succinic anhydride. Indium Tin Oxide (ITO) nanoparticles have a plasmonic absorption peak in the near-infrared and, following absorption, have non radiative relaxations that lead to the conversion of the energy absorbed by the electrons into heat that will be exchanged with the surrounding environment. [2] This could be of interest in phototherapy of surface tumors. ITO NPs, having affinity for carboxylic functions, were made to interact in an aqueous environment with the various derivatized nanocellulose samples described above. A fluorescent probe of the BODIPY family and a sugar unit were subsequently introduced that will allow the delivery to be observed and directed toward neoplastic cells. In-cell biological tests will demonstrate the efficacy of the obtained system.

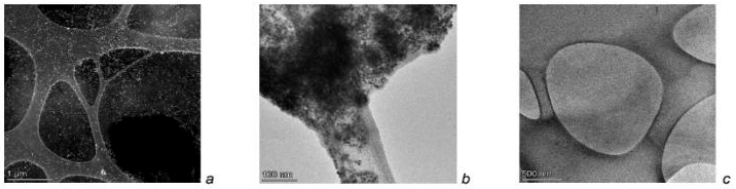

Figure 1: TEM images of the CNC decorated with ITO. From left to right *a)* CNC-oxidized, *b)* CNC-succinic *c)* CNC-carboxymethylated.

[1] N. Lin et al., *Eur. Polym. J.* **2014**, *59*, 303-325.

[2] A. Mazzotta et al. *ACS Appl. Mater. Interfaces*. **2022**, *14*, 35276–35286.

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