Luminescent biohybrid nanomaterials from nanocellulose and carbon dots (CDs)

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Cellulose nanofibrils (CNF) and cellulose nanocrystals (CNC) containing carboxyl groups were modified with luminescent, water-dispersible carbon dots (CDs). CDs were obtained from simple and robust microwave assisted pyrolysis of glycerol in the presence of 2,2-(ethylenedioxy)-bis-(ethylamine).¹ Intriguing properties of CDs include stable photoluminescence, hypotoxicity and excellent biocompatibility which are desirable features for example in biological systems and bioimaging applications.²,³ Quartz crystal microgravimetry with dissipation monitoring (QCM-D) and surface plasmon resonance (SPR) were used to investigate the coupling of CDs onto cellulose nanomaterials.⁴ Luminescence of synthesized biohybrid nanomaterials (CD-CNFS and CD-CNC) was confirmed by confocal fluorescence microscopy. Moreover, atomic force microscopy (AFM), and transmission electron microscopy (TEM) were applied to characterize the main morphological features of the produced biohybrid nanomaterials. CD-modified CNFs and CNCs may find use in various biosensing and imaging applications by the virtue of their fluorescence and surface functional groups. The CNF-CD may also be utilized in anti-counterfeit applications for example by printing the fluorescent CNF-CD gel on a paper substrate. Main results and possible applications for CD-CNFS and CD-CNC systems will be discussed.

Schematic representation of the synthesis of luminescent biohybrid nanomaterials from nanocellulose and carbon dots (CDs)

References