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NANOCELLULOSE AND ELECTROCHEMICAL BIOSENSORS: A NEW TOOL TO REPAIR PAPER ARTWORKS

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In the last years from researchers and industry the cellulose nanocrystals (CNCs) have recently gained great attention because of their unique properties, including high tensile modulus, high specific surface area, biodegradability, biocompatibility and sustainability [1]. Moreover, they are rich in surface hydroxyl group and display a good affinity to a variety of materials, including conventional paper (that is made up mainly by cellulose fibers). Importantly, CNCs are nano-dimensioned rods with average length of few hundreds of nanometers and width corresponding to that of an elementary fibril (10 nm). These characteristics fit very well with water pools found in amorphous cellulose that is present in degraded and fragile paper artworks. Thus, CNCs can be applied to repair high quality paper with special surface properties or modify other solid surfaces [2,3]. In this context, we propose a new procedure to restore the paper materials by filling water pools using CNCs, which were prepared and functionalized ad hoc in laboratory as “chemically interacting filler”. CNCs are also transparent, and their deposition on the paper artwork will not compromise the precious contents that, by definition, a restoration process must preserve. The conservation strategy, proposed herein, is followed using a disposable non-invasive and compatible real time monitoring tool, based on an amperometric biosensor coupled with a sampling flow system/Gellan gel (used in the past to monitor the cleaning process of paper artworks [4]). In the present work, the amount of unsuccessfully adsorbed nanocellulose is measured by using an amperometric biosensor, where microbial cellulases (from Trichoderma sp. and/or Aspergilluse sp.) are immobilized. In order to assess the validity of this approach, several invasive and not invasive techniques, such as, fluorescence microscopy, SEM, FTIR-ATR, HPLC, XRD have been used [5].

References

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