Study the influence of environmentally friendly plasticizers in pyrrole-doped nanocellulose films

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This work is intended to find novel solutions to energy storage and transmission using green nanotechnology. Previous works have shown the properties of pyrrole-doped nanocellulose films through diverse modification methods and different processing to achieve rigid and flexible films. However, there are still questions regarding how to include these components into more complex systems. Therefore, finding a solution could translate into improving the performance of the entire production and health, medicine, and electronics sectors. For this reason, the recent development of nanotechnology and the global concern for the environment focus on using biobased products to obtain high-value-added materials from lignocellulosic biomass as an alternative to replacing non-renewable materials. With these considerations, cellulose nanopapers with high mechanical performance and good electrical conductivity were manufactured. Cellulose nanofibers (CNF) previously extracted from bleached pulp were functionalized with pyrrole (Py) by a chemical in situ polymerization, with the presence of a metallic catalyst and an oxidizing agent. The structure and morphology of the manufactured nanopapers and their thermal, mechanical and conductive properties were studied. First, pure cellulose nanofibrils were prepared, then different samples of conductive nanopaper, varying the reaction time of the CNF/PPy mixture and the addition of selected plasticizers triethyl citrate, Tween 80, and diethyl maleate. Then, similar composite films were prepared with an amino-silane as the non-conductive counterpart with the corresponding plasticizer. Finally, composites containing silane-modified nanopapers with a simple circuit of pyrrole doped nanocellulose were elaborated to study the composite film's conductivity and selected physicochemical properties.