

**Title: Extraction and characterization of nanocellulose from bamboo**

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There is a need for developing renewables materials due to the increasing demand of alternatives to the unrenewable petroleum supplies. Nanocrystalline cellulose (NCC) or cellulose nanocrystals (CNs), which derives from cellulose, the most abundant biopolymer, is one of the most promising materials.

Cellulose is the most abundant organic polymer on earth which mainly provides structural reinforcement to the plants cell walls. Cellulose consists of a chain of thousands of bonded glucose units with  $\beta$  (1 $\rightarrow$ 4) links. It is mainly obtained from lignocellulosic biomass (plant dry biomass) to produce paperboard and paper. That lignocellulosic biomass is mostly composed by cellulose, which by strong hydrogen bonding networks forms microfibrils, hemicellulose, which binds together those microfibrils and lignin, which have various purposes like provide stiffness and cover the cellulose microfibrils. As will be seen later, several methods can be applied to extract the cellulose from the lignocellulose biomass. That cellulose contains crystalline and amorphous regions, which have different resistance to chemical attacks (crystalline regions have higher resistance while amorphous regions have lower), through different methods, which mainly involves sulfuric and hydrochloric acids, the amorphous regions are hydrolysed leaving the crystalline regions intact, those crystals that have a diameter between 5-70 nm and a length between 100-250 nm are called nanocrystalline cellulose. CNs are a renewable material with good mechanical properties and a nano-scaled dimension which opens a wide range of possible applications.

CNs can be obtained from almost any source of cellulose, from plants to bacteria. This report is part of a collaboration with the University of Guayaquil in Ecuador, the possibility of using bamboo as a source of cellulose to obtain CNs material has been studied since it's a material of great importance, widely used for its mechanical properties and with incredibly high growth rates.

This report provides an overview of the CNs, an emerging nanomaterial, the different ways to isolate the cellulose from which the CNs are extracted, the process required to obtain those CNs and different techniques to characterize it.

**Keywords:** Cellulose, Design of Experiments, Nanocrystalline Cellulose.