Understanding the building-up of cellulose nanocrystal /xyloglucan multilayers

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Plant cell walls are composite materials that form the major part of plant stem. The increasing interest of renewable resources to produce new biobased materials or biofuels has prompted scientists to develop mimetic assemblies in order to gain both a better insight of plant cell wall organization and to develop new strategies in order to improve biopolymers uses. The rules governing the interactions between polymers in this assembly are far from being fully understood at present [1]. In this context, we investigated the building-up of biopolymers multilayers (up to 8 layers) composed of cellulose nanocrystals (CN) with and without xyloglucan (XG). In one hand, the growth of CN/XG multilayer built up by sequential deposition was evaluated using dipping method by varying different parameters (rinsing steps and biopolymer concentrations). Film thickness of CN/XG multilayers has been measured by profilometry. In the other hand, mechanism of CN and CN/XG multilayers building-up was evaluated from Quartz Crystal Microbalance (QCM-D) technique (Figure 1).

Figure 1. Adsorption process of alternate layers of poly-L-Lysine (PLL)/cellulose nanocrystals (C) onto a 5 MHz quartz crystal as determined by QCM-D. ΔF (—) and ΔD (…) versus time for harmonics n = 3 , 5 and 7.

Frequency (ΔF) and energy dissipation (ΔD) shift measurements provide information about adsorbed mass and viscoelastic properties [2]. The key parameters to elaborate CN/XG multilayers are highlighted. Combined with QCM-D data, new insight on the potential interaction mechanism for the multilayer growing is given.