

ISOLATION, CHARACTERIZATION AND APPLICATION OF CHITIN NANOWHISKERS (CtNWS) AND CHITOSAN-SHEATH CHITIN-CORE NANOWHISKERS (CsNWS)

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ABSTRACT

Chitosan-sheath and α -chitin-core nanowhiskers (CsNWs) have been successfully generated by surface deacetylation of chitin nanowhiskers (CtNWs) in the never-dried state. CtNWs were derived from acid hydrolysis (3 N HCl, 30 mL/g, 104 °C) of chitin at 65 % yield and *CrI* of 86 %. The acidic aqueous CtNWs suspensions are slightly translucent and show good dispersibility (Fig. 1a). Deacetylation (50 % NaOH, 6 h, 24 h and 48 h, 50 °C) did not alter neither nanocrystal dimensions (4-12 nm thick, 15 nm wide, 247 long) nor morphology (Fig. 1b). Liquid-state high-resolution NMR of never-dried CsNWs colloidal suspensions confirmed successful surface deacetylation. All deacetylated CsNWs retained the same α -chitin crystalline, but reduced to 54% *CrI* from the deacetylation of the surface layers. Freezing dilute suspensions of CtNWs or CsNWs followed by freeze-drying produced a fluffy mass with distinct morphologies reflecting their different surface chemistries. CtNWs/cellulose acetate (CA) nanocomposite fibers were electrospun (14 kV, 1 mL/h) from 15% CA in acetone/DAMAc/H₂O (61,7/33.3/5 v/v/v%). At 2.5% CtNWs, the average fiber diameter was significantly reduced from 563 nm to 240 nm (Fig. 1c). It was also showed that the surface properties of CtNW/CA nanocomposite fibers could be tuned by the electrostatic adsorption of chitosan nanowhiskers as evidenced by zeta potential measurements. Biological assays showed that VERO cell growth was promoted on CA fibers by the incorporation of CtNWs and CsNWs. CtNWs and CsNWs suspensions presented antibacterial activity, causing 85 % and 98 % bacterial death following 24 h of contact, respectively. Furthermore, fibers with surface adsorbed CsNWs exhibited antibacterial activity against *Escherichia coli* at 99 % of CFU death in 24 h.

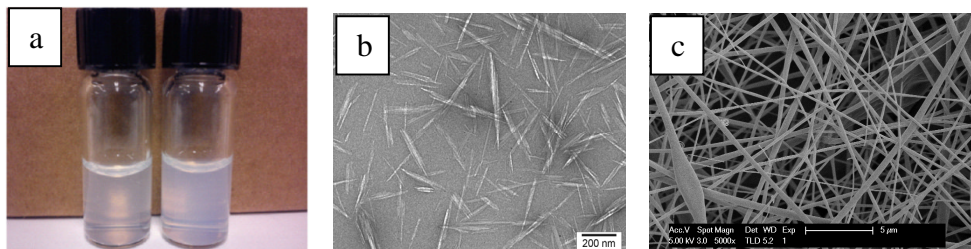


Fig. 1: (a) acidic aqueous suspensions of CtNWs, respectively; (b) TEM of chitosan nanowhiskers; (c) SEM of CtNW(2.5%)/CA nanocomposite fibers.

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