Supplementary data

DN Strategy Constructed Photo-crosslinked PVA/CNC/P(NIPPAm-co-AA) Hydrogels with Temperature-sensitive and pH-sensitive Properties

The influence of CNC contents in the DN hydrogels

CNC aqueous suspension was added to the PVA solution at given CNC/PVA mass ratios of 0.005:1, 0.01:1, 0.02:1, 0.03:1 in the preparation process of PVA/CNC/P(NIPPAm-co-AA) hydrogels. The results showed PVA/CNC/P(NIPPAm-co-AA) hydrogels had best mechanical strength when the CNC/PVA mass ratio was 0.01:1.

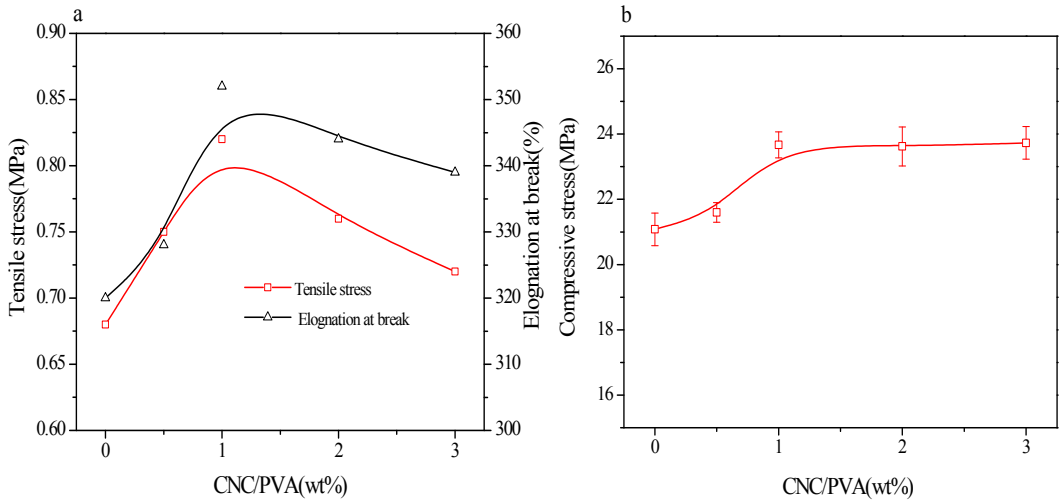

Fig 1. Tensile property (a) and compressive stress (b) of PVA/CNC/P(NIPPAm-co-AA) hydrogels with different CNC contents.

PVA/CNC/P(NIPPAm-co-AA) hydrogels (Fig. 1a) of increased CNC loading showed an increase in the tensile stress (TS) and elognation at break (EB). The reinforcement effect of CNC is evident at 0.01 (CNC/PVA w/w) loading of CNC, implying the contribution of CNC percolation, which is important in the reinforcement process. At low CNC loadings, the reinforcing effect of CNC is a direct result of the random orientation of the CNC and their interaction with PVA (as show in Fig. 2, compared with PVA, the peak between 3700 and 3100 cm^{-1} for PVA/CNC hydrogels shifted to lower frequencies), as well as the rigidity of the rod-like CNC structure (as show in Fig. 3). When the CNC content is above 0.01 (CNC/PVA w/w), the values of the TS and EB of the PVA/CNC/P(NIPPAm-co-AA) did not changed significantly, most likely due to CNC agglomeration in the PVA polymer matrix. Aggregation of CNC takes place at higher loadings and the structure becomes clustered. As a result, the contribution of CNC to TS and EB was negligible. However, Fig. 1b displayded aggregation of CNC didn't reduce the compressive strength of the hydrogel, this may be related to the orientation of the CNC under compressive stress.

In addition, the CNC contents have nothing to do with the temperature-sensitive and pH-sensitive properties of DN hydrogels.

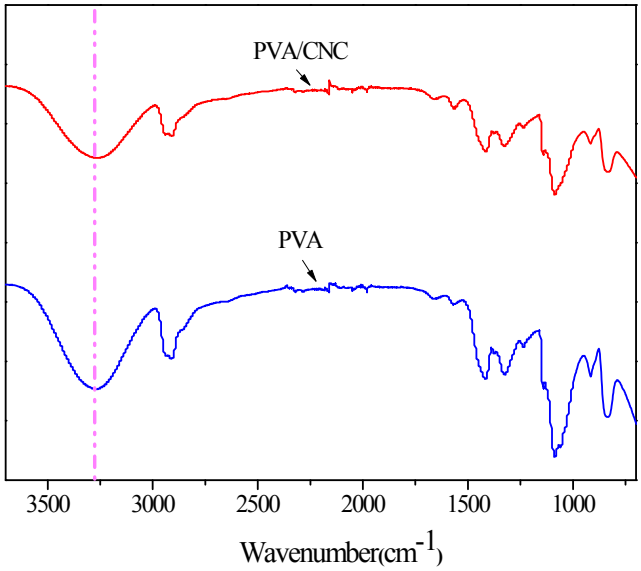

Fig. 2. FT-IR spectra of PVA and PVA/CNC.

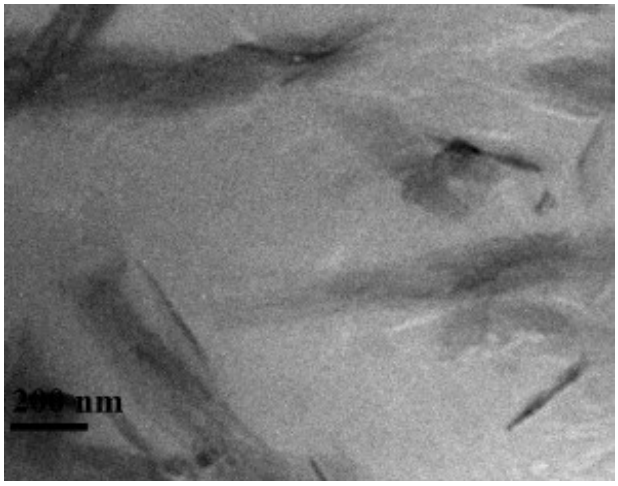

Fig. 3. The TEM image of CNC.