Functional Nanocomposites Based on Bacterial Cellulose

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Bacterial cellulose (BC) is produced by *Gluconacetobacter xylinus* cultivated in a medium containing glucose. Different from plant-derived cellulose, it has unique properties such as nano-sized network structure, high purity, high crystallinity and high water-holding capacity. The moisture content of never-dried BC is around 99%. Additionally, BC with layered structure is formed under static culture conditions. This study provides a new strategy to prepare functional composites containing BC, which have characteristic functions based on BC.

We have developed one-dimensional swelling-shrinkage of a dried sheet of BC-poly(sodium acrylate) nanocomposites in water. The nanocomposite was readily synthesized by the polymerization of sodium acrylate and acrylic acid with *N,N'*-methylenebisacrylamide in the presence of BC hydrogel and the dried sheet was obtained by drying the nanocomposite at heating. When the sheet was immersed in water, the thickness of the sheet extensively changed in comparison with the horizontal size. The vertical swelling ratio of the composite sheet against the horizontal one reached maximum 5, and the swollen sheet shrunk to the original shape by drying under vacuum. This swelling-shrinkage cycle could be repeatedly conducted. Furthermore, temperature-responsive one-dimensional swelling-shrinkage materials have been developed by using poly(*N*-isopropylacrylamide).

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