

## Bacterial nanocellulose: a multifunctional nanomaterial

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Cellulose is the most abundant biopolymer on earth. It plays a structural role in plants and a protective function in some fungi and bacteria. *Acetobacter xylinum* (reclassified as *Gluconacetobacter xylinus*) is capable of producing cellulose in nano dimensions with significantly different macromolecular properties compared with plant cellulose<sup>1</sup>.

Bacterial cellulose (BC) exhibits high purity (no lignin, hemicellulose), a high degree of polymerization and a remarkable tensile strength. It has a greater water holding capacity (200 times its dry weight). These properties along with the ability to mould the cellulose during production have led to innovative uses in biomedical, food and agriculture, electronic and engineering fields<sup>1</sup>. Such novel uses include BC nanofilms and nanocomposites used in high quality speaker diaphragms, a specialty carrier for battery fluids and fuel cells, a separation medium for water treatment, viscosity modifier and radical applications in biomedical areas filed, including artificial skin, vascular grafts, dental implants, and artificial blood vessels<sup>2</sup>.

In this study BC was produced not using a pure culture of *A. xylinum* but using an alternative method to isolate *A. xylinum* strain from pineapple peel residue (PC) and vinegar starter culture (VC). Nata-de-coco, the food prepared by fermenting coconut water by *A. xylinum* is composed of bacterial cellulose. Hence nata-de-coco was prepared using PC and VC, the resulting BC pellicles were purified, lyophilized and characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) and particle size analysis. Pure cellulose in the form of micro crystalline cellulose (MCC) was also compared with the isolated BC. FTIR results portrayed the presence of the characteristic anomeric carbon regions (950-750  $\text{cm}^{-1}$ ) including a band at 833.17  $\text{cm}^{-1}$  thereby confirming the presence of  $\beta$  1-4 glycosidic linkages in BC. XRD pattern for PC and VC revealed three main peaks at 6°, 18° and 23° of 2 $\theta$ . MCC showed peaks at 15° and 22°. SEM images confirmed the ultrafine network-like structure characteristic of bacterial cellulose. Particle size analysis also confirmed its nanometric widths of 142.2 nm and 224.1 nm for PC and VC. The study highlights the significance and distinguishing properties of BC compared with MCC and its potential for applications in green bio-nanotechnology.

### References

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