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Nanocellulose reigning many fields

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The importance of using materials from bio-based sources has gained tremendous attraction in research. Cellulose finds application in nearly every advanced field owing to its availability and unique characteristics. It is a renewable, cost-effective biopolymer, which in the nanoscale form possesses unique properties, such as large surface area, high reactivity and strength. Nanocellulose is the product or extract from native cellulose (obtained from plants, animals, and bacteria), which is composed of the nanoscaled structure material. It has a rich presence of hydroxyl groups, which provides it a crystal structure, and binding ability with different metal ions, dyes and other elements. Nanocellulose can be divided into three types, namely cellulose nanocrystals (CNC), cellulose nanofibrils (CNFs), and bacterial cellulose nanofibres (BCNFs). CNCs are prepared using acid hydrolysis (generally sulphuric acid), which removes the amorphous region containing lignin and results in a purely crystalline structure. CNFs are prepared using mechanical techniques involving high forces, such as grinding and ultrasonication. CNFs contain both crystalline and amorphous regions in them. The sources for CNCs and CNFs extraction are usually wood, cotton, hemp, flax, wheat straw, sugar beet, potato tuber, mulberry bark, ramie, algae, and tunicin. BCNFs are extracted from specific species of bacteria. They display the same molecular attributes as CNCs and CNFs but have a unique nano-porous structure, which provides high water retention capacity, a high degree of polymerisation and crystallinity. Nanocellulose with its abundance, high aspect ratio, better mechanical properties, renewability, and biocompatibility has attracted many scientists leading to design and develop various materials with tunable features. The use of nanocellulose materials is not only seen in nanocomposites, wastewater treatment, etc. but also witnessed in new evolving biomedical applications.

Keywords: Nanocellulose, Biopolymer, Nanostructures, Cellulose nanocrystals, Cellulose nanofibrils, Bacterial cellulose nanofibres, CNCs, CNFs, BCNFs

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