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Editorial

A Brief View of Cellulose-Based Bio Composites and Nanocomposites

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EDITORIAL NOTE

Cellulose is a natural polymer, which is a long chain made up of smaller molecules linked together. Sugar, -D-glucose, makes up the cellulose chain's links. When water is removed from the equation, the sugar units are joined by joining the H and -OH groups. Cellobiose is a disaccharide formed by joining two of these sugars. The glucose units in the cellulose chain are organized into 6-membered rings called pyranoses. Between the C-1 of one pyranose ring and the C-4 of the next ring are single oxygen atoms. The glucose units in the cellulose polymer are referred to as anhydro glucose units because a molecule of water is lost during the reaction of an alcohol and a hemiacetal to generate an acetal.

Due to its high strength and stiffness, biodegradability and renewability, and manufacture and application in composite development, cellulose macro- and nanofibers have gotten a lot of attention. The use of cellulose nanofibers in composite development is a relatively recent study topic. Because of the improved mechanical, thermal, and biodegradation properties of composites, cellulose microfibers and nanofibers can be utilized as reinforcement. Because cellulose fibers are hydrophilic by nature, increasing their surface roughness is required for the production of composites with improved characteristics

The reducing end of the cellulose molecule has a free hemi-acetal at C-1, the nonreducing end has a free hydroxyl at C-4, and the internal rings are linked at C-1 and C-4. However, the chemistry of the internal units' alcohol groups predominates due to the lengthy chain length, as long as the chains are not split by the reaction conditions. Unlike simple alcohols, however, cellulose reactions are more often controlled by steric considerations than one might assume based on the inherent reactivity of the various hydroxyl groups. In cellulose, the C-2, C-3, and C-6 hydroxyls, as well as the C-H groups, are active sites for the integration of polymeric chains.

The strength, stiffness, and density of cellulose fibers are all relatively high. Soft-wood Kraft fibers and flax fibers have a characteristic value that is similar to E-glass fibers. During the preparation of natural fibers, different mechanical qualities can be introduced. The fiber characteristics and structure are regulated by a variety of factors and vary depending on the plant's growth location, climate, and age. Another essential component that impacts the structure and characteristic value of fiber is its technical digestion. Natural fibers in bulk, such as wood, have an elastic modulus of roughly 10 GPA.

The range of applications for cellulose-based bio composites and nanocomposites is vast. Nanocellulose-based materials are used in a wide range of industries, including paper and packaging products, construction, automotive, furniture, and electronics, due to their numerous features. Applications in pharmacy, cosmetics, and biomedicine are also being studied. Nanocellulose's mechanical features, such as high strength and stiffness, surface reactivity (due to the presence of multiple hydroxyl groups), specialized organization, and small dimensions, may well confer desirable properties to (nano) composite materials reinforced with these fibers.

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