

Cellulose

Role of cellulose nanofibrils in improving the strength properties of paper: A review

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Abstract

The pursuit for sustainability in the papermaking industry calls for the elimination or reduction of synthetic additives and the exploration of renewable and biodegradable alternatives. Cellulose nanofibrils (CNFs), due to their inherent morphological and biochemical properties, are an excellent alternative to synthetic additives. These properties enable CNFs to improve the mechanical, functional, and barrier properties of different types of paper. The nanosize diameter, micrometre length, semicrystalline structure, high strength, and modulus of CNFs have a direct influence on the mechanical properties of paper, such as tensile index, burst index, Scott index, breaking length, tear index, Z-strength, E-modulus, strain at break, and tensile stiffness. This review details the role played by CNFs as an additive to improve strength properties of paper and the factors affecting the improvement in paper quality when CNFs are added as additives. The paper also includes techno-economic aspects of the process and identifies areas that need further research.