

# Nanocellulose, the futuristic materials now breaking to market

*Background information for Arkio Industries Ltd's solid nanocellulose R&D work*

**Harmless, fully recyclable while super strong with space-age permeability, water retention and bioavailability properties, nanocellulose promises to be the signature material category of the 2020s. Now Arkio Industries Ltd is the first in the world to launch pure nanocellulose solid structures, initially in the form of bespoke components and profiles.**

## **From adding the fine sheen to magazine paper to competing with carbon fibre**

The novel Arkio components are made of microfibrillated cellulose (MFC) that is a gel-like and very viscous substance in its natural form, largely consisting of water. MFC is typically made of plant cellulose via chemical and mechanical treatment, often in pulp mills since the material is a common coating for fine paper grades. The Arkio Industries innovation is in the exact mixture and additives to the base MFC material, combined with advanced moulding and curing techniques that enable the very high aspect ratio fibrils to form strong hydrogen bonds while recovering the process water. The resulting solid MFC components have unique properties: they are comparable to carbon fibre reinforced tubes in strength, warm to touch (osseous even) with a great texture, consistently opaque, and take dyes well.

## **Superior sustainable material with a long development history**

Since first produced in the early 1980s, nano- and microscale cellulose materials in various formats have attracted worldwide attention, both academic and industrial. Wide-scale applications have had to wait, however, until the 2020s saw the rapid industrialisation of nanocellulose production. The crude, mechanical early methods which basically amounted to crushing wood to fine pulp in a solution gave way to various chemical treatment methods and efficient shearing of the resulting gel-like substance, to preserve the nanoscale fibrils that give much of nanocellulose its intriguing properties.

Nanocellulose is an umbrella term for micro and nano scale cellulosic products. Since the field is new and moving rapidly, there is some flexibility in terminology. The main commercial novel cellulose types are the hair-like fiber forms Microfibrillated cellulose (MFC) and the finer nanograde Cellulose Nanofibrils (abbreviated NFC or CNF), and the chemically broken up strands as Cellulose nanocrystals (abbr. CNC, NCC). Further, the coarser grain Microcrystalline cellulose (MCC) is sometimes considered to belong in the material family. An even purer grade is bacteria-produced cellulose (BC), but the process is currently too costly for industrial applications.

## **Some recent perspectives to current and near future uses of nanocellulose**

**2013:** <https://www.sciencedirect.com/science/article/pii/S1369702113001958>

**2018:** <https://pubs.acs.org/doi/10.1021/acs.chemrev.7b00627>

**2021:** <https://onlinelibrary.wiley.com/doi/epdf/10.1002/adma.202004349>

**2022:** <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9694617/>

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