Technology Offer

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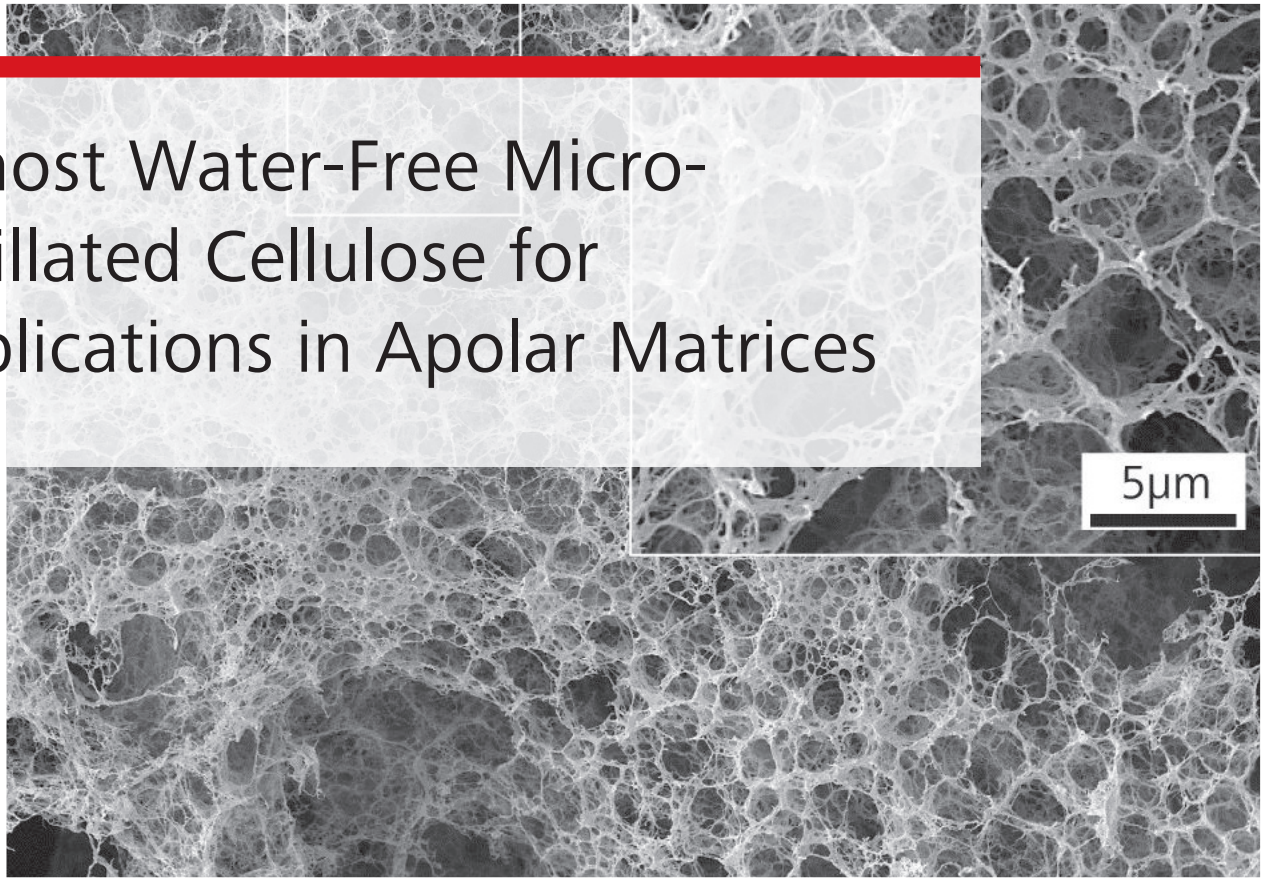
Empa
Materials Science and Technology

Almost Water-Free Micro-fibrillated Cellulose for Applications in Apolar Matrices



Invention

Owing to its advantageous rheological and mechanical properties, microfibrillated cellulose (MFC) would be a favourable compound for use in novel materials, but for its highly hydrophilic nature. The present invention overcomes this limitation by admixing an oily diluent to the fresh aqueous MFC suspension, and subsequently removing the major part of the water. The use of diluents with a vapour pressure lower than that of water facilitates a reduction of water content to as low as 30 wt%.

Such almost water-free MFC can be used as rheologic enhancer in a variety of hydrophobic matrices such as silicone or olive oil. Furthermore, the almost water-free MFC has been found to be immune against the typical drawbacks of MFC drying, such as hornification, and can be readily resuspended in water or further functionalised.

Background

MFC is a desirable component in various novel materials in technical, medical or food applications where it is used as building block, reinforcing agent or rheology enhancer, replacing e.g. inorganic filler compounds such as fumed silica in silicones. The ability to functionalise MFC opens another vast range of applications which are, however, currently limited to aqueous matrices.

Making MFC available for dispersion in apolar or hydrophobic matrices requires the removal of the surrounding water and a decrease of the surface polarity of the MFC. Simple drying is not a viable route since it leads to hornification of the MFC (i.e. the irreversible solidification of the material similar to concrete hardening) resulting in a loss of its advantageous properties. Approaches based on solvent exchange require organic solvents and/or surfactant, which cannot be fully removed from the end product and thus restrain the use in interesting medical or nutritional applications because of legal constraints or quality demands.

Advantages

The most obvious advantage of the invented process is its simplicity: An oily phase is added to the MFC suspension to produce a ternary mixture (MFC/water/oil), from which the water content can be reduced by classical techniques like distillation. The MFC remains concentrated in small, spherical beads with minimal water content which can be mechanically removed from the mixture, e.g. by filtration, and then be further processed. The oily dilutent is preferably the same as needed for the final dispersion of the MFC (silicone oil, mineral oil, olive oil).

Applications

Possible applications of this technique concern the field of rheology modifiers for oils (food or non-food grade), paints or silicon-based sealings (a sample is presented in the Vision Wood module of the NEST). Due to the shear thinning properties of MFC (diminishing viscosity with increasing "velocity"), the liquid phase containing the material can be easily pushed out of a tube but remains on its place when the movement stops. Other applications concern the reinforcement of apolar matrices like hydrophobic polymers.

Ownership

Empa, Swiss Federal Laboratories for Materials Testing and Research, Überlandstrasse 129, CH-8600 Dübendorf; Patent pending

Keywords

biopolymer, cellulose, microfibrils, chemical modification, oil, hydrophobic polymers

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