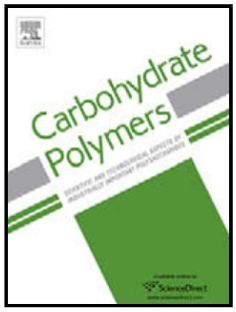

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Nanoparticles capture on cellulose nanofiber depth filters

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Abstract

A self-standing filter with a porosity of 80% is prepared from naturally abundant cellulose biopolymer in its native state by water-based cationization and freeze-drying processes. The positive surface charge of the filter in a wide pH range favors its interaction with various nanoparticles (NPs), while its tortuous sheet structure builds a contact between cellulose nanofibers (CNF) and the NPs, and hinders them to pass through the filter. Unlike membranes used for the retention of NPs and viruses, the separation in the CNF filter is not only limited to its surface but occurs also in its interior even when the NPs are orders of magnitude smaller than the filter pores. Additional functionalities added to the filter enlarge the spectrum of NPs it can separate. NPs supported onto the filter can thereafter be utilized for the reduction of harmful chemicals into their benign form. The present filter concept may not only address shortcomings of the current membrane systems, but could offer a disruptive technology for the sustainable and universal water purification.

Keywords: nanocellulose; filter; nanoparticles; freeze-drying.