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# Cellulose binders for electric double-layer capacitor electrodes: The influence of cellulose quality on electrical properties

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**Abstract**

Cellulose derivatives are widely used as binders and dispersing agents in different applications. Binders composed of cellulose are an environmentally friendly alternative to oil-based polymer binding agents. Previously, we reported the use of cellulose nanofibers (CNFs) as binders in electrodes for electric double-layer capacitors (EDLCs). In addition to good mechanical stability, we demonstrated that CNFs enhanced the electrical performance of the electrodes. However, cellulose fibers can cover a broad range of length scales, and the quality requirements from an electrode perspective have not been thoroughly investigated. To evaluate the influence of fiber quality on electrode properties, we tested seven samples with different fiber dimensions that are based on the same kraft pulp. To capture the length scale from fibers to nanofibrils, we evaluated the performance of the untreated kraft pulp, refined fibers, microfibrillated cellulose (MFC) and CNFs.

Electrodes with kraft pulp or refined fibers showed the lowest electrical resistivity. The specific capacitances of all EDLCs were surprisingly similar, but slightly lower for the EDLC with CNFs. The same electrode sample with CNFs also showed a slightly higher equivalent series resistance (ESR), compared to those of the other EDLCs. Graphite dispersions with MFC showed the best dispersion stability.

*Keywords:* nanocomposite, nanocellulose, cellulose, graphite, supercapacitor, electric double-layer capacitor

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