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Novel Imaging Approach for Quantitative Morphometry of Nano-Cellulose Scaffolds

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Bacterial-derived nano-cellulose (NC) is a novel material with promising biomedical applications. We focus on its potential as a non-biodegradable scaffold for cartilage tissue-engineering (TE). NC is composed of a mesh of cellulose nano-fibrils. For TE it is important to control porosity and interconnectivity to facilitate cell migration. The aim of this study was to identify a 3D imaging protocol for quantifying pore size and interconnectivity.
Samples were quenched in LN2 and freeze-dried. Phase-contrast was performed at the TOMCAT beamline with a modified Bronnikov algorithm (MBA) at 10 keV with a 4x (1.85 µm, 3.7 x 3.7 mm2) and 20x objective (0.37 µm, 0.75 x 0.75 mm2). Average pore size of macropores (Ø125 µm) and micropores (<Ø5 µm) were identified with the 4x and 20x objective, respectively.
Since dry NC behaves as a pure phase object (no absorption), MBA is an ideal method. In this work, NC can be easily segmented, and pore size can be obtained by distance transformation. Therefore phase-contrast X-ray tomography with MBA is a promising 3D imaging protocol for characterization of the porosity of NC.

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Imaging

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