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Using synchrotron-based microtomographic imaging to characterize biofilm architecture in porous media

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Biofilm structure or architecture in porous media has mostly been observed in two dimensions, at the nanoscale, or at limited resolution in three dimensions. Where synchrotron-based x-ray microtomography lends itself naturally to detailed characterization of physical variables such as porosity, pore morphology, pore network structure, it is not necessarily a natural choice for imaging biological material. Because biofilms have very similar x-ray absorption characteristics as water, imaging with x-ray tomography is not straightforward. However, we have adapted the technique so that it is possible to image biofilms in porous media without disturbing their natural spatial arrangement. Using a physical straining approach, we are able to differentiate between the biomass-filled pore space and fluid-filled pore space. The resulting tomography images of biofilm architecture have been successfully compared to regular microscopy data for verification.