Electropumping of Water through Functionalised Carbon Nanotubes

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There are many nanotechnology applications that would benefit from being able to effectively pump water through nanotubes, including lab-on-a-chip technologies, drug release and delivery, and desalination. Continuum hydrodynamics analysis and Nonequilibrium Molecular Dynamics (NEMD) simulations have shown that a net positive flow can be generated by applying a rotating electric field to a polar fluid confined to a nanochannel or nanotube when that nanochannel or nanotube has asymmetric hydrodynamic boundary conditions (electropumping). In this presentation we show that sufficient asymmetric boundary conditions can be created for electropumping by functionalising part of carbon nanotube with carboxyl groups. We also demonstrate that the effectiveness of electropumping is related to the degree of functionalisation and nanotube diameter.