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Oscillating Diffusion - A New Diffusion Mechanism for Nanoparticles Exposed to Ultrasound in a Hydrogel[1] JEFFREY MARSHALL, DONG MA, JUNRU WU, University of Vermont — Diffusion is the primary mechanism for transport of particles and chemicals in a biofilm, which is essential for many biofilm mitigation strategies. The current research reports on a recently discovered diffusion mechanism which we call oscillatory diffusion. In this mechanism, an oscillating flow (ultrasound) can be used to significantly enhance nanoparticle diffusion in a porous medium (a biofilm hydrogel). It is assumed here that the particle and pore sizes are such as to exhibit hindered diffusion, caused by intermittent capturing of particles by the porous medium for brief time periods. The research includes experimental studies with different particle sizes in which the enhancement of particle diffusion coefficient in a hydrogel by ultrasound exposure is confirmed and detailed measurements are reported. A simple stochastic model of the oscillatory diffusion process is presented. Preliminary results will also be presented for a larger-scale experiment in which the time-accurate particle path is measured in a porous bed in the presence of an oscillatory flow. This latter experiment seeks to examine the proposed oscillatory diffusion mechanism and validate mathematical models for this process.

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