Abstract Submitted
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Secondary flows enhance mixing in a model of vibration-assisted dialysis[1] JOHN PITRE, Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI, BRUCE MUELLER, SUSAN LEWIS, Department of Clinical, Social and Administrative Sciences, College of Pharmacy, University of Michigan, Ann Arbor, MI, JOSEPH BULL, Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI — Hemodialysis is an integral part of treatment for patients with end stage renal disease. While hemodialysis has traditionally been described as a diffusion-dominated process, recent in vitro work has shown that vibration of the dialyzer can enhance the clearance of certain solutes during treatment. We hypothesize that the addition of vibration generates secondary flows in the dialysate compartment. These flows, perpendicular to the longitudinal axis of the dialysis fibers, advect solute away from the fiber walls, thus maintaining a larger concentration gradient and enhancing diffusion. Using the finite element method, we simulated the flow of dialysate through a hexagonally-packed array of cylinders and the transport of solute away from the cylinder walls. The addition of vibration was modeled using sinusoidal body forces of various frequencies and amplitudes. Using the variance of the concentration field as a metric, we found that vibration improves mixing according to a power law dependency on frequency. We will discuss the implications of these computational results on our understanding of the in vitro experiments and propose optimal vibration patterns for improving clearance in dialysis treatments.

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