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Influence of Non-homogeneous Particle Distributions on Drug Release in a Couette *in vitro* Dissolution Device BALAJI JAYARAMAN, JAMES BRASSEUR, Penn State, YANXING WANG, Georgia Tech — Drug dissolution rates from powdered formulations are commonly measured in *in vitro* devices. Both measurements and models commonly assume perfect mixing of drug and particle within the device. In this study we analyze the potential importance of heterogeneity in particle concentration and distribution using CFD that incorporates physically accurate mathematical representations of hydrodynamic enhancement of mass transport from shear as applicable to drug dissolution *in vivo* as well as *in vitro*. We have developed a high-fidelity computational formulation using the Lattice Boltzmann Method (LBM) with the parallel particle tracking for a polydisperse collection transported by the flow. Drug release from the small ($<$100 μm) Lagrangian 'point' particles is modeled using a mathematical framework that is built on a validated first principles 'quasi-steady state' approximation with correlations for shear enhancement and integrated with the coarser Eulerian LBM flow field using a subgrid formulation Our Eulerian-Lagrangian formulation takes into account spatial variations in particle 'bulk' concentration from polydisperse particle distributions with specified particle distribution heterogeneities. We shall discuss the primary influences of heterogeneous bulk concentrations surrounding individual particles and non-homogeneous particle distributions in an *in vitro* Couette flow device to quantify the relative influences of shear enhancement on drug dissolution *in vivo* vs. *in vitro*

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