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Nonlinear transport of soft droplets in pore networks FRANCK VERNEREY, EDUARD BENET CERDA, KANGHYEON KOO, University of Colorado - Boulder — A large number of biological and technological processes depend on the transport of soft colloidal particles through porous media; this includes the transport and separation of cells, viruses or drugs through tissues, membranes and microfluidic devices. In these systems, the interactions between soft particles, background fluid and the surrounding pore space yield complex, nonlinear behaviors such as non-Darcy flows, localization and jamming. We devise a computational strategy to investigate the transport of non-wetting and deformable water droplets in a microfluidic device made of a random distribution of cylindrical obstacles. We first derive scaling laws for the entry of the droplet in a single pore and discuss the role of surface tension, contact angle and size in this process. This information is then used to study the transport of multiple droplets in an obstacle network. We find that when the droplet size is close to the pore size, fluid flow and droplet trafficking strongly interact, leading to local redistributions in pressure fields, intermittent clogging and jamming. Importantly, it is found that the overall droplet and fluid transport display three different scaling regimes depending on the forcing pressure, and that these regimes can be related to droplet properties.

Franck Vernerey
University of Colorado - Boulder

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