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Numerical Modeling of Two-phase Electrohydrodynamic Instability Mixing VENKAT NARAYANAN, JIANBO LI, JEFFREY ZAHN, HAO LIN, Rutgers University — Organic-aqueous liquid (phenol) extraction is one of many standard techniques to efficiently purify DNA directly from cells. Mixing of the two fluid phases increases the surface area over which biological component partitioning may occur. Electrohydrodynamic (EHD) instability provides a means for effective two-phase micromixing, and has been experimentally demonstrated. In this work, analysis and simulation are combined to study two-phase EHD instability; main focus is placed on simulating the nonlinear instability regime and droplet formation. Specifically, the work investigates the effects of the applied electric field, geometry, surfactants, and convective flow rate on instability and mixing characteristics. The eventual objective is to maximize surface area and dispersion of the organic phase for optimized DNA extraction. The Taylor-Melcher leaky dielectric model is implemented using a finite volume, immersed boundary method, and preliminary results are presented and discussed.

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