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Electric-Field Induced Pattern Formation in Layers of DNA Molecules at the Interface between Two Immiscible Liquids[1] JOHANNES HARTMANN, STEFFEN HARDT, SICHENG ZHAO, Institute for Nano- and Microfluidics, Technische Universitt Darmstadt, ADITYA BANDOPADHYAY, Department of Mechanical Engineering, India Institute of Thechnology Kharagpur — Electrohydrodynamic/electrokinetic flows play a key role as driving mechanism of pattern formation in colloidal dispersions and at liquid-liquid and liquid-solid interfaces with adsorbed particles. We report an analogous phenomenon of electric field-induced concentration patterns of DNA molecules at the interface of an aqueous two-phase system. The electric field, applied normal to the liquid-liquid interface, drives the molecules to the interface where they get trapped. Hydrodynamic interactions between the molecules arise by electroosmotic flow due to the Debye layer around the polyelectrolytes, leading to pattern formation in the DNA concentration field at the interface. We describe the time evolution of the concentration field by a non-linear integro-differential equation. A linear stability analysis of the equation yields a critical time after which the system destabilizes if exited by a mode of given wavelength. We find that the scaling behavior predicted by theory agrees with experimental results. The presented scheme could be used as an efficient method to pre-concentrate DNA molecules at an interface.

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