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Flow induced by membraneless osmosis between a droplet and a bath MATTHIEU ROCHE, CORENTIN TRÉGOUET, BO SUN, HOWARD A. STONE, Department of Mechanical and Aerospace Engineering, Princeton University — Biological material can be sorted using aqueous solutions containing two polymers. These mixtures, known as aqueous two-phase systems, experience phase separation after production because of the incompatibility of one polymer with the other. Each phase of the final solution is rich in one of the polymers. However, the concentration in polymers will often be very different from the concentration of the two initial solutions. Indeed, the interaction of water with each of the polymers induces a gradient of osmotic pressure, which leads to the redistribution of water between the two phases. Here we study the consequences of this so-called membrane-less osmosis on the deposition of a droplet of a solution of dextran on the surface of a layer of solution of poly(ethylene glycol). A flow on a scale comparable to that of the layer sets in over timescales of a few hours. We use particle tracking to describe the flow pattern. We observed the growth of vortices. By changing the concentration in polymers, the depth of the layer and the size of the drop, we relate the properties of the velocity field to the osmotic pressure of water in the ternary system water/dextran/poly(ethylene glycol). Finally, we describe important consequences of these observations for applications.

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