

Electronic Supplementary Information

Delivery of minimally dispersed liquid interfaces for sequential surface chemistry

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Table S1. Composition of the buffer solutions used in GFP response to pH stimulation assay

| pH | Composition |
|----|--|
| 4 | 50 mM Potassium hydrogen phthalate 0.1 mM Hydrochloric acid |
| 5 | 50 mM Potassium hydrogen phthalate 22.6 mM Sodium hydroxide |
| 6 | 50 mM Potassium phosphate 5.6 mM Sodium hydroxide |
| 7 | 50 mM Tris 46.6 mM Hydrochloric acid |
| 8 | 50 mM Tris 29.2 mM Hydrochloric acid |
| 9 | 50 mM Tris 5.7 mM Hydrochloric acid |

Supplementary videos:

SM_1_oil_removal: Operation of the on-chip oil-phase removal module. The aqueous phase is delivered in individual droplets encapsulated in an organic solvent to an array of 20 μm wide and 100 μm long posts, located at a distance of 15 μm from one another. Across the array, we apply a negative pressure that is sufficiently high to remove the continuous phase, but lower than the capillary pressure of the interface between the phases such that the aqueous phase remains in the main channel. As the oil phase is removed through the array of pillars, the approaching aqueous droplets merge with the continuous aqueous phase along the pillar array and continue through the main channel to the reaction site.

SM_2_two_liquid_switching: Demonstration of flow-switching in the flow confinement between alternating 1.3 s injections of DI water and 100 μM fluorescein, delivered over a distance of 60 μm to the reaction surface.

SM_3_multi_liquid_switching: *Demonstration of switching between four processing liquids: a red dye, a blue dye, a green dye and DI water for varying time durations between 5 and 15 s, simulating a hypothetical multiple-step assay.*