Demonstration of Syringe-pump-induced Disturbance in Microfluidic System with Low Interfacial Tension

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Syringe pump provides precise and constant flow rates so it is widely used in microfluidic research and applications. Most syringe pumps are mechanically driven and introduce fluctuations or pulses to the inlet flow and thus affect the steadiness of the flow. However, to the best of our knowledge, no evidences confirmed that these are really induced by syringe pumps. Here we introduce a robust visual detection of the unsteadiness induced by the stepping motor in a syringe pump, in form of ripples on the interface of an aqueous two-phase system which has low interfacial tension.

We use a typical glass capillary device to generate a co-flow of two immiscible phases in our experiments [1]. The ripples are found to exhibit the same frequency as that delivered by the stepping motor of the syringe pump which drives the inner fluid, named as fpump, for various flow rates Q, syringe diameters D and advancing step sizes s, according to fpump = 4Q/(πD2s).

The experimental results suggest that the low interfacial tension system can reflect the disturbance aroused from the inner pump, thus give an insight into understanding the fluctuation that syringe pumps induces and provide a way to test whether the unsteadiness in microfluidic system is related to syringe pump or not.

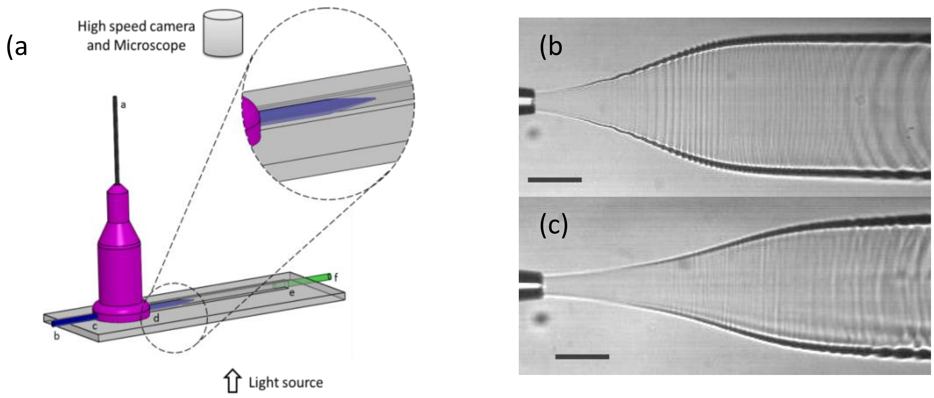

Figure 1. (a) Microcapillary device for co-flow of ATPS. (b, c) Optical microscope image of a jet of inner fluid surrounded by a continuous phase, for which the two fluids are driven by syringe pumps (LSP01-2A) and pressure pumps respectively.

Reference:

[1] A. Sauret, C. Spandagos and H. C. Shum, Lab on a Chip **12** (18), 3380-3386 (2012).