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Marangoni effect on droplet from an experimental flow pattern study to application for proteomic

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The flow field around a bubble/droplet moving with respect to a surrounding liquid in a Hele-Shaw cell can usually be characterized by a recirculating flow, which is typically attributed to a Marangoni effect due to surface tension gradients generated by a non-uniform distribution of surfactants (or temperature) along the liquid-gas interface.

In the first part of the presentation, we try to visualize such a flow employing 3D micro-particle tracking velocimetry. We perform experiments on an immobile flattened air bubble that is surrounded by a flow of aqueous solution of surfactant, in a microfluidic chamber described in the work of Sungyon Lee et al. (Soft Matter, 2012, 8, 10750). The suspending fluid is seeded with spherical micro-particles, with those captured by the recirculating flow orbiting in a three-dimensional trajectory in the vicinity of the liquid-air interface. We address the effect of velocity of the surrounding fluid, surfactant concentration and bubble radius on the recirculating flow pattern.

In the second part of the presentation we will present a more applied study where Marangoni effect is used to enhance peptides detection for proteomic studies. We designed recirculation flow which focuses analytes on a deposited droplet. We develop a simple platform based on an automated droplet microfluidic system (DMF) to generate monitored nanoliter aqueous droplets in oil and their deposition on a commercial stainless steel plate for MALDI-TOF analysis of peptides or protein digests. We will show that the detection sensitivity is improved (to few tens of attomoles) and positive detection can be achieved from sub-nanomolar peptides solutions.