Tailoring the water transport rate across the oil layer under osmotic pressure in microfluidic systems

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Osmotic pressure is a critical factor in determining the stability and the transport property in microfluidic systems such as microcapsules and water-in-oil-water (W/O/W) double emulsion droplets. In this study, we focus on the characterization of water transport rate under osmotic pressure in a liquid oil layer, which serve as semi-permeable membrane. We first demonstrate that the release profile of hydrogel microcapsules can be tuned by incorporating a semi-permeable oil layer within a hydrogel shell with varying stiffness. Then, we systematically investigate the effect of surfactant type and concentration on the water transport rate across a thin oil layer in double emulsions. We anticipate that this study will provide further understanding of osmosis in microfluidic systems for precision control of water transport and programmable release of the encapsulated cargo.