

Microfluidic production of microspheres and microcapsules for photocatalytic water treatment and CO₂ capture

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Microfluidics is a promising technique for the production of monodispersed droplets and particles with tuneable size and morphology. In this work, monodispersed polymeric particles were produced in a single step using glass capillary microfluidic devices and continuous on-the-fly photopolymerization (Figure 1). The fabricated particles include monodispersed microspheres consisting of acrylate polymer embedded with TiO₂ for photocatalytic water treatment and microcapsules with thin polymer shell and CO₂-selective liquid core for CO₂ capture. Micron-sized water-in-oil (W/O) and water-in-oil-in-water (W/O/W) emulsion droplets were used as templates for generation of microspheres and microcapsules, respectively. For the CO₂ capture microcapsules, the inner fluid was 5 wt% K₂CO₃ solution with m-cresol purple, the middle fluid was a 3 wt% PGPR solution in a UV- curable liquid acrylate monomer and the outer fluid was an aqueous solution composed of 40 wt% glycerol and 4 wt% polyvinyl alcohol (PVA). For the water treatment microspheres, the dispersed fluid was a UV-curable acrylate monomer containing dispersed TiO₂ nanoparticles and the continuous fluid was an aqueous solution comprised of 40 wt% glycerol and 4 wt% PVA.

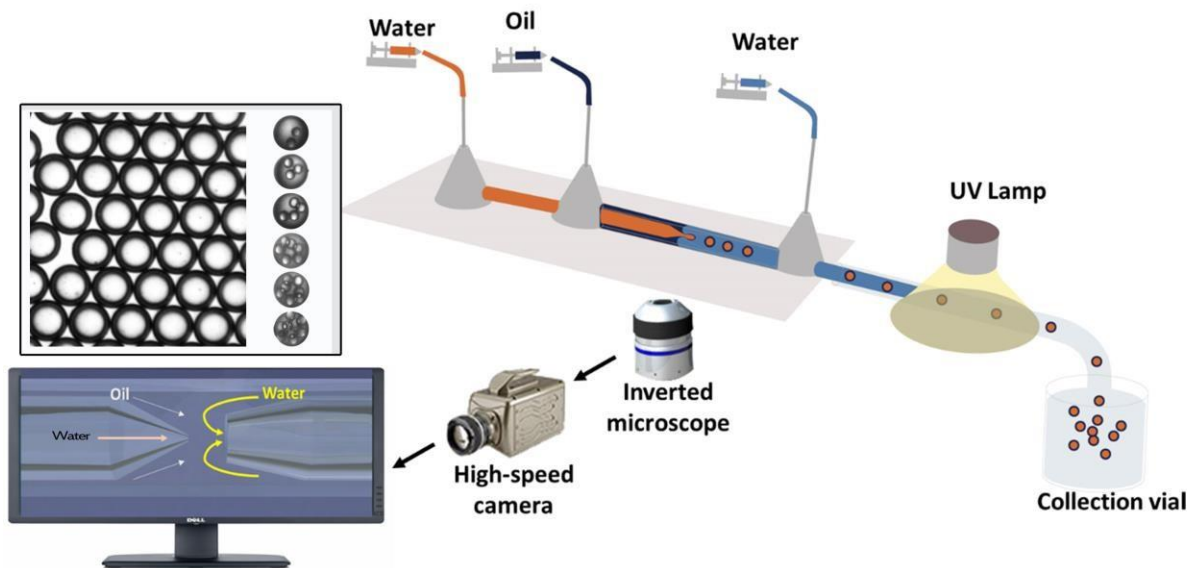


Fig 1. Schematic view of the experimental set-up for the production and monitoring of emulsion droplets generation. The inset figure shows monodisperse core-shell droplets and multi-core droplets with controlled number of monodispersed inner drops generated in microfluidic device.