

Fabrication of polymeric particles with heterogeneously patterned surfaces by micromixing within microfluidic devices

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Microfluidic emulsification and subsequent solvent evaporation has been used to fabricate bipolymer microspheres with heterogeneously patterned surfaces and uniform sizes. The obtained particle morphologies were characterised as Janus (Figure 1a), patchy Janus (Figure 1b), patchy (Figure 1c and d) and homogeneously mixed (Figure 1e). All particles are smaller than 100 μm .

Two different biodegradable synthetic polymers, poly (DL-lactic acid) (PLA) and polycaprolactone (PCL) were pre-mixed and dissolved in volatile solvent (dichloromethane) and the organic polymer solution is then dispersed in a microfluidic device in the outer phase comprised of a mixture of polyvinyl alcohol (PVA) and water. Two types of microfluidic devices were utilized to make monodispersed organic phase droplets, single-crystal silicon microchannel (MC) array devices and glass capillary devices. The surface morphology of the microspheres depended on the droplet size and the rate of removal of dichloromethane during the droplet-to-particle transition in the collection channel. The particle morphologies are visualised by confocal laser scanning microscopy (CLSM) using two different hydrophobic fluorescent dyes (Nile Red and Rhodamine B) displaying different affinities to PCL and PLA.

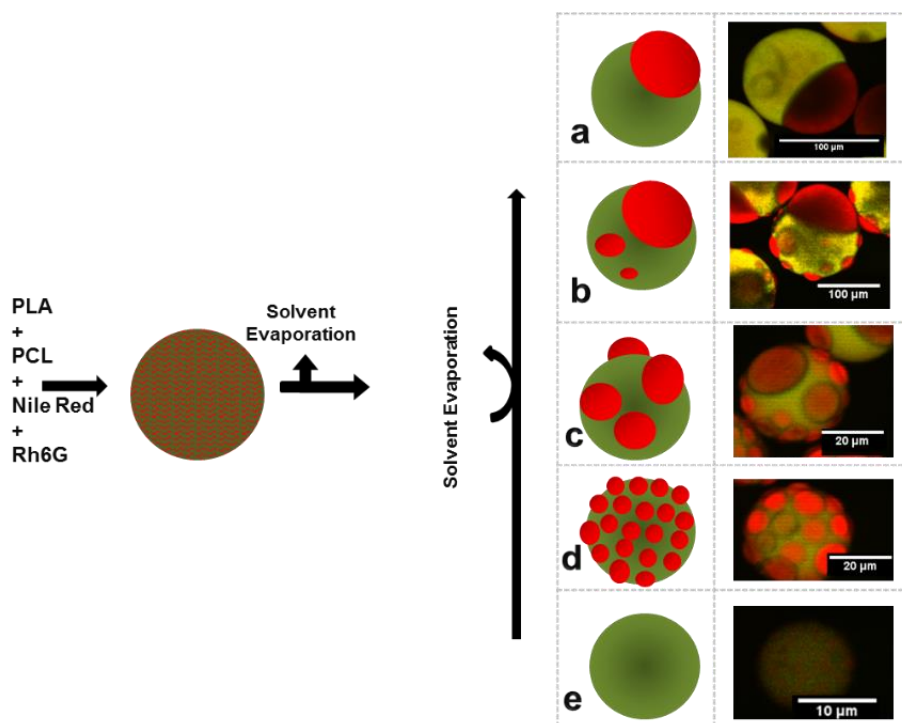


Figure 1. CLSM images of particles along with the cartoon model. All particles are formed by premixing PLA and PCL in the mass ratio of 1 to 2 in dichloromethane.