Microfluidic Generation of PEG/Dextran Based Aqueous Two Phase Systems

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The combination of droplet microfluidics and aqueous two-phase systems (ATPS) enable an oil-free route for stable and controllable fabrication of microparticles for biomedical applications. However, it is difficult to generate stable and monodisperse aqueous two phase droplets due to ultra-low interfacial tension between the fluids comprising the ATPS. In this work, we present several different methods to microfluidically produce uniform PEG/Dextran based ATPS. Within a certain concentration regime, we demonstrate that the size of the ATPS droplets produced can be modulated by tuning the flow rates of each phases. Moreover, we show that stable PEG/Dextran based ATPS can be well encapsulated within a molecular bilayer comprising of poly(butadiene)-b-poly(ethylene oxide)(PB-PEO) to result in a cell mimicking polymersome with long term stability. We anticipate that these polymersomes with ATPS interior can be utilized for artificial cell study, cell encapsulation, drug delivery, and other applications.