Microcarriers with Multiple Compartments for Programmed Release of Encapsulants

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Microcarriers have been used to release drugs at controlled rate and reduce undesired harmful effects. However, conventional methods to prepare microcarriers need microfluidic devices with multi-channels, elaborate control of flow rate, which then restrict the diversity of shape of microcarriers. Here, we report microfluidic method to make various microcarriers through phase separation in emulsion drops. Two immiscible polymers which one is biodegradable and the other one is pH-responsive polymer are dissolved in organic solvent as dispersed phase, which are then immersed in basic solution with surfactant as continuous phase through glass microfluidic device. Polymers have been concentrated as solvent evaporation, which are then exposed to unstable state by closed two immiscible polymers so they separate to two phases to minimize Gibbs free energy of mixing. Two phases spontaneously move to minimize interfacial energy, so we can get various shaped microcarriers, according to polymer blends, organic solvent and pH of continuous phase. Finally, to confirm release behaviors of microcarriers, two fluorescent dyes are added into dispersed phase as model drugs, so we can confirm the distinct release behaviors of each microcarrier through intensities of fluorescent dyes.