

Synthesis of Microcapsule Particles by Microsuspension Controlled/Living Radical Polymerization (*ms* CLRP) in Aqueous Dispersed Systems

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Abstract

Microencapsulation technology has been developed for a long time and widely applied in various applications. Microencapsulation can take place by coacervation and spray drying methods, in situ polymerization, interfacial polymerization, and radical polymerizations in aqueous dispersed systems. We proposed an innovative method by utilizing a microsuspension conventional radical polymerization (*ms* CRP) of micrometer-sized, monodisperse divinylbenzene/toluene droplets (prepared by the dynamic swelling method), in which small amount of polystyrene dissolved, in aqueous dispersed systems¹. Toluene was encapsulated by crosslinked poly(divinylbenzene) (PDVD) shell as core and spontaneously evaporated, resulting in hollow crosslinked particles. The formation mechanism of such a microcapsule (hollow) particles was proposed and named *Self-assembling of Phase Separated Polymer (SaPSeP)* method. In place of toluene, a series of encapsulation of hinokitiol, paraffin, ultraviolet absorbent, fluorescent agent, and heat storage materials was carried out by the *ms* CRP with the *SaPSeP* method.

However, the diameter of microcapsules prepared by *ms* CRP with the *SaPSeP* method had an upper limit on the basis of its mechanism. Another problem is the formation of a lot of submicrometer-sized byproduct particles by occurring emulsion polymerization in the aqueous medium in addition to the desired micrometer-sized (microcapsule) particles when microcapsule particles consisting of hydrophilic polymers such as (meth)acrylic based monomer and their copolymers, and copolymers of DVB with methyl acrylate were prepared.

Recently, we successfully overcome these drawbacks by applying controlled/living radical polymerization (CLRP) in microsuspension systems (*ms* CLRP)^{2,3}. In my lecture, the concept of the microencapsulation technique and some application will be described.

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- 2) T. Suzuki, T. Mizowaki, M. Okubo, "Versatile synthesis of high performance, crosslinked polymer microcapsules with encapsulated n-hexadecane as heat storage materials by utilizing microsuspension controlled/living radical polymerization (*ms* CLRP) of ethylene glycol dimethacrylate with the *SaPSeP* method" *Polymer* **2016**, *106*, 182-188
- 3) P. Chaiyasat, S. Namwong, M. Okubo, A. Chaiyasat, "Synthesis of micrometer-sized poly(methyl methacrylate) particles by microsuspension iodine transfer polymerization (*ms* ITP)" *RSC Advances* **2016**, *6*, 95062-95066.

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