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Preparation of Ag colloidosomes from Pickering emulsions stabilized by mercaptocarboxylated Ag nanoparticles

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Colloidosomes are hollow superstructures with colloidal particle shells, and they can be prepared by using Pickering emulsion as templates. Specifically, crosslinking/thermal annealing of shell particles, evaporation of inner phases is reported as methods to prepare colloidosomes. Metal colloidosomes are recently developing fields which are potential for anticancer agent [1], photothermal materials [2], etc. Previously, colloidosomes with Fe_3O_4 shells were reported by Yang et al. [3]. It was also reported that Fe_3O_4 colloidosomes have better uptake into tumor cells and show higher stability in tumor cells than their building blocks [1]. However, the preparation of Fe_3O_4 nanoparticles mentioned in the above papers requires extremely high temperature; 300℃ and occurs severe reaction during the nanoparticles formation. On the other hand, Ag and Au nanoparticles are also potential for anticancer agent, but Ag nanoparticles which sizes are nearly 10 nm has acute toxicity to mice [4]. In addition, raw materials of Au nanoparticles are very expensive. Therefore, we considered that using Ag nanoparticles (AgNPs) as building blocks can investigate milder and cost-efficient preparation of metal colloidosomes. The aim of this study is to prepare Ag colloidosomes from AgNPs-stabilized Pickering emulsion. First of all, we prepared AgNPs by phase transfer method. The prepared AgNPs were characterized by UV-vis spectroscopy and DLS, which showed its maximum absorption peak was at near 420 nm and their size distribution ranged from 1 to 100 nm, confirming that AgNPs were prepared. Second, we prepared Pickering emulsions using the AgNPs aqueous solution and chloroform as an organic solvent. Fluorescence microscopy measurement of the AgNPs-stabilized Pickering emulsions prepared by adding oil soluble Nile Red to their organic phase confirmed that O/W Pickering emulsion were prepared. Third, we prepared Ag colloidosomes by evaporation of inner phase of the Pickering emulsions by heating at 70℃. The prepared colloidosomes were characterized by DLS, optical microscopy, and SEM with EDS. As a result, ca. 1 μm hollow structures with Ag shells were observed. We observed similarities between the heated Pickering emulsions and creaming-occurred emulsions gained by just leaving them at room temperature for 3 days. Therefore, we successfully prepared colloidosomes with Ag shells by washing the creaming-occurred emulsions, without any heating processes. It was concluded that non-heating preparation of Ag colloidosomes were succeeded, which is milder and more cost-effective than conventional methods.

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