Structural Study of Au-GEMA Nanoparticle by SANS, SAXS, TEM, and XAFS Techniques

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Gold nanoparticles have found various applications in catalysis, optics, and sensors. Stabilization of gold nanoparticles has been employed using a variety of alkanethiols, surfactants, and polymers. In order to develop a size-controlled synthesis method of gold nanoparticle, we synthesized new amphiphilic multi-sugar type oligomers, C_{12}-*m*GEMA (GEMA is a glucosyloxyethyl methacrylate, *m* denote polymerization degree of GEMA), as a stabilizing surfactant for the gold nanoparticles. Previously, the aggregation behaviors of C_{12}-*m*GEMA in aqueous solution were investigated by using small-angle neutron and X-ray scattering (SANS and SAXS) techniques. We found that C_{12}-*m*GEMA aggregates formed globular micelles with the radius of ca. 3.7 nm in aqueous solution. In this study, we investigated the structure of Au-GEMA nanoparticle by using combining use of SANS, SAXS, transmission electron microscope (TEM), and X-ray absorption fine structure (XAFS) techniques.

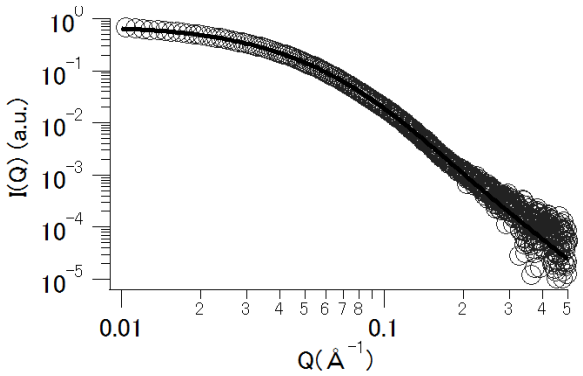

Fig. 1 SAXS data (○) and model fitting curve (-) for Au-C_{12}-3.0GEMA nanoparticles.

SANS, SAXS, and XAFS experiments were performed on BL15 at MLF/J-PARC, BL40B2 at SPring-8, BL27B at KEK-PF, respectively. Fig.1 shows the SAXS profiles for Au-C_{12}-3.0GEMA nanoparticles in aqueous solution. A model-fitting analysis result using theoretical scattering function of polydispersed sphere with log-normal size distribution suggested that the average radius of Au-C_{12}-3.0GEMA nanoparticle is 1.5 nm. The size distribution was consistent with that estimated by TEM-results. Comparing with the radius of C_{12}-3.0GEMA aggregate, it indicated that Au-C_{12}-3.0GEMA nanoparticle cannot grow larger than the size of C_{12}-3.0GEMA micelles. In this presentation, we will show the SANS and XAFS results and discuss the detailed structure of Au-C_{12}-3.0GEMA nanoparticles.