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Giant vesicles prepared by nitroxide-mediated photo-controlled/living radical polymerization-induced self-assembly

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Micrometer-sized giant vesicles are a model of biomembranes for mitochondria and erythrocyte. In recent years, the giant vesicles have been expected as carriers for drug delivery systems as well as nanometer-sized micelles. The giant vesicles are often obtained by the film rehydration techniques, electro formation, and standard swelling procedure using block copolymers prepared through living anionic polymerization and thermally controlled/living radical polymerization. The photo-controlled/living radical polymerization mediated by a nitroxide is also effective to synthesize block copolymers consisting of polymethacrylate esters. This photo polymerization proceeds at room temperature in the presence of photo-acid generators, such as diaryliodonium salts, triarylsulfonium salts, and an iron-arene complex to produce polymers with comparatively narrow molecular weight distribution of ca. 1.3-1.4 for methacrylate monomers. This paper describes a novel method to prepare micrometer-sized giant vesicles by self-assembly induced by the nitroxide-mediated photo-controlled/living radical polymerization. The photoradical polymerization of methyl methacrylate (MMA) was performed at room temperature in an alcohol/water-mixed solvent using 4-methoxy-2, 2, 6, 6-tetramethylpiperidine-1-oxyl (MTEMPO) as the mediator and MTEMPO-terminated poly (methacrylic acid) (PMAA) as the initiator. The PMAA was prepared by the MTEMPO-mediated photopolymerization of methacrylic acid in methanol using 2, 2'-azobis [2-(2-imidazolin-2-yl) propane] as the initiator in the presence of (4-*tert*-butylphenyl)diphenylsulfonium triflate. The colorless solution of MMA turned into a white suspension as the polymerization proceeded. The scanning electron microscopy analysis revealed that the resulting aggregates were spherical giant vesicles with several micrometer-sized diameters. The size and morphology of the giant vesicles were dependent on the MMA concentration and rotation rate of the stirring during the polymerization.

Biography

Eri Yoshida has completed her Ph.D. from Tokyo Institute of Technology, Japan. She started her studies as an Assistant Professor at Kyoto Institute of Technology. While she continued her studies, she stayed at University of North Carolina as a visiting scientist. She moved to Toyohashi University of Technology as an Associate Professor. She has published more than 100 papers in reputed journals and is serving as an editorial board member of international journals.

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