Spontaneous vesicle formation from bulky tetrasiloxane-tailed sugar surfactant

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In solution, surfactants tend to self-assemble into an amazing variety of structure such as micelles, ellipsoids, disks, cylinders, vesicles, lamellae, etc. The structure of the assemblies usually depends strongly on the molecular architecture, concentration, and solvent environment. Among them, vesicles are fascinating self-assembled structure, which may be simple model systems for biological membranes and templates for synthesizing novel materials. Spontaneous vesicles could be made from phospholipids, but formation and growth of phospholipid vesicles require a demanding biosynthesis apparatus involving several enzymes [1-3]. Thus, many routes to construct vesicle phases by using surfactants in aqueous solution have been explored [4]. In this work, we present the novel tetrasiloxane-tailed sugar surfactants TGA-m (m=1,2,3), as shown in Scheme 1, which can self-assemble into a vesicular structure due to incorporation of a bulky tetrasiloxane moiety at the terminal of the hydrocarbon chain. The vesicle (Figure 1) was examined by dynamic light scattering (DLS) and negative-stained transmission microscopy (TEM). The closed aqueous compartment in the vesicles was also verified by encapsulation of water soluble dye, bromophenol blue. The encapsulation efficiency (EF) from TGA-m vesicle was 1.81-2.82%, which is slightly larger than that (1.6%) for phospholipid vesicles formed from egg yolk phosphatidylcholine.

Scheme 1. The structure of TGA-m and schematic illustrations for vesicles formation.

Figure 1. Negative-stained TEM images of compound TGA-m: 2a, TGA-1 at 0.60wt%; 2b, TGA-2 at 0.64wt%; 2c, TGA-3 at 1.1 wt %.