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Large vesicles of ethylenediaminediacetic in ethanol due to hydrogen bonding

Dongmei Zhang[a,b], Fuliang Liu[a], Hao Xiang[b], Yanqiang Guo[a], Yashao Chen[a,*]

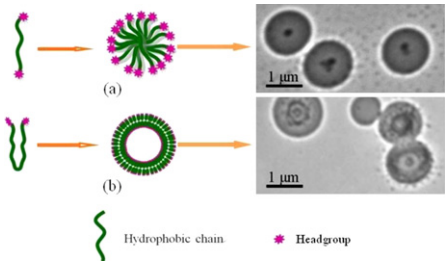
[a] Key Laboratory of Applied Surface and Colloid Chemistry (Shaanxi Normal University), Ministry of Education, School of Chemistry & Chemical Engineering, Shaanxi Normal University, Xi'an 710062, China

[b] Pavement Structure and Material Institute, CCCC First Highway Consultants Co., LTD, Xi'an 710065, China

HIGHLIGHTS

- The diameter of the ethylenediaminediacetic spherical vesicles was 1.0–1.5 μm.
- The synergistic effects of hydrogen bonding guided the large vesicles formation.
- The larger vesicles presented high stability.

GRAPHICAL ABSTRACT



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ABSTRACT

Bola surfactant ethylenediaminediacetic (EDDA) was successfully synthesized with using a novel approach. For composites obtained through the supramolecular organization in the ethanol solution, transition behavior of vesicle morphology such as worm-like, petal-like, clustered worm-like, saccules and spherical, was captured by transmission electron microscopy (TEM). In vesicles mentioned above well-defined large spherical aggregations, some of which were solid vesicles, some hollow ones and some multilamellar ones about 1.0–1.5 μm, were evidenced by fluorescence microscope. Furthermore, the morphologies and properties of the vesicles were elucidated by means of Fourier transform infrared spectroscopy (FTIR), laser particle size analyzer, geometry simulation of supramolecular architectures and fluorescence spectrophotometer. On the basis of these analyses, the main driving force of large vesicles was considered to be the strong hydrogen bonding interaction among the exposed hydrophilic part of the EDDA surfactant. During the whole process, the ethanol solution played a very important synergistic role in forming self-assembly aggregate in this system.

1. Introduction

The supramolecular self-assembly originates from the rational control of non-covalent interactions such as hydrogen bonding, π–π stacking, electrostatic and van der Waals interactions, which provided a powerful tool for the creation of well-organized structured systems such as micelles, vesicles, fibers, discs and tubes [1–4] in the nanometer or micrometer length scale. Special attention has been paid to self-assembled aggregates from a fundamental perspective as well as for their widespread application [5–7]. In particular, great efforts have been devoted to the investigation of hydrogen bonding interaction [8–10] which has a high value in universal function in the field of supramolecular chemistry due to the characteristic feature of high-strength force and marked targetability [11,12]. Moreover, for the bola surfactant as novel amphiphiles [13], the most noticeable difference compared with conventional surfactants is typically formed by two monomeric surfactants linked either by two spacer group at the level of the headgroups or the close headgroups [14,15]. As a result, considerable researches have been made to design and synthesize the novel amphiphiles possessing various kinds of self-assembled structures and peculiar phase behaviors [16–20]. Although there

* Corresponding author.
E-mail address: yschen@snnu.edu.cn (Y. Chen).

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