Accepted Manuscript

Title: Fabrication of virus-like particles with strip-pattern surface: A two-step self-assembly approach

Author: <ce:author id="aut0005" author-id="S1001841717300268-d227fb680900ca8d1df02a4dc6182f7a"> Shuo Zhang<ce:author id="aut0010" author-id="S1001841717300268-5964da4af2231152d2359c89a9607bbf"> Chun-Hua Cai<ce:author id="aut0015" author-id="S1001841717300268-f47f1878d1d5b14744adc2ee8c42dbcc"> Zhou Guan<ce:author id="aut0020" author-id="S1001841717300268-0bac39a32ef4649b59517d8e0c36c630"> Jia-Ping Lin<ce:author id="aut0025" author-id="S1001841717300268-8056cdb3da610a44ec0e0e76c4ff0cd9"> Xing-Yu Zhu

PII: S1001-8417(17)30026-8
DOI: http://dx.doi.org/doi:10.1016/j.cclet.2016.12.040
Reference: CCLET 3953

To appear in: *Chinese Chemical Letters*

Received date: 5-9-2016
Revised date: 18-10-2016
Accepted date: 24-10-2016

Please cite this article as: Shuo Zhang, Chun-Hua Cai, Zhou Guan, Jia-Ping Lin, Xing-Yu Zhu, Fabrication of virus-like particles with strip-pattern surface: A two-step self-assembly approach, Chinese Chemical Letters http://dx.doi.org/10.1016/j.cclet.2016.12.040

Original article

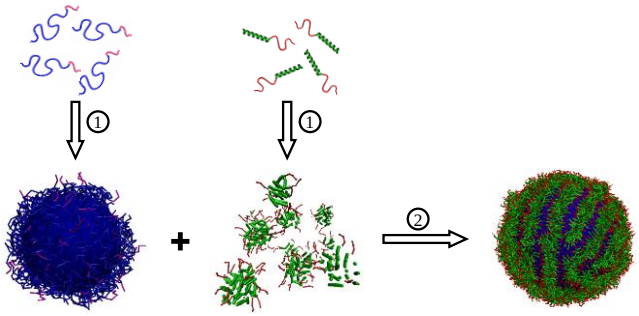
Fabrication of firus-like particles with strip-pattern surface: A two-step self-assembly approach

Shuo Zhang, Chun-Hua Cai*, Zhou Guan, Jia-Ping Lin*, Xing-Yu Zhu

Shanghai Key Laboratory of Advanced Polymeric Materials, State Key Laboratory of Bioreactor Engineering, Key Laboratory for Ultrafine Materials of Ministry of Education, School of Materials Science and Engineering, East China University of Science and Technology, Shanghai 200237, China.

∗ Corresponding authors.
E-mail addresses: *caichunhua@ecust.edu.cn (C.-H. Cai), jlin@ecust.edu.cn (J.-P. Lin)*

Graphical abstract



① Adding certain content of water
② Mixing up, adding water further and dialyzing against water

ABSTRACT
Spherical nanostructures with striped patterns on the surfaces resembling the essential structures of natural virus particles were constructed through a two-step self-assembly approach of polystyrene-*b*-oligo(acrylic acid) (PS-*b*-oligo-AA) and poly(γ-benzyl L-glutamate)-*b*-poly(ethylene glycol) (PBLG-*b*-PEG) copolymer mixtures in solution. On the basis of difference in hydrophilicity and self-assembly properties of the two copolymers, the two-step self-assembly process is realized. It was found that PS-*b*-oligo-AA copolymers formed spherical aggregates by adding a certain amount of water into polymer solutions in the first step. In the second step, two polymer solutions were mixed and water was further added, inducing the self-assembly of PBLG-*b*-PEG on the surfaces of PS-*b*-oligo-AA spheres to form striped patterns. In-depth study was conducted for the indispensable defects of striped patterns which are dislocations and +1/2 disclinations. The influencing factors such as the mixing ratio of two copolymers and the added water content in the first step on the morphology and defects of the striped patterns were investigated. This work not only presents an idea to interpret mechanism of the cooperative self-assembly behavior, but also provides an effective approach to construct virus-like particles and other complex structures with controllable morphology.

Keywords: Virus-like particles; Two-step self-assembly; Striped patterns; Defects; Polypeptide; Ordered structure

ARTICLE INFO
Article history:
Received 5 September 2016
Received in revised form 18 October 2016
Accepted 24 October 2016
Available online

1. Introduction.

Amphiphilic copolymers are able to self-assemble into various supramolecular aggregates [1-8]. Inspired by biological systems in nature, researchers have regarded the fabrication of hierarchical nanostructures that resemble natural materials as one of the topics of macromolecular self-assembly in recent years [9-13]. For example, virus is an ideal model for polymer self-assembly which possesses well-defined architectures with a protein capsid and encapsulated genetic materials as the core [14]. Virus-like particles (VLPs) are