Synopsis of Original Research Paper

Amylose engineering: Design of nanogel particles with molecular recognition

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Synopsis: Stimuli-responsive molecular assembly systems have attracted considerable attention in the fields of biotechnology and drug delivery systems. Typically, the external stimulus is heat, pH, light or the addition of molecules, such as glucose or cyclodextrin. Enzymes are also used to trigger the response of a system. We report here new enzyme-responsive micellar systems in which an enzymatic reaction controls the amphiphilicity of the surfactants. The surfactants in our study consist of a short alkyl chain and a maltooligomer as a primer which can be synthesized enzymatically. In the presence of phosphorylase and α-D-glucose-1-phosphate (G1P), the elongation reaction of the saccharide chain proceeds from the non-reducing 4-OH terminus of the (α1→4)-glucan chain. Thus, we first prepared amylose-primer surfactants (C8MP, C12MP, C16MP) where an alkyl group (C8, C12, C16) is linked to the reduced terminus of maltopentaose (MP, number of glucose units (GU) = 5). The surfactants form micelles in water, which are dissociated upon the enzymatic elongation reaction of the sugar moiety. The association of amylose primer surfactants was controlled by changing the amphiphilicity with a chain-elongation reaction triggered by the addition of phosphorylase. We demonstrate here that by using this property the micelle-to-vesicle transition of mixed lipid/ primer systems can be controlled, and this presents a new method for the reconstitution of trans-membrane protein to liposome.