Comprehensive Study on a Calcium-responsive Hydrogel and an Adhesive Hydrogel Assembled by Tyrosinase

By

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Abstract

The relationship between microscopic interactions among molecules and macroscopic behaviour of the materials is of greatly heightened interest. Here I establish a model incorporating Spy-network and calmodulin, a ubiquitously distributed protein in biosphere which responds to ambient calcium concentration with induced conformational changes. The newly engineered material appears as typical viscous liquid, while the viscoelasticity of the material varies with increased amount of calcium in the solution, indicating that the alterations of rheological properties are induced by microscopic molecular conformational changes. Further tests have been performed on this material with various calcium ion concentration to verify such correlations and to detect the topological structures in this material.

Cohesive materials of high bio-compatibility are of remarkable demands nowadays in tissue engineering and the medical field. Inspired by mussel, a mollusc that possesses ultra-adhesive foot which help itself to immobilize on solid surface, I take advantage of MFP (mussel foot protein), a tyrosine-rich protein originated from mussel foot, and make it gelate based on Spy-network with the catalysis of recombinant tyrosinase. The resultant material shows ideal mechanical properties and its adhesiveness to various surfaces have been measured.