

1. Abstract

Project Code : TRG5780110

Project Title : Designing polymer-protein conjugated networks as injectable
biodegradable hydrogels with affinity control drug delivery

Investigator : Assistant Professor Kiattikhun Manokruang
Professor Suwabun Chirachanchai

E-mail Address : kiattikhun.m@cmu.ac.th

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Abstract

Injectable hydrogels are alternative materials for drug and protein delivery in biomedical applications, which can potentially eliminate the need of surgical implantation in the treatment procedures. Prior to administration, such hydrogels, in a liquid state, must demonstrate good interactions with the incorporated molecules to maintain the sustain release of active agents and to avoid unappreciative burst release. The injectable hydrogels derived from BSA-

pH/temperature responsive poly(amino urethane) conjugates have been reported to demonstrated good sustainability for delivery of lysozyme, both *in vitro* and *in vivo*. However, the interactions between such conjugates and the loading lysozyme were not fully understood. In this present work, we reported the binding interactions between the studied complex systems, BSA-pH/temperature responsive poly(amino urethane) conjugates (CONJ1 and CONJ2) and lysozyme. Fluorescence spectroscopy in a combination with thermodynamic analysis exhibited that the binding between the conjugates and lysozyme occurred through static quenching and the binding interactions in the complexes were mainly van der Waals forces and hydrogen bonds. The binding constants (K_A) determined at 300, 308 and 318 K of CONJ1 to lysozyme were 7.96×10^4 , 6.45×10^4 and $3.20 \times 10^4 \text{ M}^{-1}$, respectively and those of CONJ2 to lysozyme were 2.63×10^4 , 2.53×10^4 and $1.19 \times 10^4 \text{ M}^{-1}$, respectively. FTIR analysis showed that the complexes between the conjugates and lysozyme demonstrated sufficiently small deviation in the conformational structures from the native lysozyme. In addition, the morphology revealed by TEM and AFM imaging portrayed the behavior of complex formation in such a way that the conjugates, before complex formation, displayed the core-shell

structures. After the complex formation, a number of lysozyme particles were noticeably entrapped as if they penetrated into the preformed core-shell conjugates.

Keywords : injectable hydrogel; BSA-polymer conjugate; lysozyme; fluorescence quenching; FTIR; protein secondary structure; TEM; AFM.