VIETNAM NATIONAL UNIVERSITY - HCMC
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY

SOCIALIST REPUBLIC OF VIETNAM
Independence – Liberty – Happiness

DISSERTATION INFORMATION

Title: ***Study of drug delivery system based on chitosan micro-nano particles and temperature, pH-sensitive biomedical hydrogels***

Major: **Chemical Engineering** Major code: **9520301**

PhD candidate: **Nguyen Thi Thanh Hien**

Advisors: **1: Assoc. Prof. Dr. Huynh Dai Phu**

2: Dr. Ha Cam Anh

University: **Ho Chi Minh City University of Technology, VNU - HCMC**

Major Contributions of This Dissertation:

This thesis studied the synthesis of biomaterial materials, including thermosensitive, pH-sensitive hydrogels from Poly Ethylene Glycol (PEG), D, L - Lactide, and micro-nano chitosan particles to apply as the injectable drug delivery system. The results show the thermosensitive PLA_{1750}-PEG_{1750}-PLA_{1750} (T-2.6 25%) hydrogel and the temperature, pH-sensitive OS-PLA_{1750}-PEG_{1750}-PLA_{1750}-OS (P-2.6 25) hydrogel displayed a good gel state in 37°C, pH 7,4, and owning micelles feature. In addition, the micro-nano chitosan particles formed by the electrospraying method obtained round shapes, uniform, with an average diameter of 367 nm. These materials exhibited degradation and good biocompatibility.

Evaluation results of *in vitro* hydrophobic drug release (ibuprofen) of the T-2.6 thermosensitive hydrogels were related to the rule of *in vitro* degradation: initial slow and fast after three weeks. Meanwhile, for a hydrophilic drug as paracetamol, the drug release from hydrogels and micro-nano chitosan particles was quick. Therefore, solutions that combine hydrogel materials and chitosan micro-nano particles were proposed to improve hydrophilic drugs delivery. The first solution is to create micro-nano particles from a solution of chitosan and thermosensitive hydrogel containing paracetamol. As a result, there is a dramatically increasing in the LC (3,94%) and EE (60,25%) because of hydrogen interaction between functional groups of chitosan and PLA, but drug release control is difficult. The second solution is to generate micro-nano chitosan particles coating an exendin-4 hydrophilic drug and disperse them in

temperature and pH-sensitive hydrogels to prolong drug release time. This experiment aims to take advantage of two barriers: drug diffusion out of the chitosan particles to disperse into the hydrogel structure, from which the drug diffuses out of the hydrogel. The results displayed that the drug release rate of the combined system was slower than that of the P-2.6 hydrogel and bare chitosan particles. The positive outcome creates primes for further research into the exendin-4 drug delivery system to treat type 2 diabetes, an urgent problem now.

Advisors **Ph.D. candidate**

Assoc. Prof. Dr. Huynh Dai Phu Dr. Ha Cam Anh Nguyen Thi Thanh Hien