University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

RUYAO CHEN

BEng (Donghua University, 2014)

"Curcumin-Loaded Block Copolymer Nanoparticles for Drug Delivery Using Microfluidics"

Department of Chemistry

Friday, January 13, 2017
2:00 P.M.
Human and Social Development Building
Room A250

Supervisory Committee:
Dr. Matthew Moffitt, Department of Chemistry, University of Victoria (Supervisor)
Dr. Jeremy Wulff, Department of Chemistry, UVic (Member)

External Examiner:
Dr. Mohsen Akbari, Department of Mechanical Engineering, UVic

Chair of Oral Examination:
Dr. Karen Courtney, School of Health Information Science, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

This thesis included three stages of experiments. The goal of the thesis was to prepare nanoparticle-encapsulated curcumin for the purpose of drug delivery. The first step was the nanoparticle preparation. The self-assembly of block copolymer (poly(ε-caprolactone)-*b*-poly(ethylene oxide)) and curcumin was conducted on a gas-liquid two phase microfluidic reactor. During preparation, various chemical parameters and flow rates were tested. The nanoparticles showed flow variability with the size decreasing with increasing flow rate, and loading efficiency increasing with increasing flow rate. The increase of water content and drug-to-polymer loading ratio also proved to increase loading efficiency and decrease the size of nanoparticles. The release profiles, however, showed fast release rates under various preparation conditions, with nearly complete release after ~5 h. In the next stage of the research, we discussed release optimization in preparation for future pharmacokinetic studies. Increasing the flow rate had greater influence on slowing down release rates compared to changing other parameters such as decreasing the drug-to-polymer loading ratio and increasing the water content. A procedure to extract and quantify curcumin from mouse blood was also developed in this stage. In the final stage of the research, nanoparticle-encapsulated curcumin was tested on human breast cancer cell line MDA-MB-231. The result showed the nanoparticle formulation had a growth inhibition effect on MDA-MB-231, although the cytotoxicity was compromised by encapsulated in the nanoparticles.