Multifunctional Polymeric Micelles for targeted chemotherapy and medical imaging for liver cancer

Norased Nasongklal[1*] and Man Theerasilp[1]
[1]Department of Biomedical Engineering, School of Engineering, Mahidol University, Nakorn Pathom 73170, Thailand
Phone +66 2441 4255, Fax +66 2441 4254, [*]E-Mail: norased.nas@mahidol.ac.th

Abstract

Polymeric drug delivery systems in the nanoscale (micelles) can reach target cells or organs via ligand-receptor interaction and Enhanced Permeability and Retention (EPR) effect. For the nanoscale DDS, tumor-targeted drug delivery will potentially revolutionize the chemotherapy of cancers. Therefore, multifunctional polymeric micelles are developed as cancer-targeted and imaging drug delivery systems. The amphiphilic block copolymer of poly(ethylene glycol)-block-poly(ε-caprolactone) (PEG-*b*-PCL) was synthesized where terminal group of the PEG chain was installed with glucose molecules. Doxorubicin, used as a fluorescent probe, was loaded into glucose-micelles. The enhanced amount of doxorubicin as a result of glucose-micelles in HepG2 was evaluated by fluorescence microscopy and flow cytometer. Imaging probes for various imaging techniques such as MRI, fluorescence and radiolabeling are introduced to these drug delivery systems to visualize and monitor the drug release and transportation in vivo. To implement SPIO-loaded micelles as a MR contrast agent, the 3T clinical MRI was applied to determine transverse relaxivities (r_{2*}) and relaxation rate ($1/T_{2*}$) values. *In vitro* MRI showed different MRI signal from cancer cells after cellular uptake of SPIO-loaded micelles. Distribution of drugs inside organs can be studied quantitatively by imaging techniques to correlate the amount of drugs in tissues and therapeutic effects. These results show the use of multifunctional polymeric micelles as a targeted cancer chemotherapy and MRI imaging probe.

Keywords: Polymeric drug delivery system, nanoparticle, anticancer drug, micelles, MRI