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Thermosensitive magnetic liposome nanodrugs for cancer therapy

Thermosensitive magnetic liposomes were developed for controlled release of a thrombolytic drug and anticancer chemical/gene drugs for thrombolysis and glioma treatment. As the FDA has approved the application of liposome-encapsulated anticancer drugs in clinical practice, magnetic liposome formed by entrapping iron oxide Magnetic Nanoparticles (MNP) in phospholipids could be a safe platform for drug delivery. By incorporating (phospholipid-Dipalmitoylphosphatidyl-Choline, DPPC) with a Melting Temperature (Tm) slightly above the physiological temperature in the liposome, the thermosensitive magnetic liposome was designed for controlled release of entrapped drugs subject to temperature increase from 37 °C to 43 °C or through a hyperthermia effect induced by an Alternating Magnetic Field (AMF). In addition, the co-entrapped MNP could be used for magnetic targeted delivery of the cargo in the liposome under the guidance of a magnet. The temperature-sensitive liposomes were synthesized from DPPC, distearoylphosphatidylethanolamine-N-poly (ethylene glycol) 2000 (DSPE-PEG2000), cholesterol (CH) and bis-dodecyl dimethyl bromide (DDAB). Citric acid modified iron oxide MNP were encapsulated into the liposome along with anticancer chemical drug (Irinotecan, CPT-11)/gene drug (*SLP2* shRNA) to prepare thermosensitive cationic magnetic liposome-CPT11-shRNA (TCML-CPT11-SHRNA). The composition of phospholipids was first optimized followed by physicochemical analysis by DLS, cryo-TEM, FTIR, TGA, DSC, SQUID, Zeta potential and XRD. Enhanced drug release was confirmed by temperature change from 37 °C to 43 °C or in the presence of an AMF. Furthermore, *in vitro* cell culture experiments confirmed that the drug carriers exhibited no cytotoxicity against fibroblasts and cancer cells. The drug-loaded carriers also showed better therapeutic effect toward killing cancer cells compared with free drugs. The blood hemolysis assay showed non-hemolytic activity, indicating good blood compatibility. Finally, *in vivo* experiments using xenograft tumor mouse model with U87 human glioblastoma cells with magnetic guidance and AMF treatment demonstrated the efficacy and safety of treatment using TCML-CPT11-shRNA.

Biography

Jyh-Ping Chen has been a Professor in Chemical and Materials Engineering at Chang Gung University since 1997. He is currently a Researcher in Department of Plastic and Reconstructive Surgery, Chang Gung Memorial Hospital and holds joint appointments as Professor in Department of Materials Engineering, Ming Chi University of Technology; Research Center for Food and Cosmetic Safety; Research Center for Chinese Herbal Medicine, Chang Gung University of Science and Technology, Taiwan. He has received his BS degree in Chemical Engineering from National Taiwan University in 1981 and PhD in Chemical Engineering from Pennsylvania State University in 1988. He has published over 150 papers in SCI journals with more than 3500 citations. He is a Guest Editor or Editorial Board Member for 13 international journals and a Peer Reviewer for more than 50 reputed SCI journals. His current research interests include biomaterials, tissue engineering and drug delivery.

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