



“Ring-Opening Polymerization-Mediated Biopolymer Synthesis and Applications”

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ABSTRACT:

Polymeric nanoparticles are promising carriers for the delivery of chemotherapeutics for cancer therapy because they are able to carry large payload of therapeutic modality, extravasate leaky tumor vasculature, and mediate sustained drug release in tumor tissues. Of a handful of nanoparticulate carriers being studied, polymeric nanoencapsulates are particularly promising because they can be readily prepared through the co-precipitation of hydrophobic polymers and small molecule drugs. However, nanoencapsulates typically have significant drug burst release, low drug loading and uncontrollable drug encapsulation efficiency. To address these issues, we developed nanoconjugation technique to allow successful formulations of sub-100 nm sized, mono-modal nanoconjugates with definable drug loading, quantitative drug loading efficiency and controlled release profiles. Nanoconjugates were prepared through a drug-initiated ring opening polymerization followed by nanoprecipitation. In the first step, hydroxyl-containing therapeutic agents are used as initiators to initiate living polymerization of cyclic ester monomers (e.g., lactide), and result in polyester-therapeutics conjugates. In the second step, precipitation of the polyester-therapeutics conjugates gives the desired polyester-drug nanoconjugates. Using paclitaxel as a model drug, we have been able to formulate drug-poly lactide nanoconjugates with 100% drug incorporation efficiency and very high drug loading. These new types of nanoparticles are promising delivery vehicles for targeted cancer therapy with improved efficacy and reduced toxicity.

BIOGRAPHY :

Professor Jianjun Cheng obtained a B.S. degree in Chemistry from Nankai University, China, in 1993, and a M.S. degree in chemistry from Southern Illinois University at Carbondale in 1996, and a Ph.D. degree in materials science from the UC-Santa Barbara in 2001 with Professor Timothy Deming. From 2001 to 2004, Cheng was a senior scientist and a project leader at Insert Therapeutics, Inc., a startup biotechnology company. After working as a postdoctoral fellow at Massachusetts Institute of Technology with Professor Robert Langer from 2004 to 2005, Cheng joined the faculty of University of Illinois at Urbana-Champaign in 2005. He currently holds a primary appointment in the Department of Materials Science and Engineering, and is affiliated with the Department of Bioengineering, and Micro and Nanotechnology Laboratory. Dr. Cheng's research has made significant translational impact. At Insert Therapeutics he developed IT-101, a cyclodextrin polymer-based drug delivery technology for the treatment of colon cancer. IT-101 reached clinical trial in 2006. His research on prostate cancer targeting using aptamer nanoparticles conjugates was highlighted by Forbes Magazine as one of the Top Five Nanotechnology Breakthroughs in 2006. Cheng is the co-inventor of 11 patents, 7 of which are licensed or in active use in industry. He received the Prostate Cancer Foundation Competitive Award (2007), the American Chemical Society Petroleum Research Foundation Award (2007) and the National Science Foundation CAREER Award (2008). Cheng also received the Teaching Excellence Awards at UIUC in 2008 and 2009.