Triggerable Self-immolative Polymer Delivery Systems: From Polyglyoxylates to Polyglyoxylamides

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Abstract

Smart, stimuli-responsive polymers are of significant interest for delivery systems that can be triggered to release drugs by either intrinsic biological or externally applied stimuli that degrade the polymers. For most stimuli-responsive polymers, multiple stimuli-mediated reactions are required to completely break down the polymer. Self-immolative polymers are a special class of stimuli-responsive polymers that can depolymerize end-to-end upon the cleavage of a stimulus-responsive end-cap from the polymer terminus. This depolymerization mechanism imparts high sensitivity to stimuli as well as versatility in that a single polymer backbone can be cleaved by different stimuli simply by changing the end-cap. This presentation will describe our recent work on the conversion of polyglyoxylates to polyglyoxylamides (PGAMs) *via* the amidation of poly(ethyl glyoxylates). Using different primary amines, PGAMs with varying structures were synthesized, including water-soluble and cationic versions. In addition, PGAMs with lower critical solution temperatures (LCST) near 37 ºC were discovered. Depolymerization led to disappearance of LCST behavior and the aggregation state of the polymers influenced their depolymerization rates. *In vitro* studies indicated that the chemical structures of the polymers influenced their toxicity and some PGAMs were well tolerated by cells. Overall, PGAMs are a new class of smart polymers for new drug delivery applications.

Biography

Professor Gillies' research interests are in the development of biodegradable polymers, stimuli-responsive polymers, and phosphorus-containing polymers as well as their biomedical applications. Through multidisciplinary collaborations with academic partners and companies, she is working on the development of oral and intra-articular drug delivery systems, anti-bacterial coatings, and scaffolds for regenerative medicine. Dr. Gillies has published more than 125 peer-reviewed journal articles and holds 6 patents/patent applications. She has received a number of awards including a Tier 2 Canada Research Chair in Biomaterials Synthesis, E. W. R. Steacie Memorial Fellowship, Early Researcher Award (Ontario), and Fallona Interdisciplinary Science Award (Western), and is a member of the Royal Society of Canada College of New Scholars, Artists, and Scientists.