

Chemical Engineering Master's Defense

Preparation of a Novel Aminoglycoside-based Microgel and Nanogel for Biomedical Applications

School for Engineering of Matter, Transport and Energy

Amrita Amy Mallik

Advisor: Dr. Kaushal Rege

abstract

Hydrogels are three-dimensional, hydrophilic, polymeric networks that can load large amounts of water while maintaining an intact network structure. Hydrogels have garnered a lot of attention in the biomedical field because they are biocompatible and can load up to 1000 times their weight in water or biological fluids. At smaller dimensions, referred to as micro- and nanogels, they have an additional benefit of reaching sites in the body that cannot be reached by macro-sized hydrogels.

Based on a previously synthesized hydrogel, and due to the advantages of smaller dimension in biomedical applications, we have synthesized aminoglycoside antibiotic-based nanogels and microgels. Microgels and nanogels were synthesized following a ring opening polymerization of epoxide-containing crosslinkers and polyamine-containing monomers. The nanogels were screened for their cytocompatibilities and transfection efficacies, and compared to polyethylenimine (PEI), a current standard for polymer-mediated transgene delivery. Nanogels demonstrated minimal to no toxicity to the cell line used in the study even at high concentrations. Due to the emerging need for large-scale production of DNA, microgels were evaluated for their binding capacity to plasmid DNA. Future work with the aminoglycoside antibiotic-based nanogels and microgels developed in this study will involve optimization of nanogels and microgels to facilitate in better transgene delivery and plasmid DNA binding, respectively.



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