Online Proceedings

Poster Session 2

Commons East, Easel 66

1:00 PM to 2:30 PM

Microelmulsion Formation of Nanoparticles for the Delivery of Ciprofloxacin

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Mentor: Anthony Convertine

Melioidosis, a disease caused by Burkholderia pseudomallei, is the third most fatal infectious disease in Thailand and causes morbidity and mortality in many other Southeast Asian countries. Due to fears that this bacterium could be weaponized, the US government lists this bacterium as a tier 1 select agent. Current treatments involve weeks of IV-delivered antibiotics and months of pills to prevent reoccurrence of the infection. Despite the availability of these treatments mortality can be as high as 40% in some locations. This situation calls for a more effective means of treatment to reduce loss of life, treatment time, and cost involved in fighting melioidosis. In order to develop a more efficient treatment, I created a novel delivery system to deliver large doses of antibiotics and, potentially, prophylactically load cells with therapeutic to prevent infection. I formulated nanoparticles using reversible addition-fragmentation chain transfer (RAFT) polymerization and microemulsion. The particles were first formulated using an inert monomer to test uniformity of the constructs and optimize the microemulsion procedure. Once this procedure was optimized, I added a prodrug monomer containing ciprofloxacin to the construct and the new constructs were characterized for size, shape, and the kinetics of prodrug degradation to its active form. Cytotoxicity to mammalian cells was tested with MTS assays using RAW 264.7 cells. Planktonic assays were also performed to test the efficacy of this novel delivery system to combat Burkholderia as compared to free ciprofloxacin.

Poster Session 3

Commons East, Easel 81

2:30 PM to 4:00 PM

Polymeric Nanoparticles for Intracellular Antibiotic Therapy Against Tularemia and Melioidosis

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Mentor: Patrick Stayton, Bioengineering
Mentor: Anthony Convertine

Francisella tularensis and *Burkholderia pseudomallei*, the agents of tularemia and melioidosis, respectively, have been identified by the Centers for Disease Control and Prevention (CDC) as bioterrorism agents that could lead to mass casualties and severe threat to public health. These pathogens are highly infectious and aerosolizable intracellular alveolar pathogens that can cause fatal respiratory tract infections. The intracellular compartmentalization of these pathogenic organisms within alveolar macrophages is a significant barrier to bacterial clearance and contributes to their associated morbidity and mortality. Currently, there is no effective treatment to eradicate melioidosis and tularemia other than prolonged antibiotic therapy and even with several months of intensive antibiotic treatment, complete clearance of these pathogens is not guaranteed. Therefore, there is an urgent clinical need to develop new therapeutic drug nanocarriers that can deliver antibiotics intracellularly to alveolar macrophages to increase treatment efficacy of tularemia and melioidosis. The goal of this project is to design biodegradable and nontoxic polymeric nanoparticles with various drug release rates and drug loading densities to overcome pathogens' drug resistance mechanisms. The nanoparticle scaffolds will be synthesized using Polysorbate 80 via Thiol-ene and Thiol-Michael "click" reactions to maintain biocompatibility while incorporating functional groups that are amenable to chemical modification for enhanced drug conjugation. Once the nanoparticle scaffolds are characterized, they will be conjugated to antibiotics such as ciprofloxacin via hydrolytically degradable ester bonds. Drug release profiles will be characterized in serum containing media via reverse phase HPLC to evaluate their efficacies. Once ciprofloxacin is conjugated to the nanoparticle scaffolds, in vitro studies will be conducted to evaluate the polymeric nanoparticles' therapeutic efficacy and toxicity in co-culture macrophage models of bacterial infection. Development of these polymeric nanoparticles will lead to rapid clearance of tularemia and melioidosis with shorter antibiotic administration while reducing the chances of relapse and antimicrobial resistance.