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Cationic pDNA vaccines for immuno-contraception and rabies control

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Plasmid DNA (pDNA) vaccines have the potential to elicit an immune response against a wide range of diseases. However, the limitation of poor uptake of pDNA to antigen-presenting cells and rapid degradation of pDNA encapsulated in nanoparticles prompted us to fabricate an encapsulation free pDNA nanoparticulate vaccine. The negatively charge pDNA adsorbs on cationic PLGA (poly (d, l-lactide-co-glycolide)-chitosan nanoparticles and were used as means to deliver pDNA. Nanoparticles in the size range of 380-500 nm with a zeta potential of 50.0 mV were prepared using emulsification method. pDNA PLGA-chitosan nanoparticles were dispersed in poloxamer 407 that possess fluid property at 4°C and turns into gel at body temperature. Binding affinity of pDNA to cationic nanoparticles depends on pDNA to nanoparticles ratio (P/N) and complete immobilization of pDNA to cationic nanoparticles was achieved at a P/N ratio of 1/50. pDNA adsorption efficiency of 99.0 percent was achieved in pDNA PLGA-chitosan nanoparticles prepared using chitosan glutamate concentration of 2 mg/mL. Complex of pDNA and cationic nanoparticles was well tolerated and maintained cell survival rate greater than 80.0 percent. Additionally, cellular uptake was found to be both time and concentration dependent and followed saturation kinetics with V_{max} of 11.389 µg/mL.hr and K_m value of 139.48 µg/mL. *In-vitro* release study of P/N, 1/50 showed that the nanoparticulate vaccine can sustain the release of pDNA up to 24 hours. In our study, we demonstrated that pDNA PLGA-chitosan nanoparticles were non-cytotoxic, showed enhance cellular uptake, and sustain the release of pDNA for extended period.

Biography

Amit Bansal has completed his MS in Pharmaceutical Sciences from Temple University and currently pursuing PhD at Mercer University College of Pharmacy. His research work at Mercer University was focused on development and evaluation of nanoparticulate vaccine as delivery vehicle thereby achieving sustained release of the vaccine with the aid of biodegradable polymers. He has prior research experience in the formulation development of immediate and modified release dosage forms, chemical modification of polymers and on the permeability of anticancer drugs across blood brain barrier (BBB). He has published one research paper, and is co-author of one review article and a book chapter.

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