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Formulation and development of alginate chitosan encoated OmpA micro-particle - A *Shigella* protein subunit vaccine against Shigellosis

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Shigellosis or bacillary dysentery, caused by *Shigella* sp. is an acute intestinal infection, characterized by strong abdominal cramps, fever and stools containing blood and mucus. It remains as an important public health challenge in developing as well as developed countries. The number of *Shigella* cases exceeds 165 million per year, causing 1.1 million deaths and more than 65% of cases are in children under 5 years of age. Though *Shigella* was discovered century ago, till date no licensed vaccine is available for public use. Antibiotics are the only choice for the treatment of Shigellosis. But the irrational use of antibiotics leads to emergence of multidrug resistant bacteria. Thus vaccine is the only way to prevent Shigellosis. *Shigella* encompasses four subgroups (*S. flexneri, S. sonnei, S. dysenteriae* and *S. boydii*) based on the structure of the O-antigen repeats that comprise the polysaccharide moiety of the lipopolysaccharide. Thus an ideal *Shigella* vaccine must confer protection against not only single serotype but all serogroups. In this present study, muco-adhesive chitosan alginate micro-particles were investigated as a new vehicle for delivery of OmpA protein. OmpA protein, an efficacious mucosal immunogen is embedded in the outer membrane of *Shigella* as a beta barrel protein highly conserved among all *Shigella* sp. We expressed and purified recombinant his-tag OmpA protein after cloning and coated this protein with chitosan-alginate micro-particle as a promising novel candidate vaccine. Chitosan-alginate micro-particles were prepared by ionotropic gelation method. Morphology and structure characterization of micro-particles were investigated by transmission electron microscope (TEM) and dynamic light scattering (DLS) technique for particle properties. The mean diameter of the micro-particles was about 550nm. The designed micro-particles have average particle size from 194 nm to 560 nm (poly-dispersity 0.47). The rapid charge inversion of OmpA loaded chitosan alginate micro-particles (from +33 mv to -20.78 mv) was observed during the coating procedure which indicated the presence of alginate layer on the chitosan micro-particle surfaces. In our experimental animal model, oral immunization of mice with the OmpA coated chitosan-alginate micro-particle induces strong protective immunity against the lethal challenges with different prevalent serogroups of *Shigellae*. Hence OmpA coated with chitosan-alginate microparticles (which act as a delivery system) is a promising novel candidate vaccine against human Shigellosis.

Biography

Priyadarshini Mukherjee has completed her Master of Science degree in Zoology from Bangabasi College under University of Calcutta. After completion of her MSc degree, she joined division of Bacteriology, National Institute of Cholera and Enteric Diseases (NICED), Beliaghata, Kolkata, India for PhD registration under the guidance of Dr. Hemanta Koley, Scientist, Division of Bacteriology, NICED. At present, her research interest is to understand immunogenicity and protective efficacy of combination antigens of diarrhea causing bacteria in different animal models. She has received CSIR-UGC fellowship in the December, 2012. Recently she has filed *Shigella* vaccine patent "Alginate chitosan nano-formulation of OmpA a *Shigella* subunit vaccine" IPR/NICED/OmpA/297 dated 8th April 2015.

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