

One step spray-dried polyelectrolyte microparticles enhance the antigen cross-presentation capacity of porcine dendritic cells

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Vaccination is regarded as the most efficient and cost-effective way to prevent infectious diseases. Vaccine design nowadays focuses on the implementation of safer recombinant subunit vaccines. However, these recombinant subunit antigens are often poor immunogens and several strategies are currently under investigation to enhance their immunogenicity. The encapsulation of the antigens in biodegradable microparticulate delivery systems seems a promising strategy to boost their immunogenicity. Here, we evaluate the capacity of polyelectrolyte microparticles (PEMs), fabricated by single step spray-drying, to deliver antigens to porcine dendritic cells and how these particles affect the functional maturation of dendritic cells (DCs). PEMs were loaded with either BSA-FITC or F4 fimbriae, a bacterial adhesin purified from a porcine-specific enterotoxigenic *E. coli* strain, by co-spray-drying with the PEM constituents, the polyelectrolytes dextran-sulphate and poly-L-arginine and the sacrificial template mannitol. *In vitro* generated porcine monocyte-derived dendritic cells were incubated with these PEMs and the phenotypical and functional DC maturation was assessed by confocal and live cell imaging, flow cytometry, proliferation assays and cytokine ELISAs. In confocal images we detected multiple particles per cell in >80% of the examined DCs, indicating that the resulting antigen-loaded PEMs were efficiently internalised by porcine monocyte-derived DCs. F4 fimbriae-loaded PEMs (F4-PEMs) enhanced CD40 and CD25 surface expression by DCs and this phenotypical maturation correlated with an increased secretion of IL-6 and IL-1 β . More importantly, F4-PEMs enhance both the T cell stimulatory and antigen presentation capacity of DCs. Moreover, PEMs efficiently promoted the CD8⁺ T cell stimulatory capacity of dendritic cells, indicating an enhanced ability to cross-present the encapsulated antigens. Our results confirm recent data obtained in rodent models that single step spray-dried PEMs boost the immunogenicity of vaccine antigens and could accelerate the development of veterinary and human subunit vaccines based on polyelectrolyte microparticulate delivery systems to protect against a variety of extra- and intracellular pathogens.