Protein Adsorbed PGA-co-PDL Nanocarriers for Vaccine Delivery

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Purpose
To formulate bovine serum albumin (BSA) adsorbed poly(glycerol adipate-co-ω-pentadecalactone), PGA-co-PDL nanoparticles (NPs) within L-leucine microparticle carriers for dry powder inhalation.

Methods
Nanoparticles were prepared by oil-in-water (O/W) single emulsion solvent evaporation method. Particle size and polydispersity index (PDI) were characterised. BSA was adsorbed onto NPs at three different ratios, NP:BSA (100:4, 100:10 and 100:20) at room temperature. The NPs were spray-dried in aqueous suspension of L-leucine (1:1.5) using a Büchi 290 mini-spray dryer. The resultant nanocomposite microparticles (NCMPs) were characterised for toxicity (MTT assay), aerosolization (Next Generation Impactor) and in vitro release study.

Results
NPs of size 128.50 ± 6.57 nm and PDI 0.07 ± 0.03 suitable for targeting lung dendritic cells were produced. BSA adsorption for 1 h resulted in 10.23 ± 1.87 µg of protein per mg of NPs. Spray-drying in the presence of L-leucine resulted in NCMPs with 42.35 ± 3.17% yield. In-vitro release study at 37°C for 48 h showed an initial burst release of 30.15 ± 2.33 % with 95.15 ± 1.08 % over 48 h. Aerosolization studies indicated fine particle fraction (FPF %) dae < 4.6 µm as 76.49 ± 6.26 % and mass median aerodynamic diameter (MMAD) of 1.21 ± 0.67 µm. The cell viability was 106.04 ± 21.14 % 16HBE cell line with L-leucine based NCMPs at 1.25 mg/ml concentration after 24 h treatment.

Conclusion
The results suggest that PGA-co-PDL/L-leu NCMPs may be a promising carrier for pulmonary vaccine delivery due to excellent release profile and aerosolisation behaviour.