Formulation and characterization of spray-dried budesonide in organic solvent suspensions for aerosol delivery to the lungs

Wei-Ren Ke[1], Philip Chi Lip Kwok[1] & Hak-Kim Chan[1]

[1] Advanced Drug Delivery Group, Sydney Pharmacy School, Faculty of Medicine and Health, Pharmacy and Bank Building A15, The University of Sydney, NSW 2006, Australia

Spray drying technique is a rapid method for converting a liquid feed into dried particles. However, spray-dried powders produced from solutions are mostly amorphous. The amorphous lactose is particularly unstable when exposed to moisture. To avoid this problem, a suspension containing crystalline lactose particles and dissolved BUD in an organic solvent was spray dried. In the present study, the powder generated from this suspension were characterised. The solution formulation using a cosolvent system was spray dried as a control.

The suspension formulation contained 0.77 mg/mL dissolved BUD and 12 mg/mL suspended lactose in isopropanol alcohol. The solution formulation contained 3.39 mg/mL BUD and 49.57 mg/mL lactose in 50:50 IPA/water. Both spray-dried powders were stored at 25°C/60% RH for three months. The particle properties and *in vitro* dispersion performance were examined at different storage time points.

The powder generated from solution showed rapid recrystallization. Its volumetric median diameter (VMD) was significantly increased from 4.2 to 24.4 µm after 1-week storage. Although the crystallinity of the powder spray dried from suspension measured by XRD remained the same after three-months storage, SEM indicated that interparticulate solid bridges started to form after 1-month storage. The VMD of the particles changed from 4.22 µm to a maximum of 4.37 µm after one month and 4.28 µm after three months, with the change in the fine particle fraction (FPF) from 51.4% to 25.1%. In conclusion, spray-dried powder obtained from suspension was more stable than the formulation spray-dried from solution. However, the powder still deteriorated, even though more gradually.