Development of a spray-dried inhalable dry powder presentation of a Tuberculosis vaccine candidate with demonstrated long term physical stability at high temperatures for use in developing countries

Mellissa Gomez[1], Joseph McCollum[2], Hui Wang[1], Mani Ordoubadi[1], Nicholas B. Carrigy[1], David Barona[1], Shital Bachchhav[1], Chester Jar[1], Isobel Tetreau[1], Michelle Archer[2], Alana Gerhardt[2], Chris Press[2], Ryan M. Kramer[2], Christopher B. Fox[2], Reinhard Vehring[3]

[1]Department of Mechanical Engineering, University of Alberta, Edmonton, AB, Canada
[2]Infectious Disease Research Institute, Seattle, WA, USA

Two key issues hindering the ability to safely and effectively distribute vaccines in the developing world are the cold chain maintenance required by many vaccines and the problems associated with needle delivery. One method of bypassing these issues is the development of a thermostable dry powder vaccine that can be administered via the pulmonary route as an aerosol. Our work focuses on developing a dry powder presentation of ID93+GLA-SE—an adjuvanted subunit Tuberculosis vaccine candidate—that is suitable for inhalation. Trehalose was utilized as a stabilizing excipient. Formulation development established trileucine as an effective dispersibility enhancing agent compatible with the vaccine candidate. ID93+GLA-SE and the excipient system were spray dried and the resulting powder was placed on a stability study. Results found that particle morphology was maintained after storage at temperatures up to 40 °C for a year. Similarly, high emitted dose (>95%) and lung dose (32-38%) as measured *in vitro* was preserved for one year at temperatures up to 40 °C. The chemical stability of the adjuvant system was maintained at storage temperatures up to 25 °C for as long as one year, with >80% component retention and <50% emulsion size change. After three months of storage at 40 °C the spray-dried inhalable product retained 50% of the antigen, whereas the antigen in a liquid product could not be detected after one month of storage at 37 °C.