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Inhalable cyclosporine powder for immunosuppressive treatment

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Our research brings to the development of a high respirable powder for inhalation of Cyclosporine A (CsA) with improved dissolution rate. This powder was produced by spray drying using a low amount of excipients. Different powders were produced starting from aqueous solutions containing 10-20 % (w/w) of mannitol; 0-5% (w/w) of glycine and 60-45% (v/v) of ethanol according to a design of experiment. The aerodynamic performance was analyzed through fast screening impactor and next generation impactor using RS01 inhaler. The dissolution profile of CsA powders was evaluated with a vertical diffusion cell apparatus (RespiCell™) across a polycarbonate membrane. Curves obtained from dissolutions were linearized by the Weibull distribution.

Twelve powder were characterized and the best results in terms of dissolution profile and respirability were obtained using a 20 % of mannitol for powder construction. In this way, 59.7 ± 2.8 minutes were requested to dissolve 63.2% of CsA. This value was significantly lower compared to the one of CsA raw material ($169,5 \pm 29$ min). The CsA-Mannitol spray dried powder was successfully emitted by the powder device (>87%) and the fine particle fraction was higher than 70%.

In conclusion, the work leads to the production and characterization on an inhalation powder with the potential to be administered directly to the lung for the prevention of rejection following lung transplantation and the containment of the inflammatory process due to SARS-CoV-2 infection.

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