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Formulation and investigation of ibuprofen containing inhalable nanocrystals to treat cystic fibrosis

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Cystic fibrosis (CF) is a lethal genetic disorder, which shows severe lung symptoms. The non-steroidal anti-inflammatory ibuprofen (IBU) slows the disease progression and is well tolerated. Inhalable IBU nanocrystals are advantageous for targeted pulmonary delivery, although IBU is poorly water-soluble and has a low melting point.

We aimed to produce a carrier-free dry powder inhaler containing IBU. We combined high-performance ultra-sonication and nano spray-drying. We expected improved dissolution and proper aerodynamic behavior to provide local treatment for CF.

IBU was solved in ethyl acetate, then sonicated into a polyvinyl alcohol solution. Powders were formulated via spray-drying. The following measurements were executed: dynamic light scattering, scanning electron microscopy, X-ray powder diffraction, in vitro dissolution and in vitro aerodynamic assessment (Andersen Cascade Impactor).

The particle size of the IBU was decreased into the nano range. The diameter of the spray-dried powder was between 500-700 nm and they showed spherical morphology. The dissolution was rapid. The particles gave high lung deposition and had aerodynamic diameters between 2-4 μm , which target the related lung area.

We managed to moderate the difficulties of the IBU during preparation and improve the water solubility. The proper particle size, shape, and dissolution profile besides the outstanding aerodynamic behavior could provide an innovative treatment.

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