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Development and evaluation of levofloxacin dry powder for inhalation

Lomass Soliman, Rita Ambrus

Institute of Pharmaceutical Technology and Regulatory Affairs, University of Szeged, Szeged, Hungary

Levofloxacin (LEVO) is an effective fluoroquinolone antibiotic against *Pseudomonas aeruginosa* infections in cystic fibrosis patients [1]. This research aims to develop and evaluate a carrier-free LEVO dry powder inhaler via nano-spray drying of an initial nanosuspension, achieving high drug loading, favorable physicochemical properties, and deep lung deposition, offering a convenient alternative to nebulized formulations.

Nanocomposite microparticles were produced through a two-step method, nanosuspension preparation via wet milling using HPMC K4M and tween 80 as stabilizers [2], followed by nano-spray drying [3] with leucine (LEU) utilizing 1:1, 1:2, and 1:3 LEVO: LEU molar ratios. All prepared formulations were investigated in terms of particle size, structure, thermal behavior, morphology, rheology, biopharmaceutical, and aerodynamic performance.

The processing of LEVO produced particles with a median size $D_{0.5}$ of 2–3 µm, exhibiting a monodisperse pattern with a span of less than 2. Scanning electron microscopy revealed microspheres with slight corrugation in the 1:2 and 1:3 ratios' formulations, which is beneficial for aerosolization by reducing interparticle cohesion. This was confirmed by the aerodynamic investigation using the Andersen Cascade Impactor, which recorded a high fine particle fraction (60–70%). Thermal analysis, specifically differential scanning calorimetry, confirmed the formation of new cocrystals of LEVO and LEU. The powder density decreased upon spray drying, and a marked enhancement in solubility along with rapid drug release (>90% within 10 minutes) was observed.

Hence, LEVO powder for inhalation was successfully developed and demonstrated advantageous properties, offering a promising approach for local treatment of infections.

References

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