297c Monodisperse Powders for Controlled Release Inhalation Therapy

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Whether treating the lung locally or using it as a gateway for systemic delivery of large molecular weight drugs, a common goal is to deliver drug to the deep lung. Researchers have repeatedly reported that a particle size of ~1-3 μm in aerodynamic diameter will efficiently bypass the filtering system of the mouth and upper airway. Also, large porous particles exhibiting the desired aerodynamic diameter but having increased (>20 μm) geometric diameter can potentially reduce particle aggregation and avoid phagocytotic clearance by alveolar macrophages. Current processing techniques, however, create large particle size distributions yielding only a small percentage of particles within the proper aerodynamic size range. Our lab utilizes a technique producing uniform poly(DL-lactic-co-glycolic acid) (PLGA) microspheres wherein 95% of the particles are within 0.5 μm of a target diameter. The goal of the proposed research is to systematically design PLGA particle size and density to improve the delivery of uniform large porous particles into the late stages of a multi-stage liquid impinger (i.e. improve deep lung deposition) for a variety of modeled conditions. We will also encapsulate and control the release of ciprofloxacin, an antibiotic commonly used for the treatment of deep lung infections. The performance (deposition and controlled release) of large particle formulations will be compared to uniform solid particles ~1-3 μm in diameter.