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Nanotechnology enabled innovation in inhalation drug delivery

Eride Quarta[a], Paolo Colombo[a,b], Lorenzo Degli Esposti[c], Daniele Catalucci[d], Michele Iafisco[c], Claudio De Luca[e], Gaia Colombo[f]

[a]Department of Food and Drug, University of Parma, Parma, Italy
[b]PlumeStars srl, Parma, Italy
[c]Institute of Science and Technology for Ceramics (ISTEC), Faenza, RA, Italy
[d]National Research Council (CNR), Institute of Genetic and Biomedical Research (IRGB) – UOS Milan and IRCCS Humanitas Research Hospital, Rozzano, MI, Italy
[e]Nanophoria srl, Milano, Italy
[f]Department of Life Sciences and Biotechnology, University of Ferrara, Ferrara, Italy

Effectiveness and safety of drug inhalation is critically dependent on the aerodynamic size distribution of the inhaled aerosol's particles and their composition. According to pharmacopoeias, respirable particles in an aerosol are those having aerodynamic diameter smaller than 5 µm. However, when the size of particles to inhale reaches the nanometer range, they become too small for deposition and are mostly exhaled.
Drug loaded nanoparticles are interesting for drug delivery by inhalation, not only to encapsulate drugs with different aqueous solubilities, but to overcome biological barriers within the lungs (e.g. mucus) and accumulate in alveolar macrophages or prevent clearance. Various approaches are considered aiming to make nanoparticles suitable for inhalation. It is necessary to increase the aerosol particle size by a process avoiding modification of the nanoparticle size distribution. An example of such approach are nano-embedded microparticles (Trojan particles), with or without a carrier substance. It is required that these nano-embedding microparticles are respirable and capable to restore the nanoparticles unmodified upon deposition, for subsequent drug release and targeting.
In this talk, the example of calcium phosphate nanoparticles will be presented. In particular, their application for the targeted delivery of a mimetic peptide active at cardiac level will be presented.