Nano into micro formulations based on functionalized polymers for pulmonary drug delivery

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Pulmonary drug delivery represents one of the most promising field of application of drug delivery technologies either for the peculiarity of action site or for the wide number of the interested pathologies including Cystic Fibrosis (CF). In the drug delivery field the expertise of the Laboratory of Biocompatible Polymers (LBP) concerns the design, synthesis and characterization of new functionalized polymers starting on either natural or synthetic polyaminoacids and polysaccharides to produce nanostructured drug delivery systems and nanomedicine useful for the treatment of different pathologies including lung involving deaseases.
In this field two different *Matryoshka* formulations using the Nano into micro (NiM) strategy for the treatment of infection or genetic defect in the CF patients have been produced; in particular mucus penetrating polyelectrolyte complexes containing an antibiotic drug, like Tobramicin, and mucus and cell penetrating nanoparticles loaded with Ivacaftor, a potentiator of CF, have been produced by using tailor made smart functionalized copolymers based on polyhydroxyethylaspartamide; so obtained nanomedicines have been inserted into proper microparticles (NiM strategy) in order to allow the pulmonary administration by dry power inhaler.

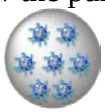

Figure 1. Nano into micro systems for the administration of drug in the CF.

NiM pulmonary dry powder formulations of tobramycin have been also successfully produced and Tobramicin showed to improve its efficacy if compared with free drug[1].
Also Ivacaftor incorporated into NiM showed to be useful for the restoring of the defect of CFTR in CF by in vitro cell experiments and NiM self showed intersting aerodynamic properties necessary for pulmonary administration[2].

1) Biomacromolecules 2017, 18, 3924−3935.
2) ACS Appl. Mater. Interfaces, 2018, 10 (1), pp 165–181.