Layer by Layer engineering of PLGA nanoparticles for control of surface properties, targeting and cellular uptake

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The Layer-by-Layer (LbL) assembly technique was applied for the surface modification of biodegradable poly (lactide-co-glycolide) nanoparticles (NPs) using poly(acrylic acid) (PAA) and polyethylenimine (PEI) as building blocks. The LBL assembly provides through non covalent modification amino and carboxilate groups that can be covalently bounded to provide specific functions to the nanoparticles. In this approach nanoparticle stability is not affected and a sequential increase in the functionality and complexity of the nanoparticle will be achieved. Amino terminated poly(ethylene glycol) (PEG) and folic acid (FA) modified PEG (PEG-FA) were grafted onto the multilayers via the condensation between carboxylic groups and amine groups on PEG or PEG-FA. The LbL assembly and the covalent functionalization were monitored with quartz crystal microbalance with dissipation technique (QCM-D), contact angle and ζ-potential measurements. Protein adsorption after incubation of the NPs and planar model multilayer in culture medium containing serum proteins was investigated and related to cell

uptake. Cell uptake experiments with Flow Cytometry showed that after PEGylation the cell uptake ratio of the NPs was significantly decreased, but became 3 times larger when PEG-FA was grafted on the NPs instead of the PEG. Confocal Scanning Laser Microscopy confirmed the flowcytometry data.