Impact of Stabilizer Concentration on the Surface Functionalization of PLGA Particles

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Particles from poly(D,L-lactide-*co*-glycolide) (PLGA) can be covalently modified for active targeting with biorecognitive molecules. Usually, steric stabilizers are added that build an adsorptive layer on the particle surface. For this purpose, the FDA-approved poloxamer 188 (Pluronic[®] F68), a PEO-PPO-PEO triblock copolymer, is the most prominent example. In the presented work the influence of different concentrations of Pluronic[®] F68 on the coupling efficiency of three ligands of different molecular weights was investigated.

Surfactant-free PLGA microparticles of 1 to 5 µm size were prepared by spraydrying [1] and subsequent fractionation. In absence and in presence of up to 5% Pluronic[®], fluorescein cadaverin (F-Cad), fluorescein-labeled wheat germ agglutinin (WGA) and immunoglobulin G (IgG) were coupled to the particle surface using the carbodiimide method.

The maximum coupling rate as determined by flow cytometry was achieved in absence of stabilizer. It decreased to 35% for IgG, 56% for WGA and 51% for F-Cad in presence of 5% Pluronic[®]. The strongest decline was observed for concentrations up to 0.025% (WGA) or 0.5% (IgG, F-Cad) Pluronic[®]. This may be mainly due to the sharply increasing thickness of the poloxamer adsorption layer at low concentrations [2]. However, the fewest particle losses during the modification process occurred with Pluronic[®] concentrations between 0.05 and 1%, and there was less aggregation at higher stabilizer concentrations.

To conclude, increasing concentrations of poloxamer impair covalent coupling to PLGA microparticles, but as the stabilizer at the same time improves the dispersion quality and reduces particle aggregation and losses during the coupling procedure, an optimum has to be determined, being 0.1% Pluronic[®] F68 for the studied system. Therefore, the stabilizer concentration must be considered for the optimization of a coupling protocol.

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