

Colloidal Stability of PLGA Nanoparticle Dispersions Containing Adsorbed Pluronic Copolymers

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This study investigates the temperature-triggered aggregation properties of Pluronic (PEO-PPO-PEO) materials and the structural properties of PLGA in the form of Pluronic coated PLGA nanoparticles. Pluronic is a BASF trade name for a block copolymer of hydrophobic polypropylene oxide (PPO) and hydrophilic polyethylene oxide (PEO). At low temperature the PEO section surrounds the PPO. As the temperature increases the PEO unravels exposing the hydrophobic PPO, causing polymer aggregation and clouding of solution. When adsorbed onto the PLGA nanoparticle surface, using the method described by Dunn et al¹, nanoparticle aggregation occurs above a critical temperature. PLGA is a copolymer formed from lactic acid and glycolic acid. In the case of this project 75% lactic acid 25% glycolic acid was used. Cloud point maps were obtained for the Pluronic systems and using these data Pluronics were selected for preparing temperature responsive Pluronic coated PLGA nanoparticle dispersions. Studies into the factors affecting the colloidal stability of the dispersions were also carried out. The isoelectric point of uncoated particles was determined using electrophoretic mobility measurements and found to be between pH 1.5 and 2, which is consistent with the pK_a of lactic acid² (of ca. 3.0). The critical coagulation concentration of the uncoated PLGA nanoparticle dispersion was also determined, using UV-visible spectroscopy, and found to be 0.35M and 0.035M for NaNO₃ and Ca(NO₃)₂, respectively. It was also found that the addition of salt decreased the critical aggregation temperature of the Pluronic coated PLGA nanoparticles and this approached 40 °C. In future work the effects of additives and pH on temperature-triggered aggregation of Pluronic coated PLGA nanoparticles and dispersion gelation will be studied.

References

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