Correlating the Viscosity, Polarity and Porosity of Polymer Nanoparticles Matrix with Drug Release Efficiency by Fluorescence

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Résumé

Polymeric nanoparticles (NPs) continue to be a promising nanovector for nanomedicine and imaging agents.1 Among them, biocompatible polyester block copolymers (BCPs) exhibit appealing features as their physicochemical properties can be readily modified by the composition of their blocks, which in turn affects the cargo release behaviours.2 However, the effects of nanoscopic properties of polymeric NPs are rarely studied. In this work, we assumed that tuning the monomer and chain length could impact the nanoscopic properties of the nanoparticles, which further helps in controlling their cargo encapsulation and release. To achieve this, clickable PEG-PCL/PLA block copolymers with different monomers and chain lengths were synthesized. Owing to their covalent fluorescent labelling using strain-promoted azide-alkyne cycloaddition, several parameters like the colloidal stability, the core viscosity, the core polarity, the core porosity and stealth of the NPs have been studied. Beyond simple fluorescent tagging, these new tools represent a major innovation as nanosensors of the internal properties of polymeric nanoparticles, enabling a finer understanding of their composition, inference of their morphology, and evaluation of how nanoprecipitation parameters shape nanoparticle structure and performance. Taking advantage of the fluorescence labelling of the NPs' core, their ability to encapsulate and release a fluorescent cargo (Sulfo-Cyanine3) was assessed by Forster resonance energy transfer (FRET). The study proved that the covalent fluorescent labelling of the BCPs is an efficient tool, offering various methods to characterize and assess the effects of the polymers' modifications on the NP's properties.

Mots-Clés: block copolymers, fluorescence labelling, nanoscopic properties, encapsulation, drug delivery, FRET

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