

Supramolecular nanoparticles based on phosphate polyamine interactions for the encapsulation of anti cancer drugs

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Self-organization of polyamines and phosphate ions constitutes an important example of non covalent association in numerous biological media. In vitro aggregation of polyamines in phosphate buffer yield to supramolecular complexes similar to the known nuclear aggregates of polyamines (NAPs) present in many replicating cells (1). NAPs interact with the phosphate groups of DNA and modulate the conformation and protection of DNA more efficiently than single polyamines. J. Yu et al., reported polyallyamine capsules formation by phosphate salt-cross-linked aggregates that can be loaded with the near-infrared dye indocyanine for photothermal cancer treatments (2). Here, we report a versatile method to synthesize multifunctional polyamine nanoparticles (PANs) through a simple synthetic procedure in phosphate buffer solution. PANs are investigated to load bioactive molecules and/or hydrophobic drugs used for cancer therapy, as well as magnetic nanoparticles for theranostic applications (3)

A detailed study was conducted to characterize the formation and the stability of PANs modulating the phosphate ion concentration, pH, ionic strength, time and temperature. The size of PANs is strictly related to the phosphate ion concentration and pH. The resulting PANs were extensively characterized by dynamic light scattering (DLS), electrophoretic mobility measurements, transmission electron microscopy (TEM). Cellular uptake and intracellular delivery of encapsulated molecules were studied by confocal laser scanning microscopy (CSLM) and flow cytometry. PANs toxicity was evaluated in vitro. In conclusion, initial results indicate that PANs is a promising system for loading and releasing of bioactive molecules.

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References:

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