Abstract

The thesis outlines possible medical applications of soft matter assemblies as nanotechnology based systems as well as their potential in the emerging field of nanomedicine. Nanomedicine can be defined as the investigation area encompassing the design of diagnostics and therapeutics at the nanoscale, including nanobots, nanobiosensors, nanoparticles and other nanodevices, for the remediation, prevention and diagnosis of a variety of illnesses. The ultimate goal of nanomedicine is to improve patient quality-of-life. Because nanomedicine includes the rational design of an enormous number of nanotechnology-based products focused on miscellaneous diseases, a variety of nanomaterials can be employed. Therefore, the thesis is driven by a focus on recent advances in the manufacture of soft matter-based nanomedicines specifically designed to improve cancer diagnostics and chemotherapy efficacy. It will in particular highlight liposomes, polymer-drug conjugates, drug-loaded block copolymer micelles and biodegradable polymeric nanoparticles, emphasizing the current investigations and potential novel approaches towards overcoming the remaining challenges in the field as well as a brief overview of formulations that are in clinical trials and marketed products. Based on vehicle-related and physiologically-related barriers (to nanoparticles accumulation in tumors) and on the main advantages and drawbacks of soft matter nanomedicines, the selected drug-loaded block copolymer micelles and biodegradable polymeric nanoparticles (non-responsive and responsive) were synthesized, characterized and their *in vitro* or *in vivo* efficacy as cancer chemotherapeutics, was demonstrated.