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Preparation of Magnetothermally Responsive Polymer Multilayer Films for Controlled Release Applications from Surfaces

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Abstract : Externally triggered and effective release of therapeutics from polymer nanoplatforms is one of the key issues in cancer treatment. In this study, we aim to prepare polymer multilayer films which are stable at physiological conditions (little or no drug release) but release drug molecules at acidic pH and via application of AC magnetic field. First, novel stimuli responsive diblock copolymers composed of pH- and temperature-responsive blocks were synthesized. Then, block copolymer micelles with pH-responsive core and temperature responsive coronae will be obtained via pH-induced self-assembly of these block copolymers in aqueous environment. A model anticancer drug, e.g. Doxorubicin will be loaded in the micellar cores. Second, superparamagnetic nanoparticles will be synthesized. Magnetic nanoparticles and drug loaded block copolymer micelles will be used as building blocks to construct the multilayers. To mimic the acidic nature of the tumor tissues, Doxorubicin release from the micellar cores will be induced at acidic conditions. Moreover, Doxorubicin release from the multilayers will be facilitated via magnetothermal trigger. Application of AC magnetic field will induce the heating of magnetic nanoparticles resulting in an increase in the temperature of the polymer platform. This increase in temperature is expected to trigger conformational changes on the temperature-responsive micelle coronae and facilitate the release of Doxorubicin from the surface. Such polymer platform may find use in biomedical applications.

Keywords : layer-by-layer films, magnetothermal trigger, smart polymers, stimuli responsive
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