Redox-responsive polymers for biomedicinal applications

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The synthetic glucocorticoid dexamethasone is used to treat inflammatory diseases, but the therapy is often accompanied by unwanted side effects. These negative impacts can be limited by the use of drug delivery systems. This study focuses on the synthesis and characterization of a redox responsive polymer carrier, which has ferrocene in its end group. The synthesized homopolymers of 2-ethyl-2-oxazoline and copolymers of 2-ethyl-2-oxazoline and 2-nonyl-2-oxazoline were analyzed in terms of their structure, self-assembly, drug encapsulation, response to the oxidative environment typical for inflammed and cancerous tissues and biocompatibility. The structure of the polymers was confirmed by NMR, GPC and MS. The approximate content of ferrocene and the critical micellar concentration were determined. Redox responsiveness was demonstrated using UV-VIS spectroscopy and isothermal titration calorimetry. Furthermore, low interaction with blood plasma proteins and the encapsulation of dexamethasone in polymer micelles were comfirmed. The non-toxicity of both the polymers themselves and the prepared formulations was determined by biological tests. The results show that the synthesized polymers could potentially be further biologically tested, possibly modified, and used for drug delivery.

Keywords: reactive oxygen species, polymer, ferrocene, drug delivery, 2-ethyl-2-oxazoline, 2-nonyl-2-oxazoline, dexamethasone

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