Abstract

In this doctoral thesis we describe a series of stimuli-responsive polymers which could be used as diagnostic tools or as smart drug delivery systems with simultaneous diagnosis (theranostics). All hereby mentioned polymers are thermoresponsive copolymers of (*N*-2,2-difluoroethyl)acrylamide exhibiting lower critical solution temperature in aqueous milieu. This means that they are water-soluble at low temperature while when heated above a certain temperature, they self-assemble into nano- or macro- sized assemblies. Because of the high concentration of fluorine atoms, all these polymers could be used as ^{19}F MRI tracers.

We designed multiple different thermoresponsive, thermo- and pH-responsive, thermo-and reactive-oxygen-species-responsive polymers that could find numerous discussed applications in human medicine. We investigated their physico-chemical properties with ^{1}H and ^{19}F nuclear magnetic resonance (NMR), size exclusion chromatography (SEC), elemental analysis, dynamic light scattering (DLS), static light scattering (SLS), small angle neutron scattering (SANS), small-angle X-ray scattering (SAXS), and turbidimetry. After the physicochemical optimization of the parameters for the selected applications, their biocompatibility was tested *in vitro*. Several promising polymers were tested *in vivo* on animal models. The clinical applicability of our polymers was further confirmed *via* merged ^{1}H and ^{19}F MR imaging of our polymers *in vitro* as a phantom study and *in vivo* with a rat model. One polymer was tested using an instrument currently used in human medicine.

Keywords: ^{19}F MRI tracer, thermoresponsive polymers, self-assembly, theranostic, multi-responsivity