# Stimuli-Responsive Triblock Copolymer For Biomedical Applications

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Stimuli-responsive polymers are polymers that respond with rapid changes to external stimuli such as pH, temperature, light or ionic strength. Responses to their stimuli may be manifested as changes in solubility, shape, surface characteristics. They can also lead to the fomation of micelles or a sol-gel transition. These materials are very intersesting for different biomedical applications such as drug delivery, tissue engineering or sensors.

In this thesis, we work on two seperate systems: on the one hand, micelles and, on the other hand, iron oxide nanoparticles. These nanoparticles are generally synthesized in a one-step process by alkaline coprecipitation of iron (II) and iron (III) precursors in aqueous solutions (Massart process). However iron oxide nanoparticles suspensions produced by Massart process are not stable enough in physiological conditions to be used as such. A stabilizing coating is needed to avoid aggregation and consequent precipitation of the colloids in body fluids.

For this coating, the polymer blocks chosen are the poly(ethylene oxide) (PEO), the poly(acrylic acid) (PAA) and the poly(N-isopropyl acrylamide) (PNIPAM). The high flexibility and hydrophilicity of PEO chains make it a candidate of choice to confer stealthiness to micelles and nanoparticles in order to avoid their rapid removal from the body by the opsonization process. The PAA is the pH-responsive block and the anchoring block. The PNIPAM is the thermoresponsive block with a thermal transition close to 37°C.

Triblock copolymer was synthesized by a Reversible Addition Fragmentation Transfer Polymerization (RAFT) process combining poly(acrylic acid) PAA, poly(N-isopropylacrylamide) and poly(ethylene oxide) or poly[acrylate methoxy poly(ethylene oxide)]. This triblock copolymer was used alone to form micelles and with iron oxide to make magnetic stabilized nanoparticles.

The behaviour of micelles and coated nanoparticles was investigated in different conditions by a combination of dynamic light scattering (DLS), transmission electron microscopy (TEM) and zeta potential measurements.

Moreover, PAA-b-PNIPAM-b-PAMPEO nanofibers were obtained by electrospinning technique. These nanofibres present interesting prospects in the field of biomaterials and biomedical applications as they could mimic the extracellular matrix of the skin.