The release kinetics of chlorhexidine base from polyNIPAM microgels crosslinked by mono- di- and tri(ethylene glycol) dimethacrylate

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Abstract

The deswelling process of microgels is controlled by diffusion, where the rate of the collapsing of the macromolecule is correlated to the dimensions of pores in the polymeric matrix. During the synthesis of microgel particles with different co-monomers the macromolecules of required characteristics are obtained, e.g. anionic, cationic or hydrophobic polyNIPAM polymers. The characteristics of the microgels could be also affected by the use of different crosslinkers. The aim of the work was to elucidate the influence of crosslinkers characterized by increasing chain length on the release of very slightly soluble drug – chlorhexidine base (CHX). Poly(NIPAM) microgels particles were synthesized by surfactant free emulsion polymerization in deionized water at 343 K, under an inert nitrogen atmosphere. Beside the main monomer - N-isopropylacrylamide, the three crosslinkers were used as the substrates for three polyNIPAM polymers: ethylen glycol dimethacrylate, di(ethylene glycol) dimethacrylate, and tri(ethylene glycol) dimethacrylate, assigned respectively as MM, MD, and MT. The reaction course was confirmed by the IR assessements. The samples of synthesized microparticles were purified by dialysis in deionised water up to constant conductivity. The volume phase transition temperature (VPTT) of synthesized microgels was assessed by the turbidimetric method in the temperature range between 18 and 45 ºC in the diluted samples. The acquired release rates and concentrations of CHX released from CHX base loaded polyNIPAM beads were compared to that obtained with a water dispersion of CHX base and CHX base loaded methylcellulose beads (MC) and polyacrylic acid beads (PA). The release rates for the polymers beads were as follows: MC>MD>MT>MM>PA measured over and below the VPTT, although the release kinetics of CHX in the same period but at the temperature over the VPTT was different comparing to that for the temperature conditions below the VPTT. The release of CHX in the presence of microgels could be divided in two stages– the transition point was observed for some of them at the point of 90 min. The microgels may be applied for the release modification of the CHX and would be further studied in this area. This research was supported by a Marie Curie Transfer of Knowledge Fellowship of the EC 6th FP under contract no. MTKD-CT-2005-029540-POLYSURF.