Molecularly imprinted stimuli-responsive hydrogels for protein recognition

Abstract:

Temperature-responsive poly(N-isopropylacrylamide)-based (PNIPAAm) hydrogels were imprinted with lysozyme via in situ photo-initiated crosslinking polymerization. The three-dimensional network of the hydrogels was tailored by tuning the ionic content through methacrylic acid as template-binding comonomer while keeping the ratio between crosslinker (N,N'-methylenebisacrylamide) and N-isopropylacrylamide fixed. Moderate salt concentrations (0.3 m NaCl) were found to be suited for template removal without phase separation of the hydrogel. Swelling and protein (lysozyme and cytochrome C) binding were investigated for imprinted and nonimprinted gels at temperatures below and above the lower critical solution temperature of PNIPAAm (32 °C). Imprinted gels showed a much higher affinity, selectivity and binding capacity for lysozyme compared to the nonimprinted reference materials. Protein binding capacity was strongly reduced above 32 °C, to zero for nonimprinted and to small values for imprinted gels. Most important, specific lysozyme binding to the imprinted gels caused a large concentration dependent deswelling. This effect was much smaller for nonimprinted gels, and the response could be modulated by the content of the comonomer methacrylic acid. Overall, this approach is interesting for the development of novel sensors or materials for controlled release applications.