

Colloidal microgels as potential transdermal delivery systems.

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Abstract

Two decades of studies of protein delivery from polymeric systems has revealed great potential for gels that respond to environmental stimuli, such as changes in temperature and or pH, in fulfilling a delivery role. Thermally responsive colloidal microgels of poly(N-isopropylacrylamide) (polyNIPAM) have been reported to act as intelligent materials in controlled drug release (Okano et al. 2002), immobilization of enzymes and cells, and in separation of aqueous proteins (Jeong et al. 2002). This paper presents the synthesis of temperature-sensitive microgels based on a copolymer of butyl acrylate (5%) co-polyNIPAM (95%), in the presence of and in the absence of ibuprofen (IBU), methyl paraben (MP) and propyl paraben (PP), by a surfactant-free emulsion polymerisation (SFEP) in water. N', N'-methylenebisacrylamide was used as a cross-linking agent and potassium persulphate as an initiator. Physicochemical properties of the microgels were determined using different techniques including dynamic light scattering and Transmission Electron Microscopy (TEM). It is speculated that the microgel appearance is similar to a core-shell microgel, having in the core the complex IBU or MP or PP-butyl acrylate and in the shell poly(NIPAM). Permeation across a model silicone membrane and human skin of IBU, MP and PP from gels synthesised in the presence of these compounds was investigated over a range of temperatures (20°C – 40°C). The transport rate of IBU and, PP from these poly(NIPAM) microgels is significantly reduced by two and one orders of magnitude, respectively, compared with the transport rate from saturated solutions. Such a reduction in flux was not however observed for methyl paraben.

Keywords: poly(NIPAM), drug delivery system, ibuprofen, parabens.