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Investigation into the properties of a bioactive polymer for renal failure patients

Reem Elsiddig
Waterford Institute of Technology, Ireland

The present work provides insight regarding the physicochemical properties of a Polyallylamine hydrochloride (PAA-HCl) hydrogel, the active pharmaceutical ingredient of a drug prescribed to prevent the absorption of dietary phosphate for renal patients. Different formulations of PAA-HCl hydrogels using an aqueous crosslinking reaction were synthesised. The key attributes of hydrogels that modulate their properties and the link between these attributes and hydrogel behaviour were investigated. Results showed that the properties of the PAA-HCl hydrogels can be controlled by varying the crosslinker epichlorohydrin concentrations. The effect of the degree of crosslinker concentration on the properties of the hydrogels has been studied using swelling ratios, thermogravimetric analysis (TGA), differential scanning calometric (DSC), and solid state nuclear magnetic resonance (SSNMR). Increasing the crosslinking concentration decreases the swelling ratio, the thermal stability and increases the glass transition temperature of the hydrogels. The relationship between hydrogel morphology and the glass transition temperature Tg obtained using DSC could be used to tailor-make hydrogels of specific Tg 's. SSNMR was found to be a promising tool for characterising solid biomaterials and examining the dynamic mobility of polymer chains. A series of kinetic studies were carried out in an agitated batch reactor in order to understand the mechanism of the phosphate binding reaction. It was found to follow pseudo second order kinetics. Thermodynamic parameters such as ΔG°, ΔH° and ΔS° were evaluated in order to assess the relationship of these parameters and the polymer morphology. The binding reaction was found to be a spontaneous endothermic process with increasing entropy at solid liquid interfaces.

Biography

Reem Elsiddig, received the BSc. degree in Applied Chemistry with Total Quality Management from Waterford Institute of Technology, Ireland, in 2009. Currently, she is studying PhD degree in Pharmaceutical and Molecular Biotechnology Research Centre, Waterford Institute of technology. Her areas of interest include polymer synthesis, materials characterisation and pharmaceuticals formulation.

reemelsiddig@hotmail.com