CHAPTER 14

Transdermal Applications of Hydrogels

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Introduction

A hydrogel is a three-dimensional polymeric network, which has the ability to swell and retain water, yet remains insoluble. The water-absorbing capacity of the gel arises from the preponderance of hydrophilic functional groups on the polymeric backbone, while the insolubility occurs as a result of the cross-linked structure (Peppas et al. 2000). This cross-linking is essential for maintaining the elastic hydrogel structure and can be physical or chemical in nature, depending on the nature of the associations. The unique properties of hydrogels have led to their application in a variety of drug delivery systems, from implantable devices to topical formulations (Hoare and Kohane 2008). The porous structure creates a carrier matrix for drug loading, with the option of controlling release by modification of the hydrogel properties. The drug release from a hydrogel proceeds at a rate dependent on the diffusion coefficient of the drug through the polymeric network, which in turn is largely dependent upon the structure and pore size of the hydrogel, in addition to the properties of the drug itself (Thakur et al. 2009). These hydrogel characteristics can easily be tuned by adjustment of the cross-link density, with the tangible outcome of controlling the swelling behaviour of the hydrogel in a given solvent. The two most important characteristics of hydrogels in controlled release applications are, therefore, the intrinsically linked properties of network permeability and swelling behaviour. Understanding and manipulating these hydrogel characteristics will aid in modeling solute release from candidate hydrogel-based controlled drug-delivery systems. As researchers seek to optimise drug delivery processes, the use of novel routes for drug administration is of great interest, with transdermal delivery the focus of much research. Having found many applications

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