

Hydrogel Network Parameters

*Sina Naficy and Geoffrey M. Spinks**

Introduction

Hydrogels are polymeric networks swollen in aqueous media. They encompass a varied group of crosslinked polymeric materials with hydrophilic structures that render them capable of holding large amounts of water within their three-dimensional networks. The hydrogel network can be prepared from monomers and/or polymers via creating covalent or physical crosslinking. Because of this three-dimensional structure, hydrogels exhibit rubber like behaviour, where the network has been diluted with solvent molecules. The final mechanical and diffusive properties of hydrogels are, then, determined by their network structure and the degree of swelling. By tuning the network parameters, hydrogels can be tailored to fulfil most requirements needed for a wide range of different applications. Hence, as the first step in synthesizing new hydrogel materials, it is essential to consider the impact of network parameters on the final performance of the hydrogels. The most important parameters that determine the network structure are directly related to the characteristics of the crosslinks that connect polymer chains together. The concentration of elastically active polymer chains between crosslinking points, the length of these polymer chains, the density of crosslinking points and the distribution of crosslinking points are all network parameters that collectively define the nature of crosslinking. In this chapter, the effects of each of these factors on the mechanical properties, diffusive properties and swelling behaviour of hydrogels are reviewed.

Mechanical Properties of Polymer Networks

A hydrogel can be pictured as a swollen three-dimensional network composed of long polymer chains connected together at crosslinking points. Because of the plasticizing

Innovation Campus, University of Wollongong, NSW, Australia, 2500.

* Corresponding author: gspinks@uow.edu.au