CHAPTER 8

Hydrogels for Imaging, Sensing and Diagnostics

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Introduction

By their hydrophilic nature, crosslinked gels are especially suited for applications in moist or liquid environments. The majority of applications can be found within the food industry and medicine. Common medical applications of hydrogels are found in wound dressings, soft contact lenses, drug delivery systems, hygiene products, and tissue engineering (Caló and Khutoryanskiy 2015). Besides these applications, hydrogels have gained considerable attention in sensor development and diagnostics. The three main areas of gel use in sensors are responsive hydrogels, size exclusion membranes, and (bio)chemical reactors. Depending on their application, important features of these gels are their pore size, swelling behavior, mechanical stability, and biocompatibility.

Initiation of the gelation process results in a decreased solubility by linking macromolecular chains. In physically crosslinked gels this process is reversible, while chemical crosslinking yields irreversible covalent bonds. Natural polysaccharides, including agarose are physically crosslinked by cooling of hot solutions. The gel is held together by hydrogen bonds between helical polymer fibers. In contrast, chemical crosslinking commonly is achieved by free radical polymerization. Photochemical gelation is a popular method for hydrogels in drug delivery, tissue engineering, and sensing systems because of the simple temporal and spatial control. Selective curing

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