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Thermoresponsive Physical and Chemical Hydrogels in Drug Delivery

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Hydrogels have long been known as an effective platform for controlled drug delivery. These can extend the diffusional path for the drug release, and hence its release time. The sol-gel transition in thermoresponsive hydrogels is triggered by temperature. In this study, we review the advantages and disadvantages of different thermoresponsive hydrogel structures with the focus on their solubility, swelling, purity, stability, and release mechanism. The HLB value of the hydrogel polymer (resembling the ratio of hydrophilic and hydrophobic contents of the structure) and its molecular weight are the most important factors affecting the reversible sol-gel transition of physical hydrogels. Above these, the crosslink density will remain as the most dynamic factor in determining gel properties of the thermosensitive chemical hydrogels. Physical hydrogels benefit from an acceptable impurity profile as those based on poloxamers and N-isopropylacrylamide can be prepared as very pure utilizing a vigorous purification procedure. Such hydrogels in their crosslinked form, however, may lose their acceptable purity profile as inter-chain chemical links reduce the purification efficiency by preventing the polymer dissolution in an appropriate extracting solvent. Due to induced crosslinks, chemical hydrogels are naturally porous in structure, which implies that the stability of such hydrogels may be affected by the crosslink density. Moreover drug release from physical hydrogels is controlled by a combined diffusion and relaxation mechanisms, while the release is dominated by diffusion mechanism for chemically crosslinked hydrogels.

Biography

Hossein Omidian has PhD in polymer, and is currently a faculty at Nova Southeastern University. He has more than 20 years of research experience with hydrogels, holding patents, book chapters, peer-reviewed manuscripts and conference presentation on the field.