reformed its original shape by rehydration [45, 72]. Shape-memory scaffolds method demonstrates greater shape by maintaining a range of physical and mechanical properties. Shape-memory scaffold alginate hydrogel is covalently cross-linked with AAD and carbodiimide chemistry using 1-ethyl-(dimethyl aminopropyl) carbodiimide, 1-hydroxybenzotriazole [45, 73]. Lee *et al*., [45] were able to produce macroporous alginate hydrogel scaffolds with defined geometry offensively delivered to the dorsal subcutaneous space of a mouse with minimal scaffold and rehydrated by PBS. Shape-memory scaffolds method has also been used for skeletal muscle cell survival, proliferation, and migration. The results confirm the potential of these shape-memory alginate scaffolds as cell delivery systems for tissue regeneration, although this strategy needs further exploration.

10.7 Biodegradation of Alginate

Due to biochemical properties and lack of enzymes in mammalian system, alginate is nondegradable. Despite the covalently cross-linked hydrogel, ionically cross-linked alginate gels can be easily degradable in mammals by direct exchange of monovalent ions to the divalent ions into the surrounding media [73]. The most acceptable method for the degradation of alginates in physiological conditions is partial oxidation of alginate chains. In an aqueous medium, alginate is oxidized with sodium ions that directly help in hydrolysis. The use of higher AAD concentration in shape-memory scaffolds for the formation of gels decreases the degradation rate of alginate. The degradation rate and mechanical properties are two critical factors in new tissue formation in tissue engineering and delivery of cells and tissue, but these two are decoupled by adjusting the molecular weight distribution of alginate. A different chemical has high content of single-end AAD molecules that degrade easily [74]. These studies clearly indicate that soft gels degrade slowly over time, unlike conventional gels. Partially oxidized alginate can be formed by binary alginate gels with low and high molecular weights by either ionic or covalent cross-linking. Compared with high MW alginate gels, increasing the fraction of low MW alginate maintains the mechanical stiffness up to 0.50, but it leads to faster degradation, irrespective of the cross-linking method [75, 76]. These various approaches may be useful alone or in combination in manipulating the physical properties of various hydrogels in the development of drug delivery and cell transplantation vehicles [77].