very good mucoadhesive agents as anionic polymers with carboxyl groups. Alginates have greater mucoadhesive strength than polymers such as polystyrene, chitosan, carboxymethyl cellulose, and poly(lactic acid) [11]. The bioavailability and efficacy of a drug is higher as a result of better adhesivity of alginate particles onto the mucosal tissues, while the passage time for proteins is longer and the drug is localized on the absorptive surface.

The main disadvantages of alginates for hard tissue engineering are their low mechanical strength and poor controllability of the microinternal architecture because of their poor mechanical properties and excessive hydrophilicity [12]. To address these limitations, several researchers have combined alginates with other biomaterials (bioceramics and synthetic polymers) to produce biocomposites that provide both the biological advantages of alginates and greater mechanical strength because of the reinforcing material [12–14].

5.2 Chemical Structure and Properties of Alginate

Alginate is a naturally occurring linear polysaccharide abundant in various species of brown algae composed of β-D-mannuronic acid and α-L-guluronic acid units [15]. The molecular weight can vary between 10 and 1000 kDa depending on the source and production process. Upon adding multivalent cations, an alginate solution rapidly forms an ionotropical gel, which makes it extremely interesting to be applied in the biomedical field [16, 17]. To enable *in vivo* injection of a Ca^{2+}-cross-linked alginate hydrogel, the cross-linking rate should be reduced. Interestingly, polyols have already been applied to slow down the hydrogel formation. It has been anticipated that the polyols hinder the immediate complexation of Ca^{2+} by alginate.

Alginates extracted from different sources differ in M and G contents as well as the length of each block, and more than 200 different alginates are currently being manufactured [18].

Although alginate does not possess cell interactive properties, several authors have overcome this issue by coupling cell-interactive peptides (e.g., RGD) or growth factors (e.g., VEGF) to the alginate backbone [16]. In addition, alginate-based semi-interpenetrating polymer networks have been prepared possessing stimuli-responsive behavior. Wang and Wang [19] have developed a pH-sensitive superabsorbent hydrogel composed of sodium alginate-g-poly(sodium acrylate) and polyvinylpyrrolidone by free-radical solution polymerization using ammonium persulfate as an initiator and N,N-methylene-bisacrylamide as a cross-linker. As alginates form hydrogels under gentle conditions, the gels may be used to