commercial alginate varies between 33 and 400 kDa. With this abundance of choice, it is essential to be aware of how differences in alginates can affect the performance parameters of pharmaceutical compositions. The variability of alginates available with respect to molecular weight, composition, and sequence of M-block and G-block in their copolymer chain changes the viscosity property, features of sol/gel transition, and capacity to uptake and absorb water and swelling response [21].

2.3.1 Composition of Alginate Polymer Chains

Structural linkage composition of alginates is determined to be made of two different uronic acid residues existing as blocks of homopolymeric sequences of either D-mannuronic acid residues (M-blocks) or L-guluronic acid residues (G-blocks), interspersed almost alternately by long sequences of heteropolymeric material (MG-blocks) [22]. The three types of blocks have been evaluated through decomposition by partial hydrolysis with hydrochloric acid (HCl). The material solubilized corresponds to the MG-block. The resistant part on fractionation at pH 2.9 yields a soluble fraction derived from the M-block and an insoluble fraction arising from the G-block [23].

From the standpoint of commercial use in pharmaceutical and food processing industries, the ability of alginates to form viscous solutions in aqueous media is crucial, and hence alginate portions are often classified on the basis of their intrinsic viscosity. The rate and degree of gelling and the nature of chemical derivatization feasible are determined by the composition of the alginic acid. The index called the M/G ratio, which is the ratio of constituent monomers in the alginic acid, is of much importance in deciding the industrial application. The viscosity of its solutions is directly affected by the alginate molecular weight, the number of M or G residues, and the solution strength. The intrinsic viscosity of alginates is influenced by the conformation (sequence of M and G residues) and ionic strength of the solution. The viscosity increases as the stiffness of the constituent chain blocks increases in the order MG<MM<GG, on the basis of intramolecular steric hindrance. With alginate being a polyelectrolyte, the electrostatic repulsion present between the charged groups on the polymer chain increases with chain extension, and the intrinsic viscosity follows with an increase [24]. Physical properties of gels can be enhanced by increasing the molecular weight of the alginate, but such high MW alginates become increasingly viscous, which is not favorable during processing, such as in destructive high shear generated during mixing and injection. So tuning formulations with a favorable mix of high and low MW alginates to manipulate average MW and its polydispersity becomes essential.