

the rest of the genes by algC, which is the biosynthetic gene. The algP was found to be present in 13 minutes (Figure 14.2b). The final sets of genes are the genotypic switching genes that include algT and muc genes. The muc genes are categorized into mucA, mucB, mucC, and mucD, which are also called as algS, algN, algM, and algW/Y, respectively. These genes are present in a row for 68 minutes (Figure 14.2c).

## 14.4 Properties of Alginates

The activity of alginate is due to its physical, chemical, and biological properties, which are discussed below.

### 14.4.1 Molecular Weight

Alginates have been used extensively in food industries as well as pharmaceuticals mainly because of its gelling property. The gelling property of alginate is determined by its viscosity, which again is determined by its molecular weight [53, 54]. Like other polysaccharides, alginates are also a polydisperse molecule present in various molecular weights [10]. With the wide variety of extraction sources, there are more than 200 types of alginates that are commercially available in the market. It is therefore very much essential to know about their molecular weight before using it for any application [55].

The molecular weight of alginates is affected by the G or M blocks present in them. It has been found that low molecular weight alginates have lower G blocks, and therefore they cannot be used as an effective gelling agent [56]. As of now, molecular weights ranging from 48,000 to 2,700,000 g/mol have been found from a variety of species such as *Laminaria digitata*, *L. hyperborean*, etc. [57]. Several techniques in identifying the molecular weight of alginates have been used. Majority of the works concentrate on sedimentation diffusing viscosity, sedimentation intrinsic viscosity determination, and light scattering [53, 58]; a work by Sperger *et al.*, [59] showed that they can be determined by solid-state nuclear magnetic resonance (NMR) even in the presence of water molecules. Similarly, several methods were there to find the intrinsic viscosity of alginates; Huggin's method was found to be the best method followed by the Martin, Kraemer, Schulz-Blashke, and Baker-Philippoff method [57]. It has been found from another study that low molecular weight alginate can be used in poly(methylene-co-guanidine) capsules [60]. Similarly, another study by Mancini *et al.*, [61] showed that the amount of alginate, irrespective of its molecular