6.4 Properties of Alginate

Alginate appears in the form of filamentous, granular, and powder form with white to yellowish-brown color [31]. The molecular formula of alginate is $C_{14}H_{22}O_{13}$ [32–35]. The molecular weight of the alginate varies from 33,000 to 40,000 gm/mol. Residues of M and G and their length vary in different types of alginate [36–39]. Alginate is found to be insoluble in water and organic solution, but its monovalent salts and esters are water soluble. Alginates having heterogeneous structure are soluble at less pH compared to poly M and poly G alginic molecules [40, 41], which get precipitated in this condition. The viscosity of the alginates depends on the M and G block present in it [42–46]. The property of the alginates changes according to physical, chemical, and environmental changes. The order of stability of different salts of alginate is given as

Sodium > Ammonium > Alginic acid

Thus, it is found that the salt of the alginate is more stable as compared to pure alginate [47].

6.5 Pathway for the Biosynthesis of Alginate

The pathway of alginate biosynthesis is generally divided into four broad categories:

(i) Synthesis of precursor substrate,
(ii) Polymerization and cytoplasmic membrane transfer,
(iii) Periplasmic transfer and modification, and
(iv) Export through the outer membrane.

For the production of sodium alginate, firstly, the brown algae and seaweeds were chopped; then, the seaweeds were milled, washed with acid, and then extracted with the help of alkali like Na_2Co_3; and they were clarified, filtered, and precipitated with the help of calcium salt (mixture of calcium alginate + alginic acid formed) [45–48].

Then, the mixture was washed to obtain the pure form and then neutralized with the help of sodium carbonate, potassium carbonate, ammonium carbonate, magnesium carbonate, and calcium carbonate so as to obtain the desirable alginate [30, 49].

The procedure for the extraction of sodium alginate was explained in Figures 6.2 and 6.3 [50–53].