

Viscosity of alginate is the most important factor that governs gel homogeneity. This viscosity can be modified by adjusting the pH of the solution. Studies revealed that at neutral pH, the gel can retain its viscosity properly. Certain properties, for instance, surface tension, viscosity, and density of coating solution, are important to estimate the film thickness [62]. Donnan and Rose [63] conducted physicochemical studies on algal alginates and determined that intrinsic viscosity of the alginates is directly proportional to their molecular size. Properties of starch and alginate together in the film formation were studied by Wu *et al.*, [64]; mixture of these two biopolymers was found to be a favorable combination of biofilm for better mechanical property. The shear-thinning behavior of the alginate film solution depends on the added starch. Therefore, addition of starch in alginate solution is maintained carefully in the industries to obtain better efficiency since increasing the shear rate will reduce the dynamic viscosity [65].

## 11.6 Packaging Properties of Alginate

Alginates have unique packaging properties such as biodegradability, tensile strength, and water permeability [66]. Characteristics of alginate are defined by their degree of polymerization, composition of the monomer, acetylation, and monomer sequence [55]. Sustainability, packaging function, and performance of the biopolymers depend on their processing techniques and compositional properties [57]. Because of the efficient oxygen barrier properties, alginates can act as a sacrificing agent; they are applied as coating for meat products where they reduce dehydration in fresh meats, and can also protect foods from oxidation [16].

Sirviö *et al.*, [36] reported that the alginate films mixed with cellulose exhibited higher thickness due to the fibrous cellulose structure. This thickness difference was studied by Rhim [27] who reported that the increase in thickness is due to the cross-linkage of alginate with aqueous solution of calcium chloride. Russo *et al.*, [67] have also validated the potential of alginate in the field of biopolymer packaging. In a different study, Yang *et al.*, [68] reported the development of collagen composite biofilm as packaging material with incorporation of sodium alginate. The authors found that addition of sodium alginate in the biofilm improves its tensile strength and elongates the film. Further, sodium alginate in the biofilm with collagen composite results in uniform structural morphology of the film.