

particles with a diameter in the range of millimeters to nanometers. The substance that is entrapped is called the core material, active phase, or payload phase, whereas the substance that is used for encapsulation is called the shell, carrier material, or matrix. The encapsulates are categorized into two types, viz., the reservoir type, which has a shell over the active agent, and the matrix type, which has active compound dispersed over the carrier material in relatively small droplets. It may also be found as homogenous deposition over encapsulate. Encapsulation in food industry helps to improve flavors in food, protects sensitive and expensive nutrients, prevents loss of food quality by external factors and also masks the undesirable taste of some nutrients that affects the free nutrients [5–49]. Several hydrocolloids have been used in encapsulation, but alginate hydrogels are the most exploited [50, 51].

Alginates have been extensively used in encapsulation of probiotics. Microencapsulation of probiotics by sodium alginate is done by two methods, viz., extrusion method in which sodium alginate solution is dripped into solution of calcium salt causing ionic gelation, and emulsification method in which gelation of alginate occurs in water–oil emulsion [52]. Several probiotic organisms such as *Lactobacillus casei* [53], *Bifidobacterium bifidum* [54], *Lactobacillus parcasei* [55], *Lactobacillus acidophilus* [56, 57], *Lactobacillus bulgaricus* [58], *Lactobacillus plantarum* [59], *Enterococcus fecium* [60], and *Lactobacillus fermentum* [61] have been encapsulated by various alginate sources. Apart from that, they have also been encapsulated with several other compounds such as starch, chitosan, carrageenan, gellan gum, locust bean gum, etc. [62]. Apart from these, several other compounds such as pitaya fruit juice [63], human insulin [64], nisin [65], ascorbic acid, [66], etc. have also been encapsulated by alginates.

13.3.5 Food Coating

Edible coatings are used for extending the life of fresh cut fruits and vegetables. These coatings also make them safe to be eaten along with the food compounds and do not cause any harmful effects to the food stuff [66, 67]. Several compounds such as hydrocolloids, lipids, and composites are used as food coating material. Alginate is one among the polysaccharide-based hydrocolloids that is used in food coating [68]. Alginates have been used in coating several fruits and vegetables such as fresh cut apples [69, 70], William pear [71], pumpkin [72], fresh cut nectarine [73], etc. Alginates have also been used in coating fresh and frozen meats such as beef [74], chicken pieces [75], pork [76], beef steak [77], bream fish [78], kilka fish [79], and lamb meat [80]. They are also used in extending the life span of Coalho cheese [81].