foam stability in beverages such as beer [44]. Sahai and Sher [45], in their invention, report that addition of propylene glycol alginate (ester alginate) improved the foaming capacity and stability of foaming fruit juices and is also reported to influence the viscosity, clarity, and color of the juice. Ester alginate, when added at a level of about 0.05% to 1% in foaming juice compositions, is reported to achieve stable foams and improved product quality. The foam stabilizer available in the market mainly comprises of propylene glycol alginate and its combination with modified/resistant starch. The combination of propylene glycol alginate with modified starch or protein finds it application as a stabilizer in low malt/protein beverages.

12.7 As Encapsulating Wall Material

Alginate is generally preferred as an encapsulating wall material due to its water absorption ability [46]. The gelling capacity of alginates is based on their ability to form complexes with multivalent cations. Propylene glycol alginate lacks the gelling property due to the esterification of carboxyl groups of alginate. Sodium and potassium salts of alginic acid are, in general, said to form gels in the presence of calcium in food system. The gelling property of alginate is beneficially used to preserve bioactive compounds by encapsulating them. The desired compound or substances such as flavor, color, antimicrobial compounds, enzymes, and yeast cells are encapsulated with calcium alginate.

The cross-linking or gel formation of alginate is carried out by two methods: external ionic gelation through extrusion (Figure 12.5) and internal ionic gelation (Figure 12.6) [47]. In the diffusion setting method, the desired compound or ingredient in the alginate solution is dropped into the calcium chloride solution, wherein in immediate contact with calcium ions, the cross-linking of alginates starts and encapsulation of ingredients or compounds takes place [48, 49]. The gelled particles or capsules formed are 500 μm to 3 mm in diameter, and the size of calcium capsules obtained is based on the diameter of the needle used for extrusion, concentration, and viscosity of alginate solution and the distance between the syringe and calcium chloride solution [50]. The use of pressurized extrusion system and nebulizers can help in reducing the particle size to less than 300 μm and less than 1 μm, respectively [51]. The application of calcium capsules in food and beverage industries is highly desirable with a size of approximately 100 μm [52]. Hence, the microencapsulated compounds can be used to improve the characteristic quality and property of food and beverages. They can also be used to retain the flavor and color of beverages,