in controlled release of enzymes, and in retention of yeast cell activity in alcoholic beverages.

In the internal ionic gelation method, the calcium ion is released in a controlled fashion from an inert calcium source within the alginate solution–vegetable oil emulsion [52]. The release of calcium ions can be attained by changing the pH, using a limitedly soluble calcium salt source, or using chelating agents [50]. This technique is prevalently used in microencapsulation of probiotics [53, 54]. The microencapsulated probiotics can be incorporated in beverages such as milk-based beverages and yogurts. The size of the microcapsules produced by this method is in the range of 20–25 μm to 2 mm, and it depends on the homogeneity and agitation speed [53].

The production of microcapsules for immobilization of living cells and for inclusion of desired food compounds/ingredients without the use of any organic solvent is preferred and is of great interest and need [55, 56].

12.7.1 Immobilization of Biocatalysts

Immobilization of live cells or enzymes helps in the retention of their viability and metabolic activity. In general, sodium, calcium, and barium salts of alginic acid are used for cell entrapment and immobilization of enzymes for their application in beverage industries especially wine and beer production [57]. Fruit pieces and skins are also used as an immobilization medium for cells in wine making to improve its flavor and quality [58–61]. The yeast cells immobilized in alginate beads are used in alcoholic drinks for ethanol production and for second fermentation of champagne. According to Hill [62], the calcium alginate immobilized yeast is suitable for bottle fermentation of sparkling wines. Immobilization of yeast cells for use in wine production enhances the taste, aroma, and overall quality of produced wine [63].

The inventors Medina *et al.*, [64] developed a novel application of immobilized yeast cells to control the browning of drinks and to also prevent any changes caused by the color change. The yeast cells were immobilized using natural alginate or carrageenan. This invention was mainly focused on the application of immobilized yeast cells in food and beverage industries to control the browning reaction.

Immobilization of enzymes using alginate also finds a major application in food and beverage industry. The immobilized enzymes are used for the conversion of glucose to fructose, production of amino acids for its application in foods, for continuous production of yogurt, and for conversion of starch to ethanol in brewing of beer. The desired reaction such as sugar to ethanol or starch ethanol can be easily controlled by removal of the