13.3.1 Thickeners and Gelling Agents

The thickening ability of any hydrocolloid is due to the nonspecific entanglement of confirmationally disordered polymer chains. Thickening was found to occur usually at overlap concentrations of the colloid with solvent [14, 15]. In dilute concentrations, colloids can move freely and do not cause thickening effect, whereas in concentrated solutions, the contact between colloids is increased, thereby their interaction and also their thickening behavior. In case of no polymer interaction, the thickening ability of colloid is affected by its molecular weight. Therefore, it can be clearly said that the thickening of any hydrocolloid depends on intrinsic velocity, the molecular weight of the colloid, and its concentration [16]. Similarly, the gelling ability of any compound is due to the formation of junction zones due to the three-dimensional interlinking of polymer with solvent interstices [17]. The gelation is formed by either of three mechanisms called as ionotropic gelation, cold set gelation, and heat set gelation [18]. Ionotropic gelation is caused by the presence of ions in which the phenomenal gelation is occurring in alginates, whereas the other two methods are followed by other colloids such as agar, starch, etc. [19–21].

The use of alginates in foods is long-standing in history and they are mainly used as thickeners, gelling agents, stabilizers, etc. [22]. The use of alginates is due to their physical properties such as viscosity enhancement, gel-forming ability, stabilization of mixtures, and interactions with food components such as protein, fat, or fiber. Apart from these, the flexibility of controlling alginate production makes them an efficient candidate [23, 24]. The most commonly used alginate in food is sodium alginate apart from other alginates, and alginates of different viscosity have been prepared from variable degree of polymerization such as 80% to >750%.

As a gelling agent, alginates have several advantages in food industry. The gelling property of alginate is affected by adding calcium ions. Pure alginic acid swells in cold water 200–300 times rather than dissolving in them, and it immediately dissolves in hot water, but by acidification, in the presence of calcium ions, it forms a gel in hot water [25]. This intrinsic property of alginates in the presence of calcium ions enables them to be produced as homogenous thermostable gels under controlled conditions. Gels of alginate are formed by egg-box mode where cooperative ion binding occurs with G blocks of adjacent alginate molecules. Apart from these, G-type alginates react highly with calcium ions than the M-type alginates [26–28].