11.6.1 Thermostability of Alginate Packaging

Generally during enzyme immobilization, calcium alginate beads are used, which do not harm enzymes, but gradually the immobilized enzymes diffuse out [69]. For bead formation, attachment of the enzyme with alginate before bead preparation is necessary. For example, enzymes like glucoamylase and pullulanase show increased starch hydrolysis along with thermostability of the enzyme during its entrapment in alginate beads [70].

11.6.2 Water Solubility

Water solubility is a widely used parameter for assessment of the resistivity of the film to water, which is considered to be an important characteristic of biopolymers in food packaging [21]. Generally, packaging material that exhibits higher water solubility will have poor resistance to water. Abdollahi *et al*., [21] reported that water solubility of pure alginate was 99.5%, depicting increased hydrophilic nature of alginate. In order to overcome this, nanoparticles (5%) were incorporated into the film. This resulted in the decrease in water solubility of about 77.49% with the addition of cellulose nanoparticles, and it was further decreased to 61.35% after the addition of MMT.

11.6.3 Water Vapor Permeability

Water vapor permeability (WVP) is another major property for any bio-based food packaging. Higher WVP of the films directly affects the food and causes deterioration of the same [21]. Many studies have been reported in this area of alginate coatings exhibiting high oxygen barrier property. The poor moisture barrier of alginate packaging is due to swelling of the same after absorption of moisture vapor from surrounding that increases the water vapor transmission and water uptake [17].

11.6.4 Tensile Strength

Fang *et al*., [71] studied that alginates possess linear and well-organized chain structure, which helps in the formation of proper connection with calcium ions. This high efficient cross-linking of alginate increases the cohesive force between the chains resulting in high tensile strength of the packaging material. Da Silva *et al*., [72] have also found that alginates possess high tensile strength compared to other biofilms like pectin. This characteristic behavior of alginate was also studied by Sriamornsak and Kennedy [73].