

and used for many medical applications because they possess high biocompatibility, low toxicity, relatively low cost, and mild conditions for gelation [2].

A hydrogel is a macromolecular polymer gel. It consists of a network of cross-linked polymer chains. Hydrogels are synthesized from certain hydrophilic monomers, either by chain or step growth along with a functional cross-linker to promote network formation. Hydrogels have greater affinity for water. They readily absorb water through H-bonding, since its network-like structure possesses voids. Due to structural properties and electrostatic attraction forces, new bond formation occurs through covalent bonding or hydrogen bonding. Their properties make them more applicable in the field of tissue engineering. Aerogels are synthetic porous materials, which are extremely thin, and they are derived from a gel where the liquid part of the gel has been replaced using gas. This replacement leads to the formation of a solid that has extremely low density and low thermal conductivity. It is also known in some other names such as frozen smoke, solid smoke, solid air, solid cloud, blue smoke, etc. By International Union of Pure and Applied Chemistry (IUPAC) definition, aerogel is “gel comprised of a macro porous solid in which the dispersed phase is a gas.” Aerogels are solid, dry, and rigid materials. It is very strong structurally. The density and average size of pores in aerogel can be controlled during the manufacturing process.

In this chapter, general properties, current applications, and biomedical applications of alginate hydrogel and aerogel will be discussed.

## 4.2 Alginate Hydrogel

Alginic acid or algin, also called alginate, is an anionic polysaccharide distributed widely in the cell walls of brown algae, which binds with water to form vision gums. It is also a significant component of biofilms produced by a major pathogen in cystic fibrosis named *Pseudomonas aeruginosa*, showing high resistance to antibiotics and killing by macrophages. Generally, color ranges from white to yellowish brown. It is solid in filamentous granular or powdered form. Alginate is a linear copolymer containing homopolymeric blocks of (1,4) linked  $\beta$ -D mannuronate (M) and its C-5 epimer  $\alpha$ -L-guluronate (G) residues covalently linked together in various sequences or blocks [3].

Alginates absorb water readily and hence are useful as an additive  $p_x$  dehydrated product such as slimming aids and in the manufacturing of paper and textiles. They are also incorporated in waterproofing and fire-proofing fabrics, food industry, gelling agents, etc. Alginates found immense application in various pharmaceutical preparations. Alginates along with