in regulating the differentiation. It is hypothesized that chondrogenesis of stem cells is related to the morphology of encapsulated cells. Human mesenchymal stem cells (MSCS), rabbit bone marrow stromal cells, human adipose derived stem cells, etc. along with alginate gels can promote cartilage regeneration. RGD-containing peptide along with alginate can enhance adhesive interaction with chondrocytes and can control the cell phenotype. These types of gels can be injected *in vivo* in a minimally invasive manner and are effective in cartilage engineering *in vivo* [47].

4.2.3.4 Muscle, Nerve, Pancreas, and Liver

Alginate gels are also studied for their ability to participate in the regeneration of various tissues and organs including skeletal muscle, nerve, pancreas, and liver. These studies include cell transplantation, growth factor delivery, or a combination of both [48, 49]. It is possible to regulate angiogenesis and myogenesis by the combined delivery of VEGF and insulin growth factor-1 (IGF-1) from alginate gels. Alginate gels have also been studied for the repair of central and peripheral nervous systems. Alginate gels covalently linked with ethylene diamine help in maintaining a 50-mm gap in cat static nerves, and it promoted the outgrowth of regenerating axons and astrocyte reaction in the spinal cords of young rats [50]. Alginate gels can also be used in the repair of peripheral nerve gaps [51]. They may be useful for cell-based neural therapies, sequence promoted adhesion of NB2a neuroblastoma cells, and neurite outgrowth from the cells.

Alginate gels encapsulated with hepatocytes may enhance the repair of failing liver. The hydrophilic nature of alginate gels allows the efficient seeding of hepatocytes into gels [52, 53]. Alginate gels encapsulated with pancreatic islet allographs are used to cure type 1 diabetes. This method helps to avoid the use of immunosuppressive drugs. These islets-encapsulated alginate beads are generally coated with poly amino acids (poly-L-lysine) to decrease the outer pore size [54]. However, alginate beads have mechanical and chemical instability, which decreases their survival period within the body. Research is ongoing on increasing their survival time by using various coating materials and various microfabrication methods [55].

4.3 Alginate Aerogel

Aerogels are a class of product materials that can be prepared using a variety of precursors ranging from inorganic synthetic to biopolymers. A research