10.1 Introduction

Alginate is an anionic polymer structural component of naturally obtained brown seaweed, algae, and some microorganisms. Alginate is a greatly useful and investigated polymer in the biomedical field because of its low toxic effects, biocompatibility, low price, and availability [1]. There are lots of gel formation by alginate. Alginate hydrogel is one of the best gel-forming alginates that is prepared by various cross-linking ways. The cross-linked hydrogel-based alginates show their similar structural properties to extracellular matrices of living tissues. Due to similarities in the structure of hydrogel-based alginates and living tissue matrices, there are huge applications of alginates like in wound healing, delivery of bioactive agents like proteins, and also as an aid in cell transplantation. Alginate-based hydrogel system can be used to exonerate macromolecular particles like protein to tiny microsized chemical drugs. The wound healing system of alginate is helpful to maintain a physiological microenvironment by diminishing microbial infection at the wound site. In the pharmaceutical, alginate gel is more applicable in a very invasive way to deliver drugs orally or through injection. Alginate gels are also auspicious for cell transplantation in tissue engineering. For patients who suffer from failures of organs or tissue, a recent advance technique helps to replace organ or tissue or can regenerate the tissues [2]. The regenerative tissues or cells can be delivered with the help of hydrogels formed by alginates [3].

10.2 Alginate: General Properties

Alginate is a structural forming polymer in seaweeds that provides mechanical strength by forming an intercellular alginate gel matrix analogous to pectin in higher plants. In the extracellular matrix, alginates exist with mixed cations found in ocean water like Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, and Na^{+}. Bacterial alginates produced from *Azotobacter* and *Pseudomonas* are functionally different from plant alginates because of their more determined chemical and physical properties. *Azotobacter vinelandii* is gram-negative soil microorganism. In unsuitable environmental conditions, *A. vinelandii* differentiates itself into desiccated cyst. Alginate is consistently extracted from brown algae (Phaeophyceae), as well as *Laminaria hyperborea*, *Laminaria digitata*, *Laminaria japonica*, *Ascophyllum nodosum*, and *Macrocystis pyrifera* [4]. The extraction was done by treatment with NaOH [5]. The precipitation of alginate is filtered with each of two chloride or sodium, and these alginate salts are transformed from alginate into alginic