

of pH [23]. The release rate of acetaminophen from tablets containing spray-dried lactose–alginate particles was found to be slower than that of a sodium alginate tablet. This may be due to the fact that the spray-dried particles [24] have a much smaller particle size.

When a drug is coated with alginate and compressed, the drug surface becomes hydrophilic. For a lipophilic drug, it can be incorporated into alginate microspheres by the use of oil-in-water emulsion technique. For example, the drug may be dissolved in soybean oil shake with aqueous alginate microspheres to obtain immobilized drug containing oil microdroplets.

Encapsulation and release of hydrophobic drugs from alginate gel are difficult. To overcome this difficulty, alginate is grafted with poly-caprolactone (PCL) and cross-linked with calcium ions to form amphiphilic gel bead. Ophylline, a model hydrophobic drug, may be encapsulated in such an amphiphilic gel. It may be mentioned that the hydrophobic chain length of PCL controls the drug encapsulation efficiency.

Carbon nano tube (CNT)-incorporated alginate gel shows sustainable release of the ophylline. The addition of CNT [25] enhances the mechanical stability of gels, without affecting the structure and morphology and no significant cytotoxicity is reported.

Chitosan is an acetyl derivative of natural polymer chitin [26, 27] containing 80% d-glucosamine and 20% N-acetyl-d-glucosamine. A multi-component composite particle consisting of alginate, chitosan, and triamcinolone has been prepared [28] for sustainable release. The same method has been extended to encapsulate metronidazole into chitosan–alginate composites [28].

8.3.1.2 *Macromolecular Drug Delivery by Alginates*

So far, we have discussed encapsulation and delivery of hydrophilic, hydrophobic, and lipophilic small drug molecules by alginate and its composites. Now, we shall discuss some features of macromolecular drug delivery by alginate and its derivatives. Alginate and its composite are potential materials for encapsulation and delivery of enzymatic (protein) drugs. These drugs are susceptible to denaturation under heat, acidic, and alkaline conditions. These drugs can be easily encapsulated into alginate-based [29] composites under relatively mild conditions, which protect the drug from denaturation. Apart from various enzymatic drugs, macromolecular drugs from recombinant DNA are also known to deliver by alginates. Different strategies are adopted to regulate the release rate of macromolecular drugs from alginate gels. In general, the release rate of such drugs from alginate gels is rapid due to the porous and hydrophilic nature of the gels. Enzymes