

### 2.4.4 Phosphorylation

Generally, phosphorylation reaction in alginate occurs in a dipolar aprotic solvent with urea/phosphoric acid as a reagent system [46]. Decrease in molar mass and lowering of molecular weight happen during the course of reaction due to the phosphoric acid. The degree of substitution of the products is up to 0.26 by this method. The blending of phosphorylated alginate and native alginate gives physical gels that resist the leaching of calcium ions.

### 2.4.5 Graft Copolymerization

The physicochemical properties of the alginate were changed by grafting with synthetic polymers. Poly(acrylonitrile), poly(methyl acrylate), or poly(methyl methacrylate) was used with ceric ammonium nitrate as an initiator for the grafting of alginate. Polyacrylamide, when grafted onto alginate backbone, showed high molecular weight and functioned as a better flocculant in the sedimentation of coal, kaolin, and iron ore slurries (refer to Figure 2.2).

### 2.4.6 Esterification

Esterification is a facile method of attaching alkyl groups to molecules. Generally, esterification of alginates occurs with several alcohols in the presence of the catalyst. The addition of alkyl groups to the alginate increases the hydrophobic nature [47, 48]. The esterification of alginate with propylene oxide gives propene glycol esters of alginates, which showed commercially other alginates derivatives. Figure 2.3 depicts the esterification of alginate.

Butyl ester of alginate, a novel material, has the ability to encapsulate both hydrophilic and hydrophobic molecules. It is obtained from

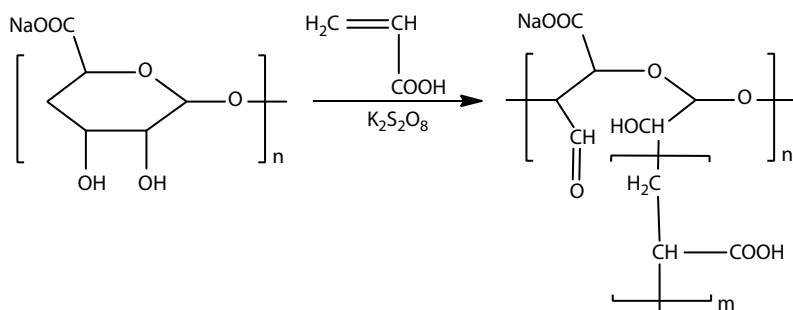


Figure 2.2 Copolymerization of sodium acrylate with sodium alginate.