4. Discussion

Insulin therapy is recommended for patients with type 1 diabetes mellitus (Fonseca, 2006). Insulin is often administered parenterally for systemic treatment due to its inherent instability in the GIT and its low permeability across biological membranes, which is a result of its high molecular weight and hydrophilic nature (Bruno et al., 2013). Moreover, approximately 70% of portal insulin is removed by hepatocytes during first-pass metabolism before entering the systemic circulation (Duckworth et al., 1988). Thus, oral delivery systems of insulin are still considered a challenge in the field of drug development.

Despite the numerous reported oral delivery studies, oral bioavailability of insulin is still quite low and normally insufficient for producing an effective systemic effect. For example, Andreani et al. reported the production of PEG-coated silica nanoparticles containing insulin for oral administration did not increase the permeation behavior of insulin through the small intestinal mucosa (Andreani et al., 2014). Moreover, insulin-loaded chitosan/sodium alginate nanoparticles prepared by complex coacervation technique were showed a half of oral bioavailability as compared to subcutaneous insulin (Prusty & Sahu, 2013). In Contrast, Sarmento et al. has formulated insulin-loaded alginate/chitosan nanoparticles and evaluated the reduced blood glucose level as pharmacological activity of in diabetic rats (Sarmento et al., 2007).

Chitosan is biocompatible and biodegradable polymers; in addition; it has permeability enhancing and mucoadhesives properties (Pedro et al., 2009). These