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Formulation insulin nanoparticle using Chitosan and Pectin polymers and their pharmacokinetic profile with oral application

Ronny Martien
Gadjah Mada University, Indonesia

Parenteral insulin is one of the major therapeutic for patients with Diabetes Mellitus (DM) especially in Type 1, which often leads to patient discomfort and other problems due to the use of it within a certain period. Formulate insulin in oral dosage form is the main choice to resolve the issue. However, application of insulin orally encounters obstacles such as degradation by protease enzyme and poor insulin permeability of the gastrointestinal tract. One solution offered is insulin formulation into the nanoparticles form. In this study, nanoparticle formulation of insulin will use a combination of low molecular weight chitosan and pectin that serves to protect insulin from degradation and also enhance insulin absorption through the gastrointestinal mucosa. The aim of this study was to obtain the optimum formula of insulin nanoparticles that can be used as an alternative therapy for patient with DM. Preparation of insulin nanoparticles carried by ionic gelation method utilizing polyelectrolyte interaction between ($-NH_3^+$) of chitosan and ($-COO^-$) of pectin to form nanoparticles that are compact and stable charge. Formula optimization was performed using Factorial Design 2^2 with Design Expert® 7.1.5 software. Concentration and pH of the pectin were used as factors, while the entrapment efficiency, particle size and polydispersity index were used as responses. The optimum formula was further evaluated like zeta potential, particle morphology, profile spectra of FT-IR and in vitro release study. The obtained optimum formula consist of chitosan of 0.05% and 0.4% pectin (pH 5.0) with the mean entrapment efficiency of 63,59% ± 2,17, particle size of 228,3 nm ± 26,3, polydispersity index of 0,354 ± 0,042, zeta potential 49,40 mV ± 11,59, particle round and dark, polymer complexation was confirmed by FT-IR and release profile following the kinetics Korsmeyer-Peppas models with non-Fickian release mechanism on media HCl buffer pH 1.2 (n = 0.454) and Fickian release mechanism on PBS buffer pH 6.8 (n = 0.369). Nanoparticle insulin have AUC [(114,9917 ± 11,88) ng.menit/mL] higher than unmodified insulin [AUC = (67,8830 ± 2,17) ng.menit/mL] and PBS as negative control [AUC = (62,9713 ± 9,12) ng.menit/mL] with $p < 0,05$. Conclution from these results are insulin nanoparticle significantly improved insulin concentration in the blood serum higher than unmodified insulin per oral.

Biography

Ronny Martien has completed his PhD from Innsbruck University Austria (2007) and Post-doctoral studies from Univ. Innsbruck (2010). He is the head of research grup, BINDR (Biopolymer and Nano Delivery Research). He is a head of PhD Program at Faculty Pharmacy, Gadjah Mada University, Indonesia. He has published more than 10 papers in reputed journals and has been serving as an Editorial Board Member of repute. His research topic are nanoparticulated drug delivery system, expecially with biopolymers as a matrix.

ronnymartien@ugm.ac.id

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