UNIVERSITI TEKNOLOGI MARA

DESIGN OF PECTINATE NANOPARTICLES AS ORAL INSULIN CARRIER

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

The formability and potential of zinc pectinate nanoparticles as an oral insulin carrier were investigated. Zinc pectinate nanoparticles were prepared through ionotropic gelation of pectin with zinc ions. When required, sodium chloride was added as channeling agent to induce rapid insulin release from nanomatrices. The formed nanoparticles were subjected to *in vitro* size, morphology, zeta potential, drug content, drug association efficiency, drug release, drug-polymer and polymer-polymer interaction studies by means of zetasizer, scanning electron microscope, high performance liquid chromatography, dissolution tester, differential scanning calorimeter and fourier transform infra-red spectrometer, as well as *in vivo* blood glucose lowering investigation using streptozotocin-induced diabetic rats. Pectin-insulin solution at pH 3 was ideal for use in nanoparticle preparation with Zn^{2+} as crosslinking agent. The formed nanoparticles were able to encapsulate insulin substantially due to favourable electrostatic interaction between negatively charged pectin molecules with insulin and Zn^{2+}. Unexpectedly, deionized water was found to exhibit a higher blood glucose lowering capacity than insulin solution, and to a lesser extent, blank and insulin loaded zinc pectinate nanoparticles. This was primarily due to interaction between water with insulin and/or excipients can lead to reduced water migration from gastrointestinal tract to systemic circulation. Formulation of insulin into polymeric nanoparticles may introduce complications in therapeutics related to water-nanoparticles interaction.

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