UNIVERSITI TEKNOLOGI MARA

DESIGN OF ALGINATE NANOPARTICLES AS ORAL INSULIN CARRIER

AMINAH BINTI KADIR

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

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COFIRMATION BY PANEL OF EXAMINERS

I certify that a panel of examiners has met on 20th October 2014 to conduct the final examination of Aminah Kadir on her Master of Science thesis entitled "Design Of Alginate Nanoparticles As Oral Insulin Carrier" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

Mohamed Salama Mohamed Ahmad Salama, PhD
Professor
Faculty of Pharmacy
Universiti Teknologi MARA
(Chairman)

Gabriele Ruth Anisah Froemming, PhD
Associate Professor
Faculty of Medicine
Universiti Teknologi MARA
(Internal Examiner)

Fakhrul Ahsan, PhD
Associate Professor
Department of Pharmaceutical Sciences
Texas Tech University Health Sciences Center
Texas
(External Examiner)

SITI HALIJJAH SHARIFF, PhD
Associate Professor
Dean
Institute of Graduates Studies
Universiti Teknologi MARA
Date: 17th February 2015

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.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Aminah binti Kadir
Student I.D. No.	:	2007239444
Programme	:	Master of Science (Pharmaceutics)
Faculty	:	Pharmacy
Thesis Title	:	Design of alginate nanoparticles as oral insulin carrier
Signature of Student	:	.....
Date	:	February 2015

ABSTRACT

The relationship of high and low molecular weight mannuronic acid (M)- and guluronic acid (G)-rich alginate nanoparticles as oral insulin carrier was elucidated. Nanoparticles were prepared through ionotropic gelation using Ca^{2+}, and then *in vitro* physicochemical attributes and *in vivo* antidiabetic characteristics were examined. The alginate nanoparticles had insulin release retarded when the matrices had high alginate-to-insulin ratio or strong alginate-insulin interaction via O-H moiety. High molecular weight M-rich alginate nanoparticles were characterized by assemblies of long polymer chains that enabled insulin encapsulation with weaker polymer-drug interaction than nanoparticles prepared from other alginate grades. They were able to encapsulate and yet release and have insulin absorbed into systemic circulation, thereby lowering rat blood glucose. High molecular weight G- and low molecular weight M-rich alginate nanoparticles showed remarkable polymer-insulin interaction. This retarded the drug release and negated its absorption. Blood glucose lowering was, however, demonstrated *in vivo* with insulin-free matrices of these nanoparticles because of the strong alginate-glucose binding that led to intestinal glucose retention. Alginate nanoparticles can be used as oral insulin carrier or glucose binder in the treatment of diabetes as a function of its chemical composition. High molecular weight M-rich alginate nanoparticles are a suitable vehicle for future development into oral insulin carrier.

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