UNIVERSITI PUTRA MALAYSIA

NANOEMULSION FORMULATION OF PALM OIL ESTERS FOR TOPICAL DELIVERY OF IBUPROFEN

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OCTOBER 2010

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

October 2010

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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By

UMMI HANI ABDULLAH

October 2010

Chair: Prof. Mahiran Basri, PhD

Faculty: Science

Ibuprofen has been widely used for the treatment of rheumatoid arthritis and related diseases but oral consumption of this drug could cause adverse side effects. Since ibuprofen is usually given to patients over an extended period, efforts to reduce its side effect have been attempted. One promising method is topical delivery via the skin. The purpose of this study was to investigate the ability of palm oil esters nanoemulsions to deliver ibuprofen topically. Five ternary phase diagrams were constructed to find the existence of the isotropic region. The ternary phase diagram were POEs/T80:S20 (100:0)/Water, POEs/T80:S20 (90:10)/Water, POEs/T80:S20 (80:20)/Water, POEs/T80:S20 (70:30)/Water and POEs/T80:S20 (60:40)/Water. After analyzing the ternary phase diagrams, various nanoemulsions were prepared from the isotropic region in the phase diagram of POES/ T80:S20 (90:10)/Water due to the largest isotropic region exhibited. Three formulations of nanoemulsions without the addition of ibuprofen

(Formulations A, B and C) and another three with the addition of ibuprofen (Formulation A', B' and C') were prepared. However, these formulations have very low viscosity and have watery feel and appearance. Therefore modification with hydrocolloids; xanthan gum and carbomer 940 was done to Formulation A'. Formulation A' was chosen to undergo modification with xanthan gum and carbomer 940 due to the highest percentage of ibuprofen released (97.50%) at 8 h as well as the formulation was with the lowest surfactant content. Xanthan gum and carbomer 940 were added from 0.2% until 1.0% to Formulation A'. Addition of xanthan gum and carbormer 940 increased the viscosity of the Formulation A' and exhibited pseudoplastic behavior which is preferable in topical applications. The permeation profiles of ibuprofen were determined using *In vitro* Franz diffusion cells and were analyzed by High Performance Liquid Chromatography. Among all formulations with xanthan gum and carbomer 940, Formulation A' Xg 0.2% (0.2% xanthan gum) showed the highest percentage of ibuprofen released (83.6%) at 8 h.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

FORMULASI NANOEMULSI ESTER KELAPA SAWIT UNTUK PENGHANTARAN IBUPROFEN SECARA TOPIKAL

Oleh

UMMI HANI ABDULLAH

Oktober 2010

Pengerusi: Prof. Mahiran Basri, PhD

Fakulti: Sains

Ibuprofen telah digunakan secara meluas bagi merawat penyakit reumatoid artritis dan penyakit- penyakit berkaitan tetapi penggunaan secara oral ke atas dadah ini
boleh meyebabkan kesan sampingan. Memandangkan ibuprofen selalu diberi kepada pesakit sejak sekian lama, usaha untuk mengurangkan kesan sampingan ibuprofen telah dicuba. Satu kaedah yang menjanjikan adalah penghantaran secara topikal melalui kulit. Tujuan kajian ini adalah untuk menyiasat kebolehan nanoemulsi ester kelapa sawit bagi penghantaran ibuprofen secara topical. Lima rajah fasa tigaan telah dibina untuk mencari kewujudan kawasan isotropik. Rajah fasa tigaan tersebut adalah POEs/T80:S20 (100:0)/Air, POEs/T80:S20 (90:10)/Air, POEs/T80:S20 (80:20)/Air, POEs/T80:S20 (70:30)/Air and POEs/T80:S20 (60:40)/Air. Selepas menganalisis rajah fasa tigaan ini, pelbagai nanoemulsi telah disediakan daripada kawasan isotropik di dalam rajah tigaan POEs/T80:S20 (90:10)/Air yang mempamerkan kawasan isotropik yang terbesar. Tiga

formulasi nanoemulsi tanpa penambahan ibuprofen (Formulasi A, B dan C) dan tiga lagi dangan penambahan ibuprofen (Formulasi A, B' dan C') telah disediakan. Bagaimanapun, formulasi ini mempunyai kelikatan yang terlalu rendah dan mempunyai rasa dan rupa seperti air. Oleh itu, modifikasi dengan hidrokoloid; Xantan gam dan karbomer 940 dilakukan ke atas Formulasi A'. Formulasi A' dipilih untuk dilakukan modifikasi berdasarkan peratusan pelepasan ibuprofen yang paling tinggi (97.50%) pada 8 jam dan juga formulasi tersebut mengandungi surfaktan yang paling rendah. Xantan gam dan karbomer 940 ditambah daripada 0.2% hingga 1.0% ke dalam Formulasi A'. Penambahan xantan gam dan karbomer 940 meningkatkan kelikatan Formulasi A' dan menunjukkan sifat pseudoplastik yang lebih digemari untuk aplikasi secara topikal. Profil pelepasan ibuprofen ditentukan menggunakan '*In Vitro* Franz diffusion cell' dan dianalisa menggunakan HPLC. Daripada semua formulasi, Formulasi A' Xg 0.2% (0.2% zantan gam) menunjukkan peratusan pelepasan yang paling tinggi (83.6%) pada 8 jam.

ACKNOWLEDGEMENTS

First and foremost I would like to thank Allah s.w.t for his blessing to finish this study. I would like first to express my sincere appreciation to my supervisor, Prof. Dr. Mahiran Basri for her advise, guidance, encouragement and constant interest throughout this study. I would also like to thank the principal researchers in our research group Prof. Dato' Dr. Abu Bakar Salleh, Prof. Dr. Raja Noor Zaliha Raja Abd. Rahman and Prof. Dr. Mohd Basyaruddin Abdul Rahman for their guidance and suggestions.

Deepest affection is also due to Prof. Anuar Kassim and Pn. Rosnah Ismail for their ideas, unfailing help, constructive critics and supports during my study. I also like to thank to the staff of Malaysian Palm Oil Board (MPOB), Mrs. Aisyah Tahir and Pn Rosmah for their generosity in providing me with the necessary information and guidance. Special acknowledgement to Mr. Nordin, Mr. Zainuddin and staff of the Faculty of Science for their contributions to this research.

My loving care also goes to my family, particularly my parents and husband for their unconditional love, understanding and sacrifices for the sake of my success. Last but not least, thanks are also directed to all my friends and laboratory mates for their concern and continuous encouragement in times of trouble and difficulties.

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I certify that an Examination Committee has met on date of viva voce to conduct the final examination of Ummi Hani Bt Abdullah on her Master of Science thesis entitle "Nanoemulsion Formulation of Palm Oil Esters for Topical Delivery of Ibuprofen" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Peertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that the student be awarded the relevant degree.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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UMMI HANI ABDULLAH

Date: 26 October 2010

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