

**UNIVERSITI TEKNOLOGI MARA**

**FORMULATION,  
CHARACTERIZATION AND *IN VIVO*  
EVALUATION OF NANOEMULSION  
FOR ENHANCING ORAL  
BIOAVAILABILITY OF IBUPROFEN**

**NURFAZREEN BINTI ANUAR**

Thesis submitted in fulfilment  
of the requirements for the degree of  
**Master of Science**

**Faculty of Pharmacy**

April 2015

## CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 6<sup>th</sup> January 2015 to conduct the final examination of Nurfazreen Binti Anuar on her Master of Science thesis entitled “Formulation, Characterization and *In Vivo* Evaluation of Nanoemulsion for Enhancing Oral Bioavailability of Ibuprofen” 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:

Mumtaz Bin Hussain, PhD  
Senior Lecturer  
Faculty of Pharmacy  
Universiti Teknologi MARA  
(Chairman)

Mohamed Salama Ahmed Salama, PhD  
Professor  
Faculty of Pharmacy  
Universiti Teknologi MARA  
(Internal Examiner)

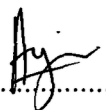
Shafii Bin Khamis, PhD  
Senior Researcher  
Medical Technology Division  
Ministry of Science, Technology and Innovation (MOSTI)  
(External Examiner)

**SITI HALIJJAH SHARIFF, PhD**  
Associate Professor  
Dean  
Institute of Graduate Studies  
Universiti Teknologi MARA  
Date: 1st April, 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 results of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledged 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 : Nurfazreen Binti Anuar  
Student I.D. No. : 2011515881  
Programme : Master of Science (PH780)  
Faculty : Pharmacy  
Thesis Title : Formulation, Characterization and *In Vivo* Evaluation of  
Nanoemulsion for Enhancing Oral Bioavailability of  
Ibuprofen  
Signature of Student : ..........  
Date : April 2015

## ABSTRACT

Ibuprofen, a phenyl propionic acid derivative, plays a significant role in the treatment of rheumatoid arthritis, osteoarthritis and related conditions. However, ibuprofen is practically insoluble in water and would not completely absorb in the gastrointestinal tract. Nanoemulsion carrier system was formulated in this study to improve oral absorption of ibuprofen. A ternary phase diagram was constructed to identify the optimal concentrations of oil, surfactant and co-surfactant. It was found that formulation containing 3% ibuprofen, 57% olive oil, 15% SE L-1695 and 25% glycerol showed the best nanoemulsion property with droplet size of 232.1 nm, polydispersity index of 0.047 and zeta potential of -31.7 mV. A reversed-phase high performance liquid chromatographic (RP-HPLC) method has been developed for the quantification of ibuprofen in rat plasma. The proposed method was validated based on linearity, accuracy and precision. The percentage mean recovery was found to be 99.16%, while the percentage of relative standard deviation of within-day and between-day measurements were all less than 5%. Subsequently, *in vivo* oral absorption study was conducted to determine the oral bioavailability of ibuprofen in rat plasma after administration. Ibuprofen nanoemulsion and oil solution in rat plasma showed AUC values of  $6670.10 \pm 283.83$   $\mu\text{g/ml}\cdot\text{h}$  and  $3060.32 \pm 169.93$   $\mu\text{g/ml}\cdot\text{h}$  respectively. The absorption of ibuprofen nanoemulsion showed an increased by 2-folds in contrast to the absorption value of the oil formulation. Meanwhile, both ibuprofen macroemulsion A and macroemulsion B showed an increase of AUC values by almost 1.5-fold as compared to the oil formulation. Therefore, it is proved that nanoemulsion formulation achieves higher rate of ibuprofen absorption as compared to macroemulsions and oil formulations.

## **ACKNOWLEDGEMENT**

First and foremost, I would like to express my gratefulness to Allah for His grace, for giving me the opportunity to embark on my Master and for completing this challenging journey successfully. My deepest gratitude and thanks go to my supervisor Dr. Khuriah Abdul Hamid. Thank you for the support, patience and ideas in assisting me with this project. I would like to express my gratitude to Dr. Tommy Julianto for providing the knowledge and assistance during my study.

My appreciation goes to the laboratory staffs for sharing their knowledge on how to operate the machine properly and helped me to find the materials that I used in this study. Special thanks to my colleagues and friends, specially Anas Syazwan Mohd Ghazali for their help and wishes for the successful completion of this project.

Finally, this thesis is dedicated to my beloved parents, Anuar Jamal and Faridah Gimin for the vision and determination to educate me. This piece of victory is dedicated to both of you. Alhamdulillah.