UNIVERSITI TEKNOLOGI MARA

FORMULATION AND EVALUATION OF SAFFLOWER OIL NANOEMULSION FOR COSMETIC APPLICATIONS USING SUCROSE MONOESTER

NOR SURAIDA BT. ABDUL RAHMAN

Dissertation submitted in partial fulfillment of the requirements for the degree of Bachelor of Pharmacy

Faculty of Pharmacy

October 2007

ACKNOWLEDGEMENTS

In the name of Allah, Most Gracious, Most Merciful, Praise to Allah for giving me strength to complete this research project

There are many individuals to whom I owe thanks for their contributions in completing this thesis.

My highest gratitude goes to my supervisor, Mr. Tommy Julianto. I thank him not only for his expertise but also his dedication in teaching and guidance. I wish to thank him especially for sharing his knowledge and experience with me in completing this study. To my research instrumentation coordinator, Dr.Kalavathy, I wish to express my deepest appreciation for her encouragement and support. I also take this opportunity to acknowledge efforts of each of the research and laboratory assistants for their cooperation throughout the course of study.

Also, I would like to thank my colleagues, Farhan Akmal and Siti Syahirah. I was extremely fortunate to have them as friends who were ever willing to help and give invaluable suggestions regarding matters in this research. It was truly a pleasure to work with both of them.

This thesis would not have been possible without the love, understanding and support from my family. My warmest love goes especially to my parents. I thank them for their constant prayers for my success.

To all my friends who inspired me to continue to strive and successfully complete this research, I convey my warmest regards.

Last but not least, I thank the Faculty of Pharmacy, for giving me the opportunity to conduct this research and for providing the latest instruments with complete laboratory facilities.

TABLE OF CONTENTS

ABSTRACT

Nanoemulsions are a class of emulsions with fine droplet size in the range of 20-500nm. Nanoemulsions are not thermodynamically stable and because of that their characteristics depend on the preparation method. The aim of this study is to investigate the effect of formulation and preparation variables of nanophase gel as pre-nanoemulsion over nanoemulsion properties. Pre-nanoemulsion gel formulation was first developed by varying sucrose monoester, glycerol/water (8:2) and safflower oil composition to form cubical liquid crystalline system or nanophase gel. Then, an emulsion in mean nanometer droplet size was produced by the mixing of pre-nanoemulsion gel with distilled water under gentle agitation. The effects of different mechanical energy on mean droplet size and stability of nanoemulsion were then determined with respect to the variation of sucrose monoester and safflower oil composition. Smaller droplet sizes of nanoemulsion were produced using stirrer while bigger droplet sizes were obtained using homogenizer. The main mechanism of this nanoemulsion breakdown using high energy emulsification method might be due to coalescence phenomenon. In addition, destabilization of nanoemulsion in long term process could be attributed to Ostwald ripening.

CHAPTER 1

INTRODUCTION

Over these few years, attention has been focused on emulsion with droplet size in nanometer range, which is referred to as nanoemulsions. Nanoemulsion is a type of emulsion in which the size of an oily phase dispersed in an aqueous phase is defined as 20 - 500 nanometers (Pey *et al*., 2006). This system which consists of extremely fine particles causes them to be transparent or translucent thus, they appear clear instead of being optically opaque (Hongda Chen *et al*., 2006). These characteristics properties make nanoemulsion of interest for fundamental studies and for practical application, especially in pharmaceutical and cosmetics industries.

Research shows that nanoemulsions with smaller droplet size can present an aspect similar to microemulsions, but, as fundamental difference, nanoemulsions are not thermodynamically stable, and because of that, their characteristics will depend on preparation method (Sol`e *et al*., 2006). Besides that, research also claimed that the size of the droplets tends to increase with time, before phase separation. The main destabilization mechanism of this system was found to be Ostwald Ripening (Liu *et al*., 2006). Nevertheless, nanosize range of the droplets prevents creaming or sedimentation from occurring on storage and droplet coalescence, hence offering increased stability of nanoemulsion (Pey *et al*., 2006).