

**UNIVERSITI TEKNOLOGI MARA**

**CHARACTERIZATION OF COSMETIC CREAM AND  
BODY LOTION CONTAINING XANTHAN GUM,  
HYDROXYPROPYL METHYLCELLULOSE (HPMC) AND  
CARBOPOL DURING STORAGE**

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Dissertation submitted in partial fulfilment of the requirements for the degree of Bachelor of  
Pharmacy (Hons.)

**2013**

## ACKNOWLEDGEMENTS

It is my privilege to undertake the project of "characterization of cosmetic cream and body lotion containing xanthan gum, HPMC and carbopol during storage" as my final year project 2012/2013. The success and final outcome of my project would not have been successful without the help and guidance from my supervisor, co supervisor, laboratory science officer, post-graduate students and my friends. Therefore it is my great honour to express my timeless gratitude and appreciation to all those that have directly and indirectly offered me assistance throughout the project.

The first person I would like to thank is my supervisor Dr Norhayati Abu Samah for giving me a chance to fulfil my interest in conducting my final project under the department of the Nutraceutical and Cosmeceutical. I am also thankful for all the help, advice and support which enable me to complete my final year project on time.

I am also indebted to my co supervisor Mr Tommy Julianto because despite having 6 other supervisee, he agreed to help me in the completion of my final year project as well as granting the title of my research paper alongside helping me in data interpretation.

I also wish to convey my appreciation to the science officer incharge for teaching me on the correct use of equipment and machinery in the laboratory used to complete my final year project.

Finally, I would also give thanks to all post-graduate students and my fellow friends for giving me encouragement and help for this paper throughout the semester. All in all, the success of this research project are due to collaboration and efforts from all the personnel mentioned above as well as myself; and I hope in near future I will once again be undertake a projects related to formulation development.

My humble gratitude

Siti Nor Diana binti Khairuddin

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## ABSTRACT

Cosmetic creams and lotions intended for topical application are generally complex mixtures of oil and aqueous components with varied rheological, texture and stability properties depending on their ingredients. The objective of this project is to investigate the effects of concentration and types of thickener: natural (i.e. xanthan gum), semi-synthetic (i.e. hydroxypropyl methylcellulose), and synthetic hydrophilic polymers (i.e. Carbopol® 934, Carbopol® 940; and Ultrez® 21) on rheology, stability and texture profiles of emulsions. For this purpose, 20 oil-in-water (o/w) (F1-F20) emulsions were prepared: F1-F12 (synthetic); F13-F16 (semi-synthetic) & F17-F20 (natural polysaccharide). Rheological parameters such as viscosity and mechanical response were determined through shear stress analysis and dynamic oscillatory test, respectively. Meanwhile, textural characterization was performed through back extrusion and spreadability tests in which parameters such as firmness, work of shear, cohesiveness and consistency were determined. Furthermore, droplet size distributions of the emulsions were monitored for over a 7-day period. Stability of the emulsions was investigated using accelerated method (20° C; 3100rpm) in order to predict the emulsions stability for one year. Based on the results, 20-emulsions (F1-F20) exhibited shear thinning (pseudoplastic) behaviour. It was found that emulsions containing synthetic thickeners (F-F12) exhibited a higher value of viscosity than those of the natural polysaccharide (F17-F20). Furthermore, at low shear rate of 0.1rpm, distinct behaviour was observed between the synthetic and the naturally derived thickeners emulsions in which yield stress is observed in Carbopol® containing emulsions and absent in xanthan gum containing emulsion. It was also observed that almost all emulsions (all except F-5) exhibited elastic behaviour;  $G' > G''$ . In stability study, it was found that only one emulsion demonstrated phase separation and failed the accelerated stability study (emulsion F3- contain 0.3% w/v Carbopol® 934 formulated using oliwax). Minor behaviour differences were noted between 0.3% and 0.5% w/v of thickener used. In conclusion, the use of different hydrophilic texturizing agents of different concentrations not only affects the rheological and textural properties of o/w emulsions but it also affects the emulsion droplet size. A prominent characteristic of stable emulsions was evidenced in emulsion containing Carbopol® 934; where at low concentration of 30%, solid-like consistency cream was noted as compared to other synthetic and naturally derived thickeners. Natural polysaccharides on the other hand showed a distinct shear thinning behaviour as compared to those of semi-synthetic and synthetic agents in rheological and textural properties and produce an emulsion of medium sized droplets. However no stable correlation between concentrations with the emulsion properties was found.



# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

The current Food and Drug Administration (FDA), Centre for Drug Evaluation and Research (CDER) Data Standards Manual defined cream as a semisolid dosage form containing one or more drug substances dissolved or dispersed in a suitable base. Whereas lotion is defined as “topical suspensions, solution and emulsions intended for the application to the skin” ( retrieved from Data Standard manual, 10<sup>th</sup> June 2013).

Cream and lotion are often characterized as a suspension or an emulsion depending on their components; one of the most commonly used and reviewed forms in the pharmaceutical, food and cosmetic industries constitute of oil-in-water (o/w) emulsions (Chapat1994).

Emulsion is defined as dispersed immiscible oil droplets in a continuous aqueous phase that may exhibit structural changes depending on the condition that it is put under (T. Tadros, 2004a; Vianna-Filho, Petkowicz, & Silveira, 2013). The effects of various factors on the emulsion stability and rheology as well as sensory