

UNIVERSITI TEKNOLOGI MARA

THE RHEOLOGY OF COMMERCIAL CREAMS AND LOTIONS

SITI AFINA ANIS BINTI ROSLAN

BACHELOR OF PHARMACY (Hons)

2015

ACKNOWLEDGEMENT

In the name of Allah, praise to Prophet Muhammad. All praises to Allah the Almighty for granting me health and strength in completing this dissertation.

First and foremost, my utmost gratitude to my supervisor, Dr. Tommy Julianto Bustami Effendi for his guidance, unfailing support, patience and encouragement to complete this study.

My appreciation also goes to my family for all the support, love and encouragement in fulfilling my dream. Last but not least, thank you to all my friends for their help and I am grateful that everyone around were very helpful in completing this dissertation.

ABSTRACT

Cosmetics such as creams and lotions are semi-solids type products formulated based on emulsion system consisting of two immiscible components. These preparations are difficult to characterize and require specific flow properties to be stable when placed into the container and applied on the affected area. For that matter, rheology is necessary as it influences how the material is formulated and developed. This research study is to analyze the rheological and textural parameters as well as other additional measurements of the commercial cosmetic creams and lotions. For this purpose, about eleven products consist of both creams and lotions marketed were studied by using the appropriate measurements. The rheological assessment of the products was studied using viscosity, oscillation amplitude sweep and oscillation frequency sweep tests while the textural analysis tests used were back extrusion and spreadability. Particle size distribution and stability analyses were also performed. It has been shown that the flow behaviour of the cosmetic products as evaluated by the rheology measurements have a strong influence on the stability of the product.

TABLE OF CONTENTS

APPROVAL SHEET.....	i
AUTHOR'S DECLARATION.....	ii
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
TABLE OF CONTENTS	v
1.0 INTRODUCTION.....	1
1.1 Background of study	1
1.2 Problem statement.....	2
1.3 Purposes of the study.....	2
1.4 Hypothesis.....	2
1.5 Scope and limitation.....	2
2.0 LITERATURE REVIEW.....	4
2.1 Cream and lotion.....	4
2.1.1 Functions of skin.....	4
2.1.2 Environmental and biological factors on skin.....	4
2.1.3 Definitions of cream and lotion	5
2.1.4 Types of cream and lotion.....	5
2.1.5 Formulations of cream and lotion.....	6
2.1.6 Functions of cream and lotion	8
2.2 Physical characterization of lotion and cream	8
2.2.1 Rheology.....	8
2.2.1.1 Introduction and definition.....	8
2.2.1.2 Rheology of cream and lotion.....	11
2.2.1.2.1 Viscosity and shear rate.....	13
2.2.1.2.2 Yield stress.....	13
2.2.1.2.3 G' , G'' and $\tan \delta$	14
2.2.1.2.4 Creep / recovery.....	15

1.0 Introduction

1.1 Background of study

Cream and lotion are semi-solid preparations of two immiscible liquids which consist of oil and water. Both semisolids are widely used as the pharmaceutical and cosmetic preparations. A lotion is expected to be thinner than a cream (Greenaway, 2010). Rheological properties of materials are important for stable manufacturing, filling, storage and handling as well as to ensure customer acceptance and application. For that matter, rheological instrumentation becomes highly demanded as a required analytical tool in the fields of pharmaceutical and cosmetic processes nowadays (Colo, Herh, Roye, & Larsson, 2004).

Rheology is the study of the flow and deformation behaviours of materials. It influences the ability of materials to flow or change shape when a force or stress is applied onto it (Vliet & Lyklema, 2005). For example, assume when a cream or lotion is squeezed out from its container, it will generally maintain its structure as it is delivered onto the skin surface. When the cream or lotion is spread on the skin, it will deform. The force that exists within the spreading action causes the change in a cream or lotion behaviour. The materials that undergo this particular deformation are called viscoelastic or plastic in which describe most semisolids products; ointments, pastes, gels, creams and lotions (Korhonen, Niskanen, Kiesvaara, & Yliruusi, 2000).

1.2 Problem statement

Semisolid products are very difficult to be prepared as both liquid and solid properties are required to put into the same material (Herh, Tkachuk, Wu, Bernzen, & Rudolph, 1998). These products require specific flow properties which are not too viscous to be placed as well as removed from the containers and not too thick so that they can be spread easily (Mastropietro & David, 2013). To fulfill the characteristics of the cosmetic cream and lotion as to achieve the satisfaction of the consumer is not an easy task. Formulators should be able to set rheology and texture through a comprehensive formulations works before the product is ready to be marketed. Therefore, rheological measurements are mostly used in the pharmaceutical and cosmetic production since it will influence the stability and effectiveness of the products.