

UNIVERSITI TEKNOLOGI MARA

**IN VITRO TRANSDERMAL DRUG DELIVERY OF
ASTAXANTHIN EMULSION: INFLUENCE OF
EMULSION DROPLET SIZE**

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**Dissertation submitted in partial fulfillment of the requirement
for the Bachelor of Pharmacy (Hons.)**

Faculty of Pharmacy

ACKNOWLEDGEMENT

First of all, i am grateful to Allah S.W.T for giving me strength to complete my final year project. I would like to express my deepest appreciation to those who provided me the possibility to complete this project. A special gratitude to my supervisor, Dr. Meor Mohd Redzuan and co-supervisor Dr.Nor Khaizan Anuar for their support and guidance especially in writing this thesis. I am thankful to Faculty of Pharmacy for providing the facilities to make this project more easy and successful. I am also thankful to my family and friends for their support throughout this project.

Thank you.

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ABSTRACT

Astaxanthin is a naturally occurring carotenoid that basically can be found in algae, yeast and marine animals such as salmon, trout and shrimp. It is a red fat-soluble compound with low oral bioavailability due to its lipophilic characteristic. Astaxanthin has been reported by various researchers as an antioxidant, anti-inflammation, anti-diabetic, anti-cancer and provide cardiovascular health. However, most of the scientific literature only focused on oral bioavailability by explaining in detail gastric dissolution with very limited information on transdermal delivery. This study demonstrate transdermal *in vitro* permeability of nanoemulsion and evaluate its effect with the reduction of droplet size. In this regard, astaxanthin permeability was evaluated by Franz diffusion cell with a Male Sprague-Dawley rat skin membrane sandwiched between the donor and receptor compartments. The result showed that the amount of astaxanthin permeable from oil formulation after 48 hours (197.67 ± 1.77 $\mu\text{g/ml}$) was quite low as compared to microemulsion (212.11 ± 2.50 $\mu\text{g/ml}$) and nanoemulsion (223.22 ± 0.95 $\mu\text{g/ml}$). This study proved that globules size reduction improved astaxanthin permeability. Nano-sized emulsion showed a 25% increase in astaxanthin permeable value as compared to oil formulation and 11% increase as compared to micro-sized emulsion. Additionally, the micro-sized emulsion showed a 12% increase with the amount of astaxanthin permeable as compared to oil formulation.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Astaxanthin is a naturally occurring carotenoid that basically can be found in algae, yeast and marine animals such as salmon, trout and shrimp (Ambati, Moi, Ravi, & Aswathanarayana, 2014). It is belonged to the xanthophyll group. It is stable at pH4.0 and at lower temperatures. Astaxanthin is a red fat-soluble compound and has low oral bioavailability due to its lipophilic characteristic. However, the absorption of astaxanthin can be increased when consumed with dietary oils. Astaxanthin has the advantage as an antioxidant effects, anti-inflammation, anti-diabetic activity, prevention in cardiovascular disease and anti-cancer activity (Régner et al., 2015). When consumed with food, it is safe with no side effect. However, the excessive intake of astaxanthin can cause animal skin to change into yellow to reddish pigmentation.

Due to low bioavailability of astaxanthin, various studies on strategy to improve bioavailability of the drug molecule have been reported. This includes use of surfactant, inclusion complexation, novel drug delivery system and particle size reduction. Particle size reduction technology has been introduced to improve the drug with low bioavailability. Nanoemulsion technology has been used to improve drug