# UNIVERSITI TEKNOLOGI MARA

# POTENTIAL EVALUATION OF *PELARGONIUM RADULA* LEAVES EXTRACT USING SUPERCRITICAL FLUID CARBON DIOXIDE FOR MOSQUITO REPELLENT SKIN PRODUCT

**NAZRIN BIN MUSTAPHA**

Thesis submitted in fulfillment
of the requirements for the degree of
**Bachelor (Hons.) Engineering**
**(Chemical)**

**Faculty of Chemical Engineering**

**July 2019**

# ACKNOWLEDGEMENT

First and foremost, I would like to thank our Creator, the Almighty, Allah S.W.T for constantly giving me the strength, inner peace, knowledge and ability to face all the circumstances during completing my research project. I gave all of my trust to Him because this achievement would not be fulfilled without His blessings.

Huge thanks to my final year project supervisor, Madam Nur Ain Binti Mohd Zainuddin for her fully guidance and encouragements. She pushed herself and gave me everything through great & significant ideas and precious advices in order for me to complete my research project with flying colors.

Then I would like to say thank you to my co-supervisor from FRIM, Cik Saidatul Husni Binti Saidin for all the cooperation and helps. Special thanks to Dr. Nazri Che Dom, senior lecturer and his master's student, Nur Athen Binti Mohd Hardy Abdullah from Faculty of Health and Science who involved on giving me an opportunity and guideline to complete my final year project especially on mass rearing and repellency test at their insectarium laboratory.

I would like also to thank my family and friend for all the big supports. Last but not the least, thank you to technicians of Chemical Engineering Faculty who are very patient to fulfil my needs on the information of this final year project.

# ABSTRACT

Supercritical Fluid Extraction (SFE) is a modern technique that is widely used when it comes to the extraction purposes. Recently, the SFE in *P. radula* leaves contains a lot of benefits towards human being because it possesses as a therapy in diabetes treatment, antimicrobial activity, pharmaceutical industries, cosmetics and as well as perfumery industries. This study focused on the highest oil yield that could be used as a repellent product toward mosquito bites. The main objectives of this study is to determine the best operating condition for the highest oil yield by using SFE-$CO_2$, to identify the best dosage of *P. radula* essential oil to be applied in lotion production against adult *Aedes Aegypti* and to study the repellency activity on the mosquitoes bites of essential oil *P. radula* extract. In general, many researchers used conventional technique such as hydro-distillation and solvent extraction to extract valuable component in oil formed itself. Unfortunately, these techniques have several disadvantages such as long extraction time, produce toxic residual and high usage of solvent. SFE has short extraction time, inexpensive, non-toxic and non-flammable. The extraction was conducted using temperature of 40, 45, 50, 55 and 60ºC and the pressure used were 100bar, 150bar, 200bar, 250bar, 300bar, 350bar and 400bar at constant flowrate of 24ml/min for 70 minutes extraction time. In this study, the best operating condition for the highest oil yield were 60ºC and 5800psi which results 1.7474%. Gas Chromatography-Mass Spectrometry (GC-MS) analysis show that *P. radula* leaves contained geraniol and citronellol while for Fourier Transform-Infrared Spectroscopy (FT-IR) analysis, it consists of methyl ($CH_2$) group, methylene (-$CH_3$) group, methyl (-$CH_3$) and bend methyl (C-H) group. Besides, the best dosage of *P. radula* essential oil was 1%.

# TABLE OF CONTENTS

# CHAPTER ONE
# INTRODUCTION

## 1.1 Background Study

*Pelargonium* species is a plant that originates from South Africa and a bushy plant up to 75cm in height. It is also known as *Geraniceae* family. It can be shrubs with strong aroma. The ancestors called it as "pokok halau nyamuk" specifically in Malaysia (Zuraida, Shukri, Erny Sabrina, & Ayu Nazreena, 2015). In general, P. *Radula* has been used to repel or kill mosquito traditionally. In recent years, many countries and areas in Asia have been experiencing diseases that transmitted from mosquitoes such as dengue, filariasis, malaria and Japanese encephalitis activity. In fact, there were 3 million people each year killed by malaria disease including one child per 30 seconds (Asnawi, Mohd Zaki, Abdul Aziz, Khamis, & Abdul Aziz, 2012). In Malaysia, dengue cases are rising from year to year such as in 2012, there were 9,607 dengue cases that caused 20 deaths compare to in 2011 which is 7,963 cases with 12 cases (Wan-Norafikah et al., 2012).

Apart from that, synthetic repellents such as N,N-diethyl-meta-toluamide (DEET) have been used widely to protect humans from mosquitoes that were developed in the 1950s. However, from previous research, when DEET is applied on skin, it caused an oily and burning sensation to some DEET users (Tabanca et al., 2013a). In contrast, the extraction of geranium oil from *Pelargonium sp.* revealed a significant anti-inflammatory activity as it contains citronellol, geraniol, and citronellyl formate as major components and other esters (Boukhatem, Kameli, Mohamed Amine Ferhat, Saidi, & Maamar Mekarnia, 2013). Other than anti-inflammatory activity, *Pelargonium Radula* is known to have the phytochemical properties, antifungal, antioxidant, antibacterial, anticancer activity, antiplasmodial, anthelmintic and insecticidal activities. In addition, geranium oil is widely used in cosmetics and perfumery industries. It is also used as a flavouring agent and as a spice.