

UNIVERSITI TEKNOLOGI MARA

**SOLUBILITY OF *GARCINIA*
MANGOSTANA OIL IN SUPERCRITICAL
CARBON DIOXIDE**

IZNI ATIKAH BINTI ABD HAMID

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of the requirements for the degree of
Master of Science

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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Name of Student : Izni Atikah Binti Abd Hamid

Student's I.D. No. : 2010631984

Programme : Master of Science (Chemical Engineering)

Faculty : Chemical Engineering

Thesis Title : Solubility of *Garcinia Mangostana* Oil in Supercritical Carbon Dioxide

Signature of Student :

Date : June 2013

ABSTRACT

Natural antioxidant as medical treatment nowadays has gained great attention in substituting the use of synthetic drugs. Mangosteen peel was proven containing abundant of potential compounds which were believed to exhibit antimicrobial, antibacterial and anticancer activity for cancer disease treatment. Conventional extraction method i.e. solvent extraction was used for years in extracting natural compounds. The method however contributed to the enormous increment of hazardous organic solvents emissions and caused generation of aqueous waste streams to the environment. Therefore, an alternative cleaner, safer and sustainable process that does not require the use of dangerous solvents is necessary. In this study, an environmental friendly solvent Carbon Dioxide (CO₂) under supercritical conditions has been chosen to extract the interest compounds from mangosteen peel. The extraction was conducted at constant flowrate of 24 mL/min within 40 minutes by varying temperature and pressure from 50 to 80 °C and from 34.5 to 55.1 MPa, respectively. The extracts obtained were identified using Gas Chromatography Mass Spectrometer (GCMS) to determine the oil compositions. The highest extraction yield of 1.85% (g oil/g sample) with 0.12 of Average Absolute Deviation (AAD) and highest solubility of mangosteen peel oil (0.575 mg oil/g CO₂) in Supercritical Carbon Dioxide (SC-CO₂) was obtained at temperature of 80 °C and pressure of 41.4 MPa. Experimental work for the whole range of temperature and pressure consumed more cost, time and energy. Therefore modeling of solubility data was required to obtain the relationship between the manipulated variable i.e. extraction temperature and pressure with the solubility of mangosteen peel oil in SC-CO₂. In this study, a multi-layer feed-forward back-propagation Artificial Neural Network (ANN) model was developed for the solubility prediction of mangosteen peel oil in SC-CO₂, where the input variables were temperature and pressure. An optimal ANN model consisted of one hidden layer and five neurons was obtained with minimum value of Mean Square Error (MSE) of 0.011 for 48 experimental data points used. The analysis showed that the ANN prediction model have a good agreement with the experimental data in which the value of correlation coefficient (R-value) for training, validating and testing obtained is 0.933, 0.982 and 0.927, respectively.

TABLE OF CONTENTS

	Page
AUTHOR'S DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF PLATES	xii
LIST OF SYMBOLS	xiii
LIST OF ABBREVIATIONS	xiv
CHAPTER ONE: INTRODUCTION	
1.1 Research Background	1
1.2 Problem Statement	3
1.3 Objectives of the Research	3
1.4 Scope and Limitation of Study	4
1.5 Research Contributions	5
1.6 Thesis Outline	5
CHAPTER TWO: LITERATURE REVIEW	
2.1 Mangosteen	7
2.2 Medicinal Properties in Mangosteen Peel	7
2.3 Traditional Extraction Method	9
2.4 Introduction to Supercritical Fluid Extraction (SFE)	11
2.4.1 Carbon Dioxide as Supercritical Solvent	12
2.4.2 Industrial Application on SC-CO ₂	14
2.4.3 Review on SC-CO ₂ Extraction from Natural Plants	15
2.5 Solubility	16
2.5.1 Review on Solubility of Oil/Substance in SC-CO ₂	17
2.6 Modeling for Solubility	19

2.7	Artificial Neural Network (ANN)	21
2.7.1	ANN in Solubility Modeling	23
2.7.2	Training and Prediction Process of the ANN	25
2.7.3	Review on ANN in SC-CO ₂	26
2.7.4	Beneficial of using ANN over Existing Thermodynamic Models	30

CHAPTER THREE: METHODOLOGY

3.1	Selection of Operating Condition(s)	33
3.2	Experimental Work	34
3.2.1	Sample Preparation	34
3.2.2	Moisture Content Determination	34
3.2.3	Particle Size Determination	35
3.2.4	Design of Experiment (DOE)	35
3.3	SC-CO ₂ Extraction	36
3.4	Gas Chromatography Mass Spectrometry (GCMS)	38
3.4.1	Sample Preparation for GCMS	38
3.4.2	GCMS Parameter	38
3.5	Modeling of Solubility using Artificial Neural Network (ANN)	39
3.5.1	ANN Architecture and Algorithm	39

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1	Effect of Moisture Content	43
4.2	Preliminary Study (The Best Particle Size Determination)	43
4.3	Experimental Design Layout	45
4.4	Percentage Oil Yield	46
4.4.1	Effect of Pressure on Oil Yield	46
4.4.2	Effect of Extraction Temperature on Oil Yield	50
4.5	Solubility of Mangosteen Peel Oil in SC-CO ₂	53
4.5.1	Effect of Temperature and Pressure on Solubility	53
4.6	Component(s) Identification in Mangosteen Peel Oil	56
4.7	ANN Modeling	59
4.7.1	Network Optimization of ANN Model	59