

**ADSORPTION KINETICS AND EQUILIBRIUM OF METHYLENE
BLUE FROM AQUEOUS SOLUTIONS USING PHOSPHORIC ACID
TREATED DATE SEEDS**

TENGGU NUR LIYANA BT TENGGU ZAINUL HISHAM

**Final Year Project Report Submitted in Partial Fulfilment of the
Requirements for the Degree of Bachelor of Science (Hons.) Chemistry
in the Faculty of Applied Sciences Universiti Teknologi MARA**

JULY 2016

ABSTRACT

Adsorption Kinetics and Equilibrium of Methylene Blue from Aqueous Solutions Using Phosphoric Acid Treated Date Seeds

In this study, the adsorbent material used to adsorb methylene blue from aqueous solutions is phosphoric acid treated date seeds. Agricultural wastes are selected as adsorbent due to their low cost compared to high cost adsorbent such as activated carbon. Parameters examined in this study are agitation rate, pH, adsorbent dosage, temperature, contact time and initial concentrations. For kinetic study, pseudo-first order and pseudo-second-order are used to analyze the adsorption rate of methylene blue on date seeds.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	viii
ABSTRACT	ix
ABSTRAK	x
CHAPTER 1: INTRODUCTION	
1.1 Background of the study	1
1.2 Problem statement	5
1.3 Objectives of the study	7
1.4 Significance of the study	8
1.5 Scope of the study	9
CHAPTER 2: LITERATURE REVIEW	
2.1 Adsorption	10
2.2 Physisorption and Chemisorption	11
2.3 Factors affecting adsorption	13
2.4 Adsorbent	15
2.5 Date seed as adsorbent	16
2.6 Previous studies of adsorption of methylene blue from aqueous solutions	18
2.7 Previous studies of using date seeds as adsorbent	19
CHAPTER 3: METHODOLOGY	
3.1 Material	20
3.1.1 Raw material	20
3.1.2 Chemicals and reagents	20
3.1.3 Glass wares	20
3.1.4 Equipment and analytical instruments	21
3.2 Methods	22
3.2.1 Adsorbent (date seeds)	22
3.2.2 Adsorbate (methylene blue)	22
3.3 Adsorption studies	23
3.3.1 Effect of agitation rate	23
3.3.2 Effect of pH	24
3.3.3 Effect of adsorbent dosage	25

3.3.4	Effect of concentration and time (kinetic)	25
3.4	UV-Vis analysis	29
3.4.1	Methylene blue analysis using UV-Vis	29
3.4.2	Determination of λ_{\max}	31
3.4.3	Preparation of methylene blue standards solutions of several concentrations	32
3.4.4	Preparation of a standard curve and measure an unknown	32
3.5	FTIR analysis	31
3.5.1	FTIR Analysis of Date Seeds Before adsorption	32
3.5.2	FTIR Analysis of Date Seeds after adsorption	32

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1	Physiochemical parameter analysis	33
4.1.1	Effect of agitation rate	33
4.1.2	Effect of pH	34
4.1.3	Effect of adsorbent dosage	35
4.1.4	Effect of concentration and time	37
4.1.5	Adsorption kinetic studies	38
	4.1.5.1 Pseudo-first-order kinetic model	38
	4.1.5.2 Pseudo-second-order kinetic model	39
4.2	Fourier Transform Infrared Spectroscopy Analysis	40
4.2.1	FTIR Analysis of Date Seeds before Adsorption of Methylene Blue	40
4.2.2	FTIR Analysis of Date Seeds after Adsorption of Methylene Blue	41

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

CITED REFERENCES	45
APPENDICES	51
<i>CURRICULUM VITAE</i>	59

LIST OF TABLES

Table	Caption	Page
2.1	Comparison of physical adsorption and chemical adsorption	12
2.6	Previous Studies of Adsorption of Methylene Blue from Aqueous Solutions	18
2.7	Previous Studies of Using Date Seeds as Adsorbent	19
4.1	Result on effect of adsorbent dosage by using UV-Vis spectrometer	36