

**ADSORPTIVE REMOVAL OF METHYLENE BLUE  
BY USING ACTIVATED CARBON DERIVED FROM**

**MUHAMMAD ADAM DANIAL BIN MOHD YUSRI**

**BACHELOR OF SCIENCE (Hons.)**

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MARA

Fakulti  
Sains Gunung

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**ADSORPTIVE REMOVAL OF METHYLENE BLUE  
BY USING ACTIVATED CARBON DERIVED FROM  
WASTE COFFEE GROUNDS**

Name : MUHAMMAD ADAM DANIAL BIN MOHD YUSRI  
Student ID : 2021868758  
Program : AS245  
Course code : FSG671  
Mobile Phone : \_\_\_\_\_  
E-mail : 2021868758@student.uitm.edu.my

**Approval by Main Supervisor :**

I certify that the work conducted by the above student is completed and approve this report to be submitted for evaluation.

Supervisor's name :

Date :

Turnitin Similarity %  
Signature **DR. ZAIDI BIN AB GHA**  
PENSYARAH KANAN KIMI  
FAKULTI SAINS GUNGAN  
UNIVERSITI TEKNOLOGI MARA  
(UITM) CAWANGAN PERLIS

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**MUHAMMAD ADAM DANIAL BIN MOHD YUSRI**

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## TABLE OF CONTENTS

	Page
<b>ACKNOWLEDGEMENTS</b>	ii
<b>TABLE OF CONTENTS</b>	iii
<b>LIST OF TABLES</b>	vi
<b>LIST OF FIGURES</b>	vii
<b>LIST OF ABBREVIATIONS</b>	vii
<b>ABSTRACT</b>	x
<b>ABSTRAK</b>	xi
<b>CHAPTER 1 : INTRODUCTION</b>	
1.1 Research Background	1
1.2 Problem Statement	3
1.3 Research questions	5
1.4 Objectives	5
1.5 Scope and Limitation of Study	6
1.6 Significance of Study	7
1.7 Expected Output/Outcomes/Implication	8
<b>CHAPTER 2 : LITERATURE REVIEW</b>	
2.1 Dyes as Water Pollutant	9
2.2 Methylene Blue Dye	10
2.2.1 Properties of methylene blue	11
2.2.2 Application and uses	12
2.2.3 Environmental impact and toxicity	13
2.3 Chemical Treatments	14
2.3.1 Ozonation	14
2.3.2 Chemical coagulation	16
2.3.3 Electrochemical	16
2.4 Physical Treatments	17
2.4.1 Membrane Filtration	18
2.4.2 Coagulation and Flocculation	19
2.4.3 Adsorption	20
2.5 Activated Carbon as Adsorbent	22
2.5.1 Characteristic of activated carbon	23

## ABSTRACT

### **Adsorptive removal of Methylene Blue by using Activated Carbon Derived from Waste Coffee Grounds**

In this study, the waste coffee grounds-derived activated carbon (CSG-AC) used was prepared via zinc chloride ( $\text{ZnCl}_2$ ) activation. CSG-AC is used as an adsorbent to remove methylene blue (MB) from the aqueous solutions. The effects of adsorbent dosage, initial concentration, contact time, solution pH, and temperature were studied in batch experiments. The experimental data were analysed by the Langmuir, Freundlich, and Temkin adsorption isotherm models. Based on correlation coefficient results (0.9998), the Langmuir isotherm model provided the best fit for the adsorption of MB onto CSG-AC. The maximum monolayer adsorption of MB onto CSG-AC was calculated to be 176 mg/g. Kinetic parameters were evaluated based on pseudo-first-order (PFO), pseudo-second-order (PSO) and Weber-Morris intraparticle diffusion (IPD) kinetic models. The regression results showed that a PSO model is more accurately representing the adsorption kinetics. The plot of  $q_t$  versus  $t^{1/2}$  for the IPD model represented multi-linearity and proved that the adsorption processes occurred in more than one step. Thermodynamic parameters were determined between temperatures of 25 to 34 °C. The  $\Delta G^\circ$  values were negative while the  $\Delta H^\circ$  values were positive and the overall adsorption process was determined as spontaneous and endothermic. While the positive value of  $\Delta S^\circ$  proposed good affinity of the MB molecules toward the CSG-AC. The results from this study suggested that CSG-AC could be a viable adsorbent in managing higher concentrations of dyes from water and wastewater.