

**COMPETITIVE BIOSORPTION OF PB(II) AND NI(II) ONTO  
NEWLY SYNTHESIZED SPONGY THIOUREA MODIFIED SPENT-  
GRATED COCONUT**

**MUHAMMAD IKRAM BIN MOHD APDI@NORMI**

**Final Years Project Submitted in  
Partial Fullfilment of the Requirements for the  
Degree of Bachelor of Science (Hons.) Chemistry  
in the Faculty of Applied Sciences  
UniversitiTeknologi MARA**

**JULY 2017**

## ABSTRACT

### COMPETITIVE BIOSORPTION OF Pb(II) AND Ni(II) (BINARY METAL IONS SYSTEM) ONTO NEWLY SYNTHESIZED SPONGY THIOUREA MODIFIED SPENT-GRATED COCONUT

The waste from spent-grated coconut was used and modified as new biosorbent to investigate the biosorption of Pb(II) and Ni(II). Initially, SGC was treated with hexane and followed by thiourea to form TSGC. This biosorbent were characterized by FTIR,  $\text{pH}_{\text{slurry}}$  and  $\text{pH}_{\text{zpc}}$ . The experimental equilibrium adsorption data were analyzed by two model and two isotherm- Pseudo-first order model, Pseudo-second order model, Langmuir isotherm and Freundlich isotherm. Among these, only Freundlich isotherm was fitted with both Pb(II) and Ni(II) as it correlation coefficients ( $R^2$ ) close to to unity. For Pseudo-first order model, only Pb(II) ions was fit with it. For Pseudo-second order model, only Ni(II) was fit it.

## TABLE OF CONTENTS

	<b>Page</b>
<b>ACKNOWLEDGEMENT</b>	iii
<b>TABLE OF CONTENTS</b>	iv
<b>LIST OF TABLES</b>	vi
<b>LIST OF FIGURES</b>	vii
<b>LIST OF ABBREVIATIONS</b>	viii
<b>ABSTRACT</b>	ix
<b>ABSTRAK</b>	x
<b>CHAPTER 1 INTRODUCTION</b>	
1.1 Background of Study	1
1.2 Problem Statement	2
1.3 Significance of Study	3
1.4 Objectives of the Study	3
<b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Heavy metal	5
2.2 Biosorption	5
2.3 Spent Grated Coconut	6
<b>CHAPTER 3 METHODOLOGY</b>	
3.1 Materials	
3.1.1 Raw Materials	8
3.1.2 Chemicals and Reagent	8
3.1.3 Apparatus	8
3.2 Method	9
3.2.1 Preparation of biosorbent	9
3.2.2 Preparation of Pb(II) and Ni(II) solution	10
3.3 Characterizations of biosorbent	
3.3.1 Fourier Transform Infrared (FTIR)	11
3.3.2 $pH_{slurry}$ and $pH_{zpc}$	12
3.4 Batch study	13
3.4.1 Absorption Uptake of Metal	13
3.4.2 Effect of pH	13
3.5 Kinetic study	13
3.6 Kinetic models	14
3.6.1 Pseudo-first order model	14
3.6.2 Pseudo-second order model	15
3.7.1 Langmuir Isotherm	16

<b>CHAPTER 4</b>	<b>RESULT AND DISCUSSION</b>	
4.1	Batch study	17
	4.1.1 Effect of pH	17
4.2	Characterization of biosorbent	19
	4.2.1 Fourier Transform Infrared (FTIR)	19
	4.2.2 pH <sub>slurry</sub> and pH <sub>ZPC</sub>	22
4.3	Kinetic models	23
	4.3.1 Pseudo-first order model	23
	4.3.2 Pseudo-second order model	25
4.4	Isotherm model	27
	4.4.1 Langmuir isotherm	28
	4.4.2 Freundlich isotherm	28
<b>CHAPTER 5</b>	<b>CONCLUSION AND RECOMMENDATION</b>	28
<b>CITED REFERENCES</b>		29
<b>APPENDICES</b>		32
<b>CURRICULUM VITAE</b>		36

## LIST OF FIGURES

Figure	Caption	Page
4.1	Effect of pH on Ni(II) and Pb(II) removal	18
4.2	FTIR spectra of TSGC (loaded and unloaded)	20
4.3	$pH_{zpc}$ of the thiourea spent-grated coconut (TSGC)	22
4.4	Linear form of Pseudo-first order for Ni(II) at 0.1 mmol/L, 0.2 mmol/L and 0.3 mmol/L	23
4.5	Linear form of Pseudo-first order for Pb(II) at 0.1 mmol/L, 0.2 mmol/L and 0.3 mmol/L	23
4.6	Linear form of Pseudo-second order for Ni(II) at 0.1 mmol/L, 0.2 mmol/L and 0.3 mmol/L	24
4.7	Linear form of Pseudo-second order for Pb(II) at 0.1 mmol/L, 0.2 mmol/L and 0.3 mmol/L	25
4.8	$1/q_e$ vs $C_e$ of Ni(II) and Pb(II) for each concentrations	26
4.9	$\log q_e$ vs $\log C_e$ of Ni(II) and Pb(II) for each concentrations	27