

# CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

Editors:

Ma'an Alkhatib  
Abdullah Al Mamun  
Faridah Yusof



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*(VOLUME IV)*

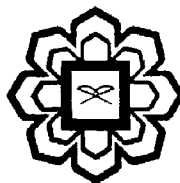
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## CONTENTS

	PREFACE	viii
CHAPTER 1	REMOVAL OF ZINC FROM WASTEWATER BY CARBON NANOTUBES <i>Nassereldeen A. Kabbashi, Ahmad Fadzil Ahmad Shuhaili, Md Z. Alam</i>	1
CHAPTER 2	REMOVAL CHARACTERISTICS OF MANGANESE (MN <sup>2+</sup> ) BY CNTS <i>Nassereldeen A. Kabbashi, Suleyman A.M, Mohamed E.S. Mirghani, Farhana I.Y</i>	8
CHAPTER 3	REMOVAL TECHNIQUES OF CADMIUM FROM WASTEWATER BY CNTS <i>Nassereldeen A. Kabbashi, Muhammad Fikri Bin Rosly, Suleyman Muyibi</i>	15
CHAPTER 4	KINETICS OF ACTIVATED CARBON FROM EFB IN MERCURY REMOVAL <i>Nassereldeen. A. Kabbashi, Ma'an F. Alkhatib, Mohammed Elwathig and Ili Nadirah Bt Jamil</i>	21
CHAPTER 5	CARBON NANOFIBERS TO REMOVE ARSENIC <i>Abdullah Al Mamun, Ma'an Alkhatib, Zahirah Abd. Kadir</i>	26
CHAPTER 6	CARBON NANOTUBES TO REMOVE CHROMIUM <i>Abdullah Al Mamun, Ma'an Alkhatib, Aishah Jamaluddin Ahmad</i>	32
CHAPTER 7	CARBON NANOTUBES TO REMOVE NICKEL <i>Abdullah Al Mamun, Ma'an Alkhatib, Siti Melor Asnida Zainudin</i>	38
CHAPTER 8	ADSORPTION ISOTHERM OF CARBON NANOTUBES IN REMOVING HEAVY METALS <i>Abdullah Al Mamun, Faridah Yusof, Norsyafini Ishak</i>	44
CHAPTER 9	CARBON NANOFIBERS TO REMOVE NICKEL <i>Abdullah Al Mamun, Ma'an Alkhatib, Halema Shajahan</i>	50
CHAPTER 10	ADSORPTION OF LEAD BY CNTS GROWN ON GAC <i>Abdullah Al Mamun, Ma'an Alkhatib, Iman Hawari</i>	54
CHAPTER 11	ADSORPTION OF CADMIUM BY CNTS GROWN ON GACS <i>Abdullah Al Mamun, Ma'an Alkhatib, Nada Hamid Al Samawi</i>	59
CHAPTER 12	PERFORMANCE OF CNTS COLUMN IN REMOVING LEAD FROM WATER <i>Abdullah Al Mamun, Md Zahangir Alam, Muhammad Akram Abdul Hadi</i>	63
CHAPTER 13	STABILITY OF DISPERSION OF (SW-CNT)-CARBOXY-METHYL CELLULOSE (CMC) IN AQUEOUS SOLUTION <i>Ahmad T. Jameel, Mohammed S. Jami and Syarifah R. Kamaruzaman</i>	68
CHAPTER 14	OPTIMUM COLLOIDAL DISPERSION OF CARBON NANOTUBE IN ETHYLENE GLYCOL USING TRITON X-100 AS DISPERSING AGENT <i>Ahmad T. Jameel, Faridah Yusof, Natrah Ibrahim and Alade A. Olanrewaju</i>	74
CHAPTER 15	CHARACTERIZATION OF IMMOBILIZED LIPASE ON MULTI-WALLED CARBON NANOTUBE <i>Nur Hidayah Zainan, Maan Fahmi Al-Khatib and Hamzah Mohd. Salleh</i>	80
CHAPTER 16	PURIFICATION OF SKIM LATEX PROTEIN USING CARBON NANOTUBES AS THE CHROMATOGRAPHIC MEDIA <i>Faridah Yusof and Peer Mohamed</i>	86

CHAPTER 17	COMPUTATIONAL STUDIES OF ADSORPTION GLYCINE <i>Ibrahim Ali Noorbacha, Hamzah Mohd Salleh and Nursafuraa Abu Talib</i>	92
CHAPTER 18	KINETIC STUDIES ON ENHANCED MERCURY ADSORPTION USING ACTIVATED CARBON <i>Nassereldeen Kabbashi, Noor Illi</i>	97
CHAPTER 19	ANALYSIS OF CROSS FLOW ULTRAFILTRATION MEMBRANE <i>Mohammed Saedi Jami, Tariq Jameel and Norasila Binti Ali Mahmud</i>	103
CHAPTER 20	APPLICATION OF CARBON NANOTUBES IMPREGNATED ON ACTIVATED CARBON FOR CADMIUM REMOVAL FROM AQUEOUS SOLUTION <i>Ma'an Alkhatib, Abdullah Al-Mamun, Nurhazwani Muhamad Nor</i>	109
CHAPTER 21	BIOPROCESSING OF MORINGA OLEIFERA FOR REMOVAL OF HEAVY METALS (CADMIUM AND CHROMIUM) <i>Suleyman Aremu Muyibi, Jamal Parveen, Wan Mohd Syraif Wan Sulaiman</i>	117
CHAPTER 22	COAGULATION PERFORMANCE OF BIOACTIVE CONSTITUENTS ISOLATED FROM MORINGA OLEIFERA SEED IN LOW TURBIDITY WATER TREATMENT <i>Suleyman A. Muyibi, Eman N. Ali, Mohamad Ramlan Mohamed Salleh, Hamzah Mohd Salleh and Md Zahangir Alam</i>	123
CHAPTER 23	DESIGN AND PRODUCTION OF CARBON NANOTUBE-BASED BIOSENSOR <i>Ma'an Alkhatib, Mohamad Faizal Bin Khamis, Waleed Fekry Faris</i>	130
CHAPTER 24	DESIGN OF AN ADSORPTION SYSTEM FOR THE REMOVAL OF PHENOL FROM WATER USING ACTIVATED CARBON <i>Ma'an Alkhatib, Ahmad Tariq Jameel, Mohammad N. A. Alherbawi</i>	138
CHAPTER 25	FEASIBILITY STUDY ON THE PRODUCTION OF BIODIESEL FROM MICROALGAE <i>Ma'an Alkhatib, Md. Zahangir Alam, Salma A. S. Binsilm</i>	148
CHAPTER 26	IDENTIFICATION OF SUITABLE RESIN TO BE MIXED WITH COMMERCIALY AVAILABLE CASSAVA STARCH FOR RIGID PACKAGING APPLICATION <i>Ma'an Alkhatib, Noorhaza Bt Alias</i>	155
CHAPTER 27	IMMOBILIZATION OF LIPASE ON MULTI-WALLED CARBON NANOTUBES <i>Ma'an Alkhatib, Hamzah Mohd Salleh, Anas M. N. Sultan</i>	162
CHAPTER 28	INTEGRATION OF ARTIFICIAL NEURAL NETWORK AND PRINCIPAL COMPONENT ANALYSIS TECHNIQUES FOR WASTEWATER TREATMENT PLANT EVALUATION <i>Mohammed Saedi Jami, Nassereldeen A. Kabbashi and Mustapha Mujeli</i>	169
CHAPTER 29	ISOLATION OF BACTERIA FROM OIL-CONTAMINATED SOIL FOR CRUDE OIL DEGRADATION <i>Ma'an Alkhatib, Humaidah Bt Dr Hj Muhammad Nur Lubis, Alade Abass Olanrewaju</i>	175
CHAPTER 30	ISOLATION OF BACTERIA FROM SOIL FOR PLASTICS DEGRADATION <i>Ma'an Alkhatib, Nur Amalina Binti Ahmad, Alade Abass Olanrewaju</i>	183

CHAPTER 31	OPTIMIZATION OF CELLULASE ENZYME PRODUCTION USING ARTIFICIAL NEURAL NETWORK	190
	<i>Mohammed Saedi Jami, Md. Zahangir Alam and Lamija Subasic</i>	
CHAPTER 32	POTENTIAL OF ARTIFICIAL NEURAL NETWORKS IN THE PREDICTION OF WASTEWATER TREATMENT PLANT PERFORMANCE	196
	<i>Mohammed Saedi Jami, Nassereldeen Ahmed Kabashi and Norhafiza Binti Abdullah</i>	
CHAPTER 33	PRODUCTION OF ACTIVATED CARBON FROM OIL PALM EMPTY FRUIT BUNCH FOR ADSORPTION OF CADMIUM IN AQUEOUS SOLUTION	202
	<i>Suleyman A. Muyibi, Ma'an Alkhatib, Jeminat Omotayo Amode</i>	
CHAPTER 34	PRODUCTION OF ACTIVATED CARBON FROM PALM OIL EMPTY FRUIT BUNCH BY CHEMICAL ACTIVATION	209
	<i>Ma'an Alkhatib, Monawar Munjid</i>	
CHAPTER 35	REMOVAL OF AQUEOUS ZINC (II) USING PROCESSED MORINGA OLEIFERA SEEDS	217
	<i>Suleyman A. Muyibi, Isam Y. Qudsieh, M. H. A. Rahman</i>	
CHAPTER 36	REMOVAL OF COLOUR FROM PALM OIL MILL EFFLUENT USING GRANULAR ACTIVATED CARBON (GAC)	224
	<i>Ma'an Alkhatib, Abdullah Al Mamun, Iqrah Akbar</i>	
CHAPTER 37	THERMAL PROPERTIES ENHANCEMENT FOR THE DEVELOPED OF ETHYLENE VINYL ACETATE/EPOXIDIZED NATURAL RUBBER/CARBON NANOTUBES NANOCOMPOSITES	232
	<i>Faridah Yusof and Norazlina Mohamed Yatim</i>	
CHAPTER 38	EFFECT OF CARBON NANOTUBES LOADING ON THE MECHANICAL PROPERTIES OF ETHYLENE VINYL ACETATE/EPOXIDIZED NATURAL RUBBER NANOCOMPOSITES	242
	<i>Faridah Yusof and Norazlina Mohamed Yatim</i>	
	INDEX	251

## CHAPTER 2

### REMOVAL CHARACTERISTICS OF MANGANESE ( $MN^{2+}$ ) BY CNTS

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#### ABSTRACT

Human activities are one of the biggest contributors for excessive manganese concentration in the environment. The proposed method to remove manganese in aqueous solution by using adsorption as in carbon nanotubes (CNT) at different parameters, which are CNT dosage, pH, agitation speed and contact time. Different pHs are pH 6.0, pH 6.5, pH 7.0, pH 7.5 and pH 8.0, CNT dosages are 5mg, 6.25mg, 7.5mg, 8.75mg or 10mg, contact time are 10 min, 32.5 min, 55 min, 87.5 min and 120 min while the agitation speeds are 100rpm, 150rpm, 200rpm, 250rpm and 300rpm. The parameters chosen for experiments are based on experimental design done by using CCD, Design Expert 6.0 with 4 parameters, 5 levels and 2 replications. Based on the results, condition set at pH 7.0, agitation speed of 300 rpm, 7.5mg and contact time 55 minutes gives the highest removal with 75.5%. From ANOVA analysis in Design Expert 6.0, the residual concentration will be very much affected by pH and CNT dosage. Initial manganese concentration is 1.2mg/L while the lowest residual concentration achieved is 0.294mg/L, which almost satisfy DOE Malaysia Standard B requirement.

**Keywords:** adsorption, CNT, DOE, manganese, parameters

#### INTRODUCTION

The removal of heavy metals from waters and wastewaters is important in terms of protection of public health and environment due to their accumulation in living tissues throughout the food chain as non-biodegradable pollutants (Gundogan, 2004). Several methods have been applied over the years on the elimination of these metal ions present in industrial wastewaters. The commonly traditional methods used for removal of heavy metal ions from aqueous solutions include ion-exchange, solvent extraction, chemical precipitation, phytoextraction, ultrafiltration, reverse osmosis, electrodialysis and adsorption (Ho, 2002; Srivastava, 2006). Adsorption is the one of the most important procedure for the removal of the heavy metals from the environment. The adsorption mechanisms of various adsorbents have been used to remove various heavy metal ions from aqueous solutions. Carbon nanotubes (CNTs) (Meyyappan, 2005) have come under intense multidisciplinary study because of their unique physical and chemical properties. CNTs include single-wall (SWCNTs) and multi wall (MWCNTs) depending on the number of layers comprising them. They have been used to adsorbents for hydrogen and other gases due to their highly porous and hollow structure, large specific surface area, light mass density and strong interaction