



**CARBON FROM AGRICULTURAL WASTE AS
AN ADSORBENT IN THE REMOVAL OF
CHROMIUM AND NICKEL IONS FROM
AQUEOUS SOLUTION**

by

NOR HARLINA BINTI HAJI HASSAN

**A thesis submitted
in fulfillment of the requirements for the degree of
Master of Science**

**School of Environmental Engineering
UNIVERSITI MALAYSIA PERLIS**

2009



DEDICATION

This work is dedicated to my husband, Bazli Azmi for his full support and to my childrens Muhammad Irfan, Muhammad Nabil, Nurul Irdina, Nurul Nabihah and Nurul Hasanah for appreciating and understanding Ummi.

© This item is protected by original copyright

ACKNOWLEDGEMENTS

First of all, I would like to express my grateful to Allah S.W.T for all His gifts that this thesis was completed on time. This thesis also dedicated to my dear family with all their pray, patience and full support that encourage me to go through the obstacle to complete my thesis.

I would like to thank Ministry of Higher Education for providing scholarship for this study, School of Environmental Engineering, UniMAP, School of Materials Engineering, UniMap and Politeknik Sultan Abdul Halim Mua'azam Shah.

I wish to acknowledge my sincere gratitude to my supervisor En. Saiful Azhar Saad and my co-supervisor Dr. Khairul Nizar Ismail (Dean of School of Environmental Engineering) and Dr. Ong Soon An who has shown endless support, understanding and kindly helped me to complete my thesis. Thanks also to the Dean of School of Materials Engineering, Pn. Naimah Ibrahim, En. Ragunathan Santiago and all lecturers at School of Environmental Engineering, UniMAP for their support.

I also would like to express my gratitude for all PLVs and technicians at School of Environmental Engineering, School of Materials Engineering UniMAP and Politeknik Sultan Abdul Halim Mua'azam Shah for their warm help during my experiment. I also wish to thanks all of mananagement staff at School of Environmental Engineering, UniMAP, En. Jamil at Gula Padang Terap Sdn. Bhd and Pn. Hafishoh at Department of Environment, Perlis.

Last but not least I also wish to dedicate the thesis to my faithful friends especially

Normah, Habsah, Izza, Hawa, Libren, Mokhzani, Ayu, Lutfi and to all that contributed their help directly or indirectly. THANK YOU VERY MUCH.

© This item is protected by original copyright

TABLE OF CONTENTS

	Page
DEDICATION	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	v
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF APPENDICES	xv
NOMENCLATURE	xvi
LIST OF ABBREVIATION	xvii
ABSTRAK	xix
ABSTRACT	xxi
CHAPTER ONE: INTRODUCTION	
1.1 Agricultural waste	1
1.2 Sugarcane bagasse	2
1.3 Rice straw	3
1.4 Wastewater treatment	4
1.5 Problem statement	5
1.6 Research Objectives	6
1.7 Research Scope	6

2.1	Treatment of Industrial Wastewater containing heavy metals	7
2.2	Heavy metals	11
	2.2.1 Nickel	11
	2.2.2 Chromium	12
2.3	Adsorption	12
	2.3.1 Types of adsorption	13
	2.3.2 Factors which affect adsorption	14
2.4	Activated Carbon	
	2.4.1 Preparation of activated carbon	18
	2.4.2 Pyrolysis	18
	2.4.3 Activation	19
2.5	Removal of metal ions from aqueous solution by agricultural waste adsorbent	20
	2.5.1 Preparation of adsorbent from agricultural waste	21
2.6	Review study characterization of raw materials and prepared adsorbents	23
2.7	Adsorption equilibrium	28
2.8	Adsorption capacity	28
2.9	Adsorption isotherms	29
	2.9.1 Langmuir Isotherm	30
	2.9.2 Freundlich isotherm	32
2.10	Adsorption kinetic	33
	2.10.1 Order of reaction	34

CHAPTER THREE: METHODOLOGY

3.1	Raw materials	37
3.2	Solutions preparation	37
3.2.1	Stock solution of metal ions	38
3.2.2	Atomic Absorption Spectrometry (AAS)	38
3.3	Production of adsorbent	40
3.4	Characterization of adsorbents	42
3.4.1	Yield	42
3.4.2	Density	42
3.4.3	pH	43
3.4.4	Total Ash Content	43
3.4.5	Moisture content	44
3.4.6	Surface area	44
3.4.7	Functional Groups	45
3.4.8	Surface morphology	47
3.5	Adsorption study	46
3.6	Batch Adsorption experiment	46
3.6.1	Adsorption isotherm and kinetic study	47
3.7	Batch adsorption studies at various conditions	48
3.7.1	Effect of pH	48
3.7.2	Effect of contact time	48

3.7.3	Effect of adsorbent doses	49
3.7.4	Effect of particle sizes of adsorbents	49
3.7.5	Effect of initial metal concentration	49
3.7.6	Effect of temperature	50

CHAPTER 4: RESULTS AND DISCUSSION

4.1	Characterization of adsorbents	51
4.1.1	Yield of adsorbents	51
4.1.2	Physical and chemical properties of adsorbents	52
4.1.3	Functional Groups	58
4.1.3(a)	Functional groups of sugarcane bagasse and pyrolyzed sugarcane bagasse	58
4.1.3(b)	Functional groups of rice straw and pyrolyzed rice straw	62
4.1.4	Surface Morphology changes and elemental composition	66
4.1.5	Relationship between pyrolysis temperature and removal efficiency of adsorbent	71
4.1.6	Selection of adsorbents for Adsorption study	72
4.2	Equilibrium studies of nickel and chromium adsorption onto RSC and SBC at various conditions	74
4.2.1	Effect of pH	74
4.2.2	Effect of contact time	78
4.2.3	Effect of adsorbent dose	80
4.2.4	Effect of particle size	82
4.2.5	Effect of initial concentration and temperature	84
4.3	Adsorption isotherms	89

4.3.1	Langmuir adsorption models	89
4.3.2	Freundlich adsorption models	94
4.4	Adsorption kinetics	95
4.4.1	Pseudo-first-order and pseudo-second-order kinetic models	99
4.4.2	Intra-particle diffusion studies	104
CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS		104
5.1	Conclusion	107
5.2	Recommendations	110
REFERENCES		111

© This item is protected by original copyright

LIST OF TABLES

Table 1.1	The proximate and ultimate analyses of sugarcane bagasse (unit: wt. %)	3
Table 1.2	The proximate and ultimate analyses of rice straw (unit: wt. %)	4
Table 2.1	Maximum effluent discharge standards of heavy metals in surface water and their toxication (Kurniawan <i>et al.</i> , 2006)	7
Table 2.2	Parameter limits of effluent of standards A and B	9
Table 2.3	Summary of the treatability of physico-chemical treatments for inorganic effluent (Kurniawan <i>et al.</i> , 2006)	10
Table 2.4	Pore diameter	15
Table 2.5	Summary of modified agricultural waste as adsorbents for the removal of heavy metal ions from aqueous solution	23
Table 2.6	Summary of Physical modification of agricultural waste	25
Table 2.7	Summary of Chemical modification of agricultural waste	27
Table 2.8	The value of separation factor R_L	32
Table 3.1	Maximum absorbance wavelength of heavy metals	39
Table 3.2	Working conditions of Atomic Absorption Spectrometer AAAnalyser 700	39
Table 4.1	Micropore volume, total pore volume and pore size of RSC and SBC as a function of carbonization temperature	57
Table 4.2	Interpretation results of FTIR spectra of raw sugarcane bagasse	60
Table 4.3	Surface functional groups of SB, SBC and CAC	61
Table 4.4	Interpretation results of FTIR spectra of raw rice straw	63
Table 4.5	Surface functional groups of RS and RSC	65
Table 4.6	Elements and chemical composition of adsorbents using EDX	71

Table 4.7	Physical and chemical properties of the selected adsorbents (Carbonization temperature: 700 °C)	73
Table 4.8	The effect of initial metal ions concentration and temperature on the equilibrium adsorption capacity of RSC and SBC	88
Table 4.9	Langmuir parameters of adsorption isotherms for (a) nickel and (b) chromium adsorption on SBC and RSC at different temperatures	93
Table 4.10	Freundlich parameters of adsorption isotherms for (a) nickel and (b) chromium adsorption on SBC and RSC at different temperatures	98
Table 4.11	Pseudo first-order kinetics results of removal of (a) nickel and (b) chromium onto RSC and SBC	101
Table 4.12	Pseudo second-order kinetics results of onto RSC and SBC	103
Table 4.13	Intra-particle diffusion rates (k) and relative particle film thickness (I) values for the plots of q_t versus $t^{1/2}$	106

© This item is protected by original copyright

LIST OF FIGURES

Figure 2.1	Schematic representation of porosity in activated carbons	16
Figure 3.1	Calibration curve for Nickel(II)	39
Figure 3.2	Calibration curve for Chromium(VI)	40
Figure 3.3	Flow diagram of pyrolysis process	41
Figure 4.1	Effect of temperature on % yield	52
Figure 4.2	Effect of temperature on apparent density	53
Figure 4.3	Surface area of carbon at different pyrolysis temperatures	55
Figure 4.4	The apparent of SBC and RSC produced at different pyrolysis Temperature of 300 – 700 °C	55
Figure 4.5	FT-IR spectra of raw sugarcane bagasse	59
Figure 4.6	The Overlay FT-IR spectra of raw sugarcane bagasse (SB), sugarcane bagasse carbon (SBC 300 - 700) at different pyrolysis temperatures of 300 - 700 °C and commercial activated carbon (CAC)	61
Figure 4.7	FT-IR spectra of rice straw	63
Figure 4.8	The Overlay FT-IR spectra of raw rice straw (RS), rice straw carbon (RSC 300 - 700) at different pyrolysis temperatures of 300 - 700 °C	65
Figure 4.9	Scanning electron micrograph of sugarcane bagasse carbon produced at different pyrolysis temperature	67
Figure 4.10	Scanning electron micrograph of rice straw carbon produced at different pyrolysis temperature	69
Figure 4.11	Effect of pyrolysis temperature on removal efficiency of Ni(II) and Cr(VI) on RSC and SBC	73
Figure 4.12	Effect of pH on the adsorption of Cr(VI) by RSC and SBC	76
Figure 4.13	Effect of pH on the adsorption of Ni(II) by RSC and SBC	77

Figure 4.14	Precipitation curve for Cr(VI) and Ni(II)	77
Figure 4.15	Effect of contact time on the removal of chromium	78
Figure 4.16	Effect of contact time on the removal of nickel	79
Figure 4.17	Effect of adsorbent dose of RSC and SBC on chromium adsorption	81
Figure 4.18	Effect of adsorbent dose of RSC and SBC on nickel adsorption	81
Figure 4.19	Effect of particle size of RSC and SBC on chromium adsorption	83
Figure 4.20	Effect of particle size of RSC and SBC on nickel adsorption	83
Figure 4.21	Effect of initial concentration and temperature on the removal of nickel onto SBC	86
Figure 4.22	Effect of initial concentration and temperature on the removal of nickel onto RSC	86
Figure 4.23	Effect of initial concentration and temperature on the removal of chromium onto SBC	87
Figure 4.24	Effect of initial concentration and temperature on the removal of chromium onto RSC	87
Figure 4.25a	Langmuir isotherms at different temperatures of nickel removal on SBC	91
Figure 4.25b	Langmuir isotherms at different temperatures of nickel removal on RSC	92
Figure 4.26a	Langmuir isotherms at different temperatures of chromium removal on SBC	92
Figure 4.26B	Langmuir isotherms at different temperatures of chromium removal on RSC	93
Figure 4.27a	Freundlich isotherms at different temperatures of nickel removal on SBC	96
Figure 4.27b	Freundlich isotherms at different temperatures of nickel removal on RSC	96

Figure 4.28a	Freundlich isotherms at different temperatures of chromium removal on SBC	97
Figure 4.28b	Freundlich isotherms at different temperatures of chromium removal on RSC	97
Figure 4.29a	Pseudo-first-order kinetic plots for the removal of nickel by RSC and SBC	100
Figure 4.29b	Pseudo-first-order kinetic plots for the removal of chromium by RSC and SBC	101
Figure 4.30a	Pseudo-second-order kinetic plots for the removal of nickel by RSC and SBC	102
Figure 4.30b	Pseudo-second-order kinetic plots for the removal of chromium by RSC and SBC	102
Figure 4.31a	Plots of intra-particle diffusion model for adsorption of nickel on RSC and SBC at 25 °C	105
Figure 4.31b	Plots of intra-particle diffusion model for adsorption of chromium on RSC and SBC at 25 °C	106

© This item is protected by original copyright

LIST OF APPENDICES

Appendix A: Perkin-Elmer Atomic Absorption Spectrometer model AAAnalyser 700	122
Appendix B: Surface area and porosity analyzer model Micromeritics Tristar 3000	123
Appendix C: Perkin-Elmer-RX 1 FT-IR System	124
Appendix D: SEM model JEOL JSM-6460 LA	125

© This item is protected by original copyright

NOMENCLATURE

Symbol	Description	Unit
C_e	The concentration at equilibrium in solution	mg/L
C_i	The initial concentration in the solution	mg/L
C_t	The concentration at time, t in solution	mg/L
I	The constant of intraparticle diffusion	mg/g
K_a	Langmuir constant	L/mg
K_f	Freundlich constant	L/g
k_1	The rate constant of pseudo-first order adsorption	L/min
k_2	The rate constant of pseudo-second order adsorption	g/mg min
k_{id}	The initial rate intraparticle diffusion	g/mg min ^{1/2}
M	The mass of adsorbent	g
n	Dimensionless empirical constant	-
q_e	The concentration of solute adsorbed on the solid at equilibrium	mg/g
q_i	The initial concentration of solute adsorbed on the solid	mg/g
q_m	Maximum adsorption capacity	mg/g
q_t	The concentration of solute adsorbed on the solid at time, t (Adsorption capacity at time, t)	mg/g
R	The removal efficiency	%
R_L	Dimensionless constant separation factor	-
T	Time	min
V	Volume of the solution	L

LIST OF ABBREVIATION

Aluminium oxide	Al_2O_3
Ammonium persulphate	$\text{NH}_4\text{S}_2\text{O}_8$
American Society for Testing and Materials Standard	ASTM
Atomic Absorption spectrometry	AAS
Brunauer-Emmet-Teller	BET
Biochemical Oxygen Demand	BOD
Chemical oxygen Demand	COD
Energy Dispersive X-ray	EDX
Environmental Protection Agency	EPA
Fourier Transform Infrared	FT-IR
Granular activated carbon	GAC
Hydrochloric acid	HCl
International Union of Pure and Applied Chemistry	IUPAC
Nickel(II) sulphate-6-hydrate	$\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$
Phosphoric acid	H_3PO_4
Phosphoric pentoxide	P_2O_5
Potassium dichromate	$\text{K}_2\text{Cr}_2\text{O}_7$
Potassium hydroxide	KOH
Potassium oxide	K_2O
Powder activated carbon	PAC
Rice straw	RS
Rice straw carbon	RSC

Scanning Electron Microscopy	SEM
Silicon dioxide	SiO ₂
Sugarcane bagasse	SB
Sugarcane bagasse carbon	SBC
Sodium hydroxide	NaOH
Sulfuric acid	H ₂ SO ₄
Zinc chloride	ZnCl ₂

© This item is protected by original copyright

ABSTRAK

Objektif kajian ini adalah untuk menghasilkan karbon daripada hampas tebu dan jerami padi melalui teknik pirolisis sebagai penjerap kepada nikel(II) dan kromium(VI) dan untuk menentukan keadaan optima bagi hubungan dengan masa sentuhan, pH larutan, dos penjerap, saiz zarah penjerap, kepekatan awal larutan dan suhu. Juga penjerapan garis sesuhu dan kelakuan kinetik penjerapan bagi penyingkiran nikel(II) dan kromium(VI) oleh setiap penjerap akan ditentukan.

Hampas tebu dan jerami padi adalah sisa pertanian tempatan yang murah dan mudah didapati. Bahan-bahan mentah tersebut telah dipirolisis pada julat suhu 300 – 700°C selama 30 minit dengan kadar pembakaran purata 30 °C/minit.

Penjerap-penjerap itu telah dikaji ciri-ciri seperti hasilan, ketumpatan, pH, kandungan abu, kadungan lembapan, keluasan permukaan dan keliangan dengan menggunakan Penganalisa keluasan permukaan dan keliangan BET, gugusan permukaan dengan menggunakan Pengubah Fourier inframerah, morfologi permukaan dengan menggunakan Elektron mikroskop imbasan dan elemen serta komposisi kimianya dengan menggunakan Serakan tenaga sinar-X.

Penjerapan didapati telah dipengaruhi oleh suhu pirolisis dan luas permukaan. Penjerap-penjerap yang dihasilkan pada suhu 700 °C telah dipilih untuk kajian penjerapan ini kerana ia menghasilkan peratus penyingkiran yang tertinggi. Keupayaan penyingkiran maksimum Ni(II) ke atas RSC dan SBC adalah masing-masing 85.65% dan 21.79%, dan Cr(VI) ke atas RSC dan SBC pula adalah masing-masing 61.81% dan 76.10%

Operasi parameter-parameter termasuk masa sentuhan (15 – 210 minit), pH larutan (1.0 – 10.0), suhu (25, 30, 45 and 55 °C), saiz partikel (1.18 mm, 600 µm, 300 µm and 150 µm), dos penjerap (0.04, 0.10, 0.20, 0.40, 0.6 and 1.0 g) dan kepekatan awal larutan (10, 25, 50, 75 and 100 mg/L). Eksperimen-eksperimen telah dijalankan secara berkelompok. Masa sentuhan, banyaknya penjerap, suhu, saiz partikel dan kepekatan awal larutan ion logam berat telah memberi kesan kepada muatan penjerapan, namun begitu yang paling penting keputusannya bergantung kepada pH larutan.

Data telah dianalisis dengan menggunakan persamaan Langmuir dan Freundlich. Kebolegunaan penjerapan telah ditunjukkan dengan model garis sesuhu Langmuir and Freundlich. Ia menunjukkan bahawa model garis sesuhu Langmuir padan data dengan baik bagi nickel(II) and chromium(VI). Nilai koefisien pembetulan R^2 yang tinggi dan factor pemisah tak berdimensi, R_L yang didapati menunjukkan bahawa penjerapan kedua-dua penjerap adalah baik. Model kinetik pseudo tertib pertama, pseudo tertib kedua dan model resapan intrazarah telah digunakan dengan menganalisis data eksperimen kinetik. Ia

menunjukkan kedua-dua penjerap mematuhi kinetik pseudo tertib kedua dengan baik. Kebolehan kedua-dua penjerap menjerap nikel(II) and kromium(VI) juga telah dibandingkan. Ia menunjukkan bahawa muatan penjerapan karbon jerami padi lebih baik bagi penjerapan nikel(II) kerana kehadiran gugusan oksigen permukaan, caj permukaan, tinggi kandungan silica dan sifat-sifat nikel sendiri. Sebaliknya karbon hampas tebu mempunyai muatan penjerapan yang tinggi terhadap kromium(VI) kerana mempunyai keluasan permukaan yang tinggi, caj permukaan dan sifat-sifat kromium itu sendiri.

© This item is protected by original copyright

ABSTRACT

The objectives of this study were to produce carbon from sugarcane bagasse and rice straw by pyrolysis technique as an adsorbent for heavy metal removal and to determine the optimum condition with respect to contact time, pH of solution, adsorbent doses, particle sizes of adsorbent, initial metal concentration and temperature. Also adsorption isotherm and adsorption kinetic behavior of nickel(II) and chromium(VI) removal by each adsorbent will be determined.

Sugarcane bagasse and rice straw are inexpensive and locally available agricultural waste. The raw materials were pyrolyzed at different temperatures ranging from 300 – 700 °C for 30 minutes with the average heating rate of 30 °C/minute.

The adsorbents were characterized for the yield, density, pH, ash content, moisture content, surface area and porosity by using BET surface area and porosity analyzer, functional groups by using Fourier Transform Infrared, surface morphology by using Scanning Electron Microscope and element and chemical composition by using Energy Dispersive X-ray.

Adsorptions were found to be affected by pyrolyzing temperature and surface area. The adsorbents that produced at 700 °C have been chosen for this adsorption study because it produced the highest percentage of removal. The maximum removal efficiency of Ni(II) on RSC and SBC as 85.65% and 21.79 %, respectively and Cr(VI) on RSC and SBC as 61.81 % and 76.10 %, respectively.

The operation parameters included contact time (15 – 210 minutes), pH of solution (1.0 – 10.0), temperature (25, 30, 45 and 55 °C), particle sizes of adsorbents (1.18 mm, 600 µm, 300 µm and 150 µm), adsorbents doses (0.04, 0.10, 0.20, 0.40, 0.6 and 1.0 g) and initial concentrations of adsorbates (10, 25, 50, 75 and 100 mg/L). The experimental tests were conducted in batch process. The contact time, amount of adsorbent, temperature, particle size of adsorbent and initial concentration of the metal ions solutions affect the adsorption efficiency but most importantly depended on the pH of solution.

The experimental isotherms data were analyzed by using Langmuir and Freundlich equation. The applicability of adsorption was described by using the Freundlich and Langmuir adsorption isotherm. It was found that Langmuir isotherm model fit well the data for nickel(II) and chromium(VI). The measured high linearity of correlation coefficient, R^2 and the values dimensionless separation factor, R_L indicated a favorable adsorption of both Ni(II) and Cr(VI) onto RSC and SBC, respectively. While, the adsorption kinetics, pseudo-first order model, pseudo second order model and intra-

particle diffusion model were analyzed on the experimental kinetics data. It was found that the pseudo second order kinetic model described the adsorption kinetic of both adsorbent well. The performance of both adsorbent in the removal of nickel(II) and chromium(VI) were also compared. It was found that the adsorption capacity of rice straw carbon on nickel(II) was high may be due to the present of surface oxygen groups, surface charge, high silica content and the properties of nickel. While, the adsorption capacity of sugarcane bagasse carbon on chromium(VI) was high was caused by the high surface area of the adsorbent, surface charge and the properties of chromium..

© This item is protected by original copyright

INTRODUCTION

1.1 Agricultural waste

Principal sources of agricultural waste are mainly farming activities or agro-industry, such as crops harvesting, abattoirs and tanneries. Waste includes organic sludge effluents, used pesticides and fertilizers, chemical containers and crop residues. Waste is often defined as something unwanted and has no economic value. However, increasingly waste generation may provide a source with certain economic values for another usage. Whereas new products can be generated from various kinds of crop residues with appropriate technology, for examples generation of energy from palm oil waste, production of compost or fertilizer from rice hull and converting rice husk to carbon and etc. Furthermore, waste if not handled properly will effect to human health and the environment (IMPAK, 2006).

Agricultural waste which is available and inexpensive in some places may be a better option for adsorbent production. A few adsorbents that stand out for high adsorption capacities are agricultural waste such as coconut shell and coirpith. These adsorbents are efficient and can be effectively used for inorganic effluent treatment containing metal ions (Babel and Kurniawan, 2004). Recently, various low cost adsorbents derived from agricultural waste, industrial by-products or natural materials, had been investigated intensively for heavy metal removal from contaminated wastewater (Kurniawan *et al.*, 2006).

Agricultural waste, such as sugarcane bagasse and rice straw are major contributors to the environment pollution especially during harvesting season. Availability of sugarcane bagasse and rice straw may offer inexpensive and renewable additional source of carbons. Sugarcane bagasse and rice straw can be an interesting precursor for activated carbon as it is cheap and easily available in Southeast Asia (Bernardo *et al.*, 1997). Moreover, it can be a way to avoid pollution cause by dumping or burning of the waste materials.

1.2 Sugarcane bagasse

Sugarcane (*Saccharum Officinarum Linn*) planted area is about 16,000 hectares in Malaysia (GAIN Report, 2005). The rapid growth of the sugarcane plants is an advantage for providing a lot of bagasse to produce new products. Bagasse is a residual cane pulp remaining after sugar had been extracted and it is a fibrous waste-product of the sugar refining industry. The sugar refinery industry produced two tonnes of bagasse from one tonne of refined sugar (Guillaume-Signoret, 2006). Bagasse is either used as fuel by sugar mills or a raw material for paper manufacturing in India (Garg *et al.*, 2007). The elemental compositions of sugarcane bagasse are shown in Table 1.1.

Abundantly available sugarcane bagasse has potential as a low cost carbon for removing organic and inorganic compounds in wastewater. Many researches, on sugarcane bagasse, (Pendyal *et al.*, 1999; Ahmedna *et al.*, 2000; Tsai *et al.*, 2001; Ahmad Khan and Wan Mohamad Amin, 2005; Jaguaribe *et al.*, 2005; Karnitz Jr. *et al.*, 2007; etc) had conducted to produce carbon as an adsorbent in wastewater management strategies. Several studies showed that the carbons produced from sugarcane bagasse can be used in sugar decolorization (Ahmedna *et al.*, 2000), removal of dyes (Tsai *et al.*, 2001), cadmium uptake