# An Overview; Wastewater Treatment Using Biochar to Reduce Heavy Metals

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## ABSTRACT

Environmental management is a issue in recent decades such as waste production by indutry especially wastewater. Needed biomaterial to solve wastewater problem caused biomaterial is a green material give not negative impact for environment. Biochar is a green leap toward reducing heavy metals content on wastewater using coconut shell waste. Biochar has been world used in many studies and practical applications are only limited to remediation of contaminants on soil. This paper describes the basic understanding and recent development biochar as an innovative solution for treating wastewater. Thus, this paper is expected to provide clear information about biochar to reducing heavy metals content on wastewater and inspiration for ongoing and future research benefit.

***Keywords**: Environmental managament, Wastewater, Biochar, Heavy metals.*

## INTRODUCTION

Environmental management is a issue in recent decades (Ruokonen & Temmes, 2019) such as climate change (Lejano, 2019), solid waste (Pfennigstorf, 1979), soil (Boddu et al., 2018), wastewater (de Matos et al., 2017) and air pollution (Pfennigstorf, 1979) will give negative impact for human health (Sun et al., 2018) and environment (Mandal & Kaur, 2019). biochar has attracted much attention due to its promising role in many environmental management issues (Kumar, Loganathan, Gupta, & Barnett, 2011)Biochar is a product of pyrolysis, gasification and combustion process (Bridgwater, 2012) can be produced by all of organic materials (Zhikun Zhang, Zhu, Shen, & Liu, 2019).

This review aims to present the efficiency of biochar in wastewater treatment and biochar production by conventional conversion of coconut-shell biomass. Wastewater is a liquid waste that dangerous for environment and will give some impact for human health (Nzediegwu et al., 2019) and ecological balance (Gupta et al, 2009). The review also presents recent advances on coconut cultivation, and conversion of harvested biomass with the focus on biochar production through pyrolysis process.

## WASTEWATER TREATMENT USING BIOCHAR

Biochar is a biomaterial has producing by organic matters, organic material that potential to creat biochar is coconut-shell (Xu et al., 2018). Indonesia is a big country that produce organic waste 64 billion tons/years with organic waste is 60% from the total waste. This waste will be give an impact for environment and human health (Mandal & Kaur, 2019) while solid waste give ,some negative impacts for human and environment, we have problem about environmental damage by industrial company. Industrial company that give some impact for environment especially in wastewater. Several studies inform that wastewater can treatments by plants (Caicedo et al., 2019), thus, we could utilize organic waste as a biomaterial that reducing wastewater.

Biochar is a new material produced by solid organic material such as coconut shell, cassava, wood, and all of organic materials. When we use biochar as a low-cost adsorbent we could save environment by solid waste caused biochar has produced by solid waste, environmental damage by wastewater and we could help socio-economy community. Recent study inform the biochar could growing up socio-economy in several community (Qambrani, Rahman, Won, Shim, & Ra, 2017)

Wastewater is dangerous material in environment, wastewater could create by mining industry (Motsi, Rowson, & Simmons, 2009), hospital (Paulus et al., 2019), food industry (Nechifor et al, 2016) and else. Wastewater has characterized by physical and chemical parametes (Wu, Yan, Zhou, & Xu, 2014) such as heavy metals content (McNamara et al., 2018), pH, temperature, salinity, BOD, COD, TSS and else (Kuyucak & St-Germain, 2016; Maya, Radin, Miau, Hashim, & Kassim, 2016; Wu et al., 2014) Wastewater have high BOD and COD content (Oladipo, Adeleye, Oladipo, & Aleshinloye, 2017)heavy metals.

Several study inform biochar could reduce heavy metals in wastewater. It caused biochar have good pores as an adsorbent, biochar could reduce heavy metals such as Cu, Ni, Cd, Zn, Al, U, Pb in many temperature for pyrolysis process. Recent study inform biochar could reducing until 95% heavy metals in wastewater with Langmuir isoterm and many mechanism **(Attachment 1).**

## CONLUSION

In this review, a wide range of biochar properties, production techniques and applications are explained. Different pyrolysis conditions and feedstock materials influence the quantities and qualities of biochar, and can be tailored according to individual requirements. Biochar is a biomaterial by char that potential organic material for environmental management especially wastewater treatment. Biochra could reduce heavy metals such as Cu, Ni, Cd, Zn, Al, U, Pb in $q_{max}$ are between 0.1309a until 62.7 with pyrolisis process in many temperatures and biochar sources. Isoterm adsorption of biochars are following Langmuir in many mechanisms. Experimental and modeling studies for create biochar are highly recommended for future research.

**Table 1.** Effect of Biochar Properties on Heavy Metals

| Biochar | Pyrolysis Temperature | Contaminants | Removal (%) | $Q_{max}$ ($mg.g^{-1}$) | Isotherm | Mechanism | Reference |
|---|---|---|---|---|---|---|---|
| Broiler litter | 500 | Cu | 75.2 | - | - | Chemisorption into a negatively charged inorganic fraction | (I. M. Lima, Boateng, & Klasson, 2010) |
| Broiler litter | 500 | Cd | 21.7 | - | - | | |
| Broiler litter | 500 | Ni | 10.1 | - | - | | |
| Broiler litter | 500 | Zn | 16.4 | - | - | | |
| Broiler litter | 700 | Cu | 95 | - | - | Adsorption by inorganic constituent (e.g phosphorus) | (I. Lima et al., 2009) |
| Broiler litter | 700 | Cd | 82.3 | - | - | | |
| Broiler litter | 700 | Ni | 5.1 | - | - | | |
| Broiler litter | 700 | Zn | 90.9 | - | - | | |
| Broiler litter | 800 | Cu | 86.9 | - | - | Adsorption by inorganic constituent (e.g phosphorus) | (I. Lima, Boateng, & Klasson, 2009) |
| Broiler litter | 800 | Cd | 59.9 | - | - | | |
| Broiler litter | 800 | Ni | 6 | - | - | | |
| Broiler litter | 800 | Zn | 75.7 | - | - | | |
| Canola Straw | 400 | Cu(II) | - | 0.59a | Langmuir | Surface complexion with carboxylic and hydrocyl functional group/adsorption through electronic attraction operating between biochar biochar surface and Cu | (Tong, Li, Yuan, & Xu, 2011) |
| Catle Manure | 100 | Al | - | 0.242a | Langmuir | Surface complexion of Al to oxygen containing | (Qian L, & Chen B, 2013) |
| Catle Manure | 400 | Al | - | 0.297a | Langmuir | Functional group and surface adsorption /copresipitation | (Chen et al., 2011) |
| Catle Manure | 700 | Al | - | 0.243 | Langmuir | Adsorption by inorganic constituent | (Chen et al., 2011) |
| Pine needles | 600 | U(VI) | - | 62.7 | Langmuir | PH depend adsorption | (Zhi Bin Zhang, Cao, Liang, & Liu, 2013) |
| pinewood | 200 | Pb(II) | - | 3.89 | Langmuir | Adsorption/diffusion into pores | (Liu & Zhang, 2009) |
| Rise husk | 300 | Pb(II) | - | 1.84 | Langmuir | | |
| Rise straw | 300 | Pb | - | 0.1309a | Langmuir | Surface complexation of Al to oxygen containing | (Qian L, & Chen B, 2013) |
| Rise straw | 100 | Al | - | 0.3976a | Langmuir | Functional groups and deposition of albite | |

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