



942/D

Biochar as a sustainable solution for pollution remediation from the municipal solid waste dumps in Sri Lanka

Yohan Jayawardhana^{1,2} and Meththika Vithanage^{1,3*}

¹*Environmental Chemodynamics Project, National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka*

²*Postgraduate institute of Science, University of Peradeniya, Peradeniya, Sri Lanka*

³*Office of the Dean, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

Pyrolysis of municipal solid waste (MSW) is a thermal conversion process which can be successfully used to transform the organic waste into energy and a value added by-product, Biochar. Since the estimated biodegradable portion is prominent and denoted as 60% from the total waste generation in Asian developing countries, pyrolysis will be a promising solution for the MSW open dumps. The objectives of this study were to evaluate physicochemical characteristics of MSW biochar (MSW-BC) produced from Organic MSW as a sustainable solution for landfill contaminant remediation. Biochar was pyrolyzed from the MSW in an onsite pyrolyzer around 450 °C with a holding time of 30 min. For physicochemical properties of biochar, pH, point of zero charge, electrical conductivity, proximate analysis, ultimate analysis, heavy metal composition, bioavailable heavy metal composition, and BET surface area were determined, in order to study its potential to be used as a sustainable material for pollution control at the open dumps. In addition, surface functional groups and structural identification were determined by respectively FTIR analysis and scanning electron microscopy analysis. Adsorption capacities for the volatile organic compounds (VOCs) (benzene, xylene and toluene) were examine by batch sorption experiments. The ultimate analyses results indicated that the low molar O/C ratio is due to high pyrolytic temperature derived MSW-BC. Additionally, FTIR suggested a loss of labile, aliphatic compounds and functional groups during pyrolysis and the formation of more recalcitrant, aromatic constituents, whereas BET and SEM data revealed a well developed porous structure and surface properties, which indicates MSW-BC to be a potential sorbent. Further, reported total and bioavailable heavy metal content were low in MSW-BC, hence it can be easily mixed with compost and used as a fertilizer. At the same time, MSW-BC will potentially be used to remediate heavy metals in the landfill leachate. Furthermore, MSW-BC demonstrated a strong ability to remove VOCs, and hence it can easily be used as a landfill cover and permeable reactive barrier material. Thus, conversion of MSW to BC would allow effective engineering to optimize their properties to be used as a potential material for sustainable resource management.

Keywords: Biochar, VOC, Landfill leachate.

Acknowledgment: Financial support from the JICA-JST SATREPS grant and NRC 15-24 is gratefully acknowledged

meththikavithanage@gmail.com

+940750279477