

The Surface Morphology and Variation of Removal of Heavy Metals from Urban Runoff using Biochar-Based Cement Paste Adsorbent

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Many studies have reported that Cu, Zn, and Pb, are the most common heavy metals found in urban runoff and they have strong mobility and toxicity. Biochar-containing materials are used for the in-situ removal of heavy metals. However, the effect of cement addition to biochar on heavy metal removal has not been studied in the available literature. Additionally, these studies used biochar synthesized under controlled laboratory conditions using muffle furnaces. The biochar used in this study was prepared using a double chamber draft-down pyrolysis reactor with a residence time of 25 ±5 minutes and pyrolysis temperature of 350-450 °C with paddy husk. Ordinary Portland cement and paddy husk biochar were mixed with an initial water/binder ratio of 0.40. The mixture was packed into Polyvinyl Chloride sections of 50 mm x 100 mm size and column removal experiments were carried out to determine Cu, Pb and Zn removal. Through Scanning Electron Microscopy (SEM) images, hydrated cement products were observed covering parts of the biochar surface and inside the pores of the biochar particle. Thus, the surface area of the biochar available for interaction with heavy metals had decreased. However, the addition of cement 1.5% (v/v) into biochar increased removal capacity approximately 2 times for Cu removal, 3 times for Pb removal and Zn removal. This is due to cement having a higher removal potential of heavy metals compared to plain biochar. The effect of the initial pH on the removal efficiencies of heavy metals was significant for plain biochar but, was negligible for the cement-modified biochar. Hence, the results of this research opened a new pathway in biochar modification. However, the effluent pH was above 11 after cement modification. Thus, the effluent needs to be neutralized before discharge into the environment.

Keywords: Industrial biochar, Cement, Heavy metals, Stormwater, Removal

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