Laboratory study of water infiltration and evaporation in biochar-amended landfill covers under extreme climate

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First Author	
Last Author	
Authors	Chen, ZK; Kamchoom, V; Apriyono, A; Chen, R; Chen, CW;
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Abstract	Biochar has been used as an environment-friendly enhancer to improve the soil hydraulic properties. Previous studies focused on the effect of biochar addition for irrigation in agricultural soils. However, the understanding of the influence of biochar addition on water infiltration in compacted soils as used in landfill covers is limited. This study investigated the effects of peanut shell biochar addition on soil water infiltration with consideration of soil microstructure variations. The performance of biochar-amended soil was also explored under extreme rainfall and drought conditions. In this experiment, peanut shell biochar with particles finer than 0.25 mm was amended into compacted silty sand. Index soil properties and microstructure were observed. One-dimension (1D) column tests and corresponding numerical modelling were carried out to investigate the performance of this cover material under different climate scenarios. The results suggested that the application of biochar can increase soil porosity, but a significant number of large pores (i.e., larger than 20 mu m) was minimized. With the application of biochar, the soil covers thus become more efficient in preventing infiltration and percolation. This is also crucial to minimize the need for a relatively large thickness of soil cover. With an increase in porosity, the biochar can improve the soil water retention. Under extreme drought, the application of biochar can reduce the very low pore-water pressure (PWP) in soils by more than 50%. From all of these, peanut shell biochar can potentially be an eco-friendly and more sustainable solution for soil covers, even under extreme climate conditions.
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Author	Dr.Eng ARWAN APRIYONO, S.T, M.Eng