Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2018-85
Project Title:	Converting organic municipal solid waste into biochar for application in ecological restoration
Applicant:	Professor Ng Wang Wai, Charles, Department of Civil and Environmental Engineering, The Hong Kong University of Science and Technology
Total Approved Grant:	$2,250,312
Duration:	1/7/2019 to 30/6/2022
Project Status/Remarks:	Completed
Project Scope:	Degraded lands (such as landfills and quarries) and man-made fill slopes need to be restored, stabilised and upgraded for safety and ecological value. In the current practice, ecological restoration, biodiversity and natural succession are often ignored in the design requirements. Due to the often-poor soil conditions, exotic plant species with their higher tolerance to stress usually become dominant over native species. Meanwhile, large amounts of municipal solid waste are dumped in landfills in Hong Kong resulting in carbon emissions. In this proposed project, wastes including sorted food waste, waste paper and green waste will be converted into biochar. To improve soil quality, this biochar will be added to disturbed lands that are being ecologically restored using native plant species. Since disturbed lands usually consist of sloping areas, the effects of biochar application on slope stability will be investigated. The objectives of this project are to investigate – (a). the effects of biochar on the performance of native plant species, (b). the effects of biochar on the soil microbial diversity (i.e. ecological functions) of degraded lands, and (c). the effects of different types of biochar on slope stability.
Summary of the Findings/Outcomes:	It is vitally important to consider biodiversity and to promote sustainability in society while upgrading man- made fill slopes and restoring degraded lands. This project investigated the effects of different waste-derived biochars on the performance of native plant species, the soil microbial diversity of degraded lands and slope stability. All biochars produced from food, green and yard waste were always alkaline. Cellulose-rich biochar (e.g., wood and peanut shell) added to soil contributed to the optimal growth of native shrub, small tree and medium tree. Generally speaking, the application of biochars can increase the diversity and richness of soil bacteria and fungi. It is evident and recommended that the use of 5% wood and peanut shell biochar will be the optimal for plant growth and soil microbes. More importantly, adding 5% biochar can reduce hydraulic conductivity but have negligible effects on soil shear strength. After the application of biochar, surface runoff will increase while water infiltration into the soil will be reduced, enhancing slope stability. A preliminary design guideline is proposed to incorporate both ecological and safety values in upgrading man-made fill slopes and restoring degraded lands.