Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2020-101
Project Title:	Hydrothermal carbonisation for recycling organic waste into biochar for soil improvement in Hong Kong
Principal Investigator:	Dr Tsang Chiu Wa Daniel, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University
Total Approved Grant:	$1,216,383
Duration:	5/7/2021 to 4/7/2023
Project Status/Remarks:	Completed
Project Scope:	This project will develop an innovative hydrothermal carbonisation (HTC) technology to recycle wet organic waste in Hong Kong (e.g., non-woody yard waste, horse stable waste, commercial & industrial food waste, and anaerobic digestate) to produce biochar as a sustainable material for soil improvement. There are currently large quantities of wet organic waste that should be diverted from landfill disposal. The project team will customise the process design and operating conditions of hydrothermal carbonisation for manufacturing biochar from Hong Kong's wet organic waste. The team will fully characterise the physicochemical properties of biochar products and evaluate against the accreditation of International Biochar Initiatives (IBI). Afterwards, the team will evaluate the efficacy of biochar products as soil amendment for improving the soil physicochemical properties. Finally, the team will validate the environmental merits and technical viability of our prototype design of hydrothermal carbonisation for biochar production by means of material and energy flow analysis (MEFA) and life cycle assessment (LCA). This project will advance state-of-the-art sustainable engineering, boost local business for organic waste recycling, and promote sustainable development and circular economy in Hong Kong.
Summary of the Findings/Outcomes:	Hydrothermal carbonization process can valorize organic waste to hydrochar, which can reduce carbon emission and environmental burden. Compared to pyrolysis, this technology is suitable for wet organic waste with high moisture content since energy-intensive drying pretreatment is not required. The properties of the hydrochar are tuneable by changing reaction conditions, such as temperature, time, pressure, and solid loading. This project studied the effects of operation conditions on the hydrochar properties and managed to reduce the emission of wastewater by recirculating the process water and decreasing the water-to-solid ratio. The produced hydrochar with various properties could be used as a clean and renewable alternative to fossil energy and applied to soil remediation to improve soil fertility and soil health and further promote plant growth. The flow of energy and material during the hydrothermal carbonization process and the overall environmental impact of the technology are also identified and evaluated, highlighting its great potential. Overall, this technique can not only reduce environmental impact by

	stabilization of carbon in organic waste but also develop sustainable energy sources and soil fertilizers.