THE HONG KONG INSTITUTION OF ENGINEERS
ENVIRONMENTAL DIVISION CUM
THE HONGKONG INSTITUTION OF ENGINEERS
YOUNG MEMBERS COMMITTEE,
HONG KONG WASTE MANAGEMENT ASSOCIATION AND
INSTITION OF MECHANICAL ENGINEERS (HONG KONG BRANCH)
SEMINAR ON ANAEROBIC DIGESTION WITH FOOD WASTE FOR ENERGY RECOVERY AND WASTE REDUCTION

The evening lecture was delivered by Dr. Po-Heng Henry Lee, Assistant Professor of Department of Civil and Environmental Engineering in The Hong Kong Polytechnic University (HKPolyU) on 3 March 2014, introducing the technology of anaerobic digestion for converting food waste into energy.


Ir Barry Lee, Chairman of Hong Kong Waste Management Association presented the souvenir to the guest speaker Dr Henry Lee, Assistant Professor of Department of Civil and Environmental Engineering of The Hong Kong Polytechnic University.

Food waste in Hong Kong accounts one-third, or 33 %, of the municipal solid wastes, which is a shocking high figure in comparison to the U.S. of 18 %. Food waste generated by commercial and industrial activities has doubled in amount in recent years, while the landfills in Hong Kong are close to their exhaustion and the territory has not enough land for landfill extension. To manage food waste in a sustainable way, the prime targets would be volume reduction, energy production and retrieval of nutrients, and anaerobic digestion provides a promising solution for it.

In general, about 87 % and 95 % of the food waste in Hong Kong is moisture and volatile solid respectively. The similar composition is found across the countries, the researches have revealed, while the ingredients have an effect on the digestion rate. The anaerobic digestion process comprises two principle processes, namely hydrolysis and acidgeoesis, which converts into acetate and hydrogen gas and carbon dioxide gas (CO_2) by 75 % and 24 % of food waste respectively. Acetate is further converted into methane gas (CH_4) and CO_2, by 72 % and 28 % of acetate. While reaction kinetics, organic density and pre-treatment process affect the amount of end product production, thermodynamics principles helps identifying the determining processes in the food waste conversion. Overall, for harvesting the highest yield, (i) excessive air or oxygen exposure should be avoided, (ii) inhibitory such as ammonia and hydrogen sulphide should be removed from the feedstock early, (iii) the process should pursue neutral pH and be present with sufficient alkalinity, (iv) the contain low volatile fatty acid, (v) the temperature should maintain constant at 30 to 38 ˚C for mesophilic range and 50 to 60 ˚C for thermophilic range and (vi) the process has enough nutrients and trace metal like iron, cobalt and nickel. Anaerobic digestion with food waste usually suffers from the accumulation of high volatile fatty acids. This, thus, renders the system stability resulting in various issues, such as foaming. An

alternative design in anaerobic food waste digestion could first start with physical pre-treatment and then undergo thermophilic digestion for conversion, followed by mesophilic digestion for polishing.

In the U.S., anaerobic co-digestion of sewage sludge and food waste in the wastewater treatment facilities is one of the practices for food waste reduction and energy recovery. The output of biogas is burnt for power generation, while the solid is thickened and become compost for fertiliser. Cases in South Korea, Sweden, Thailand and Taiwan are presented, which overall processes of thermophilic and mesophilic digestion are similar. In Hong Kong, HKPolyU also conducts studies on efficient anaerobic digestion with food waste both for CH_4 production or/and a valuable chemical, n-caproate acid, with the objectives of achieving (i) waste reduction, (ii) energy recovery and (iii) fertiliser recovery.

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