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Composting, Home Composting, Anaerobic Digestion and Microbial Fuel Cell

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Opinion Article

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DESCRIPTION

Recoverable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity and heat (CHP/cogeneration) maximising efficiencies. There are different types of composting and digestion methods and technologies. They vary in complexity from simple home compost heaps to large scale industrial digestion of mixed domestic waste. The different methods of biological decomposition are classified as aerobic or anaerobic methods. Some methods use the hybrids of these two methods. The anaerobic digestion of the organic fraction of solid waste is more environmentally effective than landfill, or incineration. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter.

Energy recovery from waste is the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas recovery. This process is often called waste-to-energy. Energy recovery from waste is part of the non-hazardous waste management hierarchy. Using energy recovery to convert non-recyclable waste materials into electricity and heat, generates a renewable energy source and can reduce carbon emissions by offsetting the need for energy from fossil sources as well as reduce methane generation from landfills. Globally, waste-to-energy accounts for 16% of waste management. The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Thermal treatment ranges from using waste as a fuel source for cooking or heating and the use of the gas fuel (see above), to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste

materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further refined into products such as activated carbon. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. An alternative to pyrolysis is high temperature and pressure supercritical water decomposition (hydrothermal monophasic oxidation). Pyrolysis is often used to convert many types of domestic and industrial residues into a recovered fuel. Different types of waste input (such as plant waste, food waste, tyres) placed in the pyrolysis process potentially yield an alternative to fossil fuels. Pyrolysis is a process of thermo-chemical decomposition of organic materials by heat in the absence of stoichiometric quantities of oxygen; the decomposition produces various hydrocarbon gases. During pyrolysis, the molecules of object vibrate at high frequencies to an extent that molecules start breaking down.

CONCLUSION

The rate of pyrolysis increases with temperature. In industrial applications, temperatures are above 430 °C (800 °F). Slow pyrolysis produces gases and solid charcoal. Pyrolysis hold promise for conversion of waste biomass into useful liquid fuel. Pyrolysis of waste wood and plastics can potentially produce fuel. The solids left from pyrolysis contain metals, glass, sand and pyrolysis coke which does not convert to gas. Compared to the process of incineration, certain types of pyrolysis processes release less harmful by-products that contain alkali metals, sulphur, and chlorine. However, pyrolysis of some waste yields gases which impact the environment such as HCl and SO_2.