

Chapter 26

Anaerobic Digestion (AD) of Organic Waste Is a Sustainable Waste Management Facility

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ABSTRACT

Sustainable waste management of biodegradable waste is one of the serious concerns in developing countries. The energy production from organic waste material by anaerobic digestion (AD) is environmentally sound, energy-efficient, and economical technology that degrades substrate, with minimum production of harmful metabolites, and reuse of its byproducts as bio-fertilizers. The use of small-scale biogas digesters in developing countries and industrial scale or integrated biogas digesters in developed countries has been operationally upgraded. These advancements in the application of AD processes are due to multiple factors, including the economic and environmental value of AD technology, and the dynamics of a range of policies and measures related to agricultural sector, waste control, and green energy production. However, compared to other waste management and energy generation methods, AD requires fewer resources and cost investment, and is therefore sustainable for waste control and energy production.

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INTRODUCTION

Waste production has become one of the growing concerns for today's world. It is produced by various sources such as, industries, agriculture and municipal systems. The increasing heaps of garbage and their poor management results in several environmental problems, health concerns and safety hazards, thus supporting the concept of unsustainable development, in terms of resource recovery and recycling of waste materials. The world is looking to achieve sustainable development targets by resource recovery and efficient solid waste management practices. The developed countries and metropolitan cities around the world are implementing the waste reduction strategies through policy guidelines, by adopting the "waste management hierarchy", which encompasses minimum waste generation from source, reuse, recycling and energy generation from waste material.

Waste management includes the use of technologies and processes to reduce the waste being produced on domestic and industrial level. The waste can be solid waste, agricultural waste, organic municipal waste, hospital waste, radioactive waste and hazardous chemical waste. Improper solid waste handling i.e. storage, collection and disposal practices, give rise to ecological and public health anomalies. Different landfill sites that are not properly managed, are the hub of toxic gases (e.g. carbondioxide; CO_2 , methane; CH_4 , carbonmonioxide; CO and hydrogen sulfide; H_2S). Among these gases, methane (CH_4) is the chief contributor of environmental problems, as (CH_4) is a greenhouse gas and is one of the causative agent of global warming (Pratt et al., 2015). Waste management is a serious problem for developing countries, but in developed countries, many practices have been adopted for waste reduction and turning it into useful products and energy (Ikhlayel, 2018).

Besides waste management, depletion of the natural energy reserves is another major concern (Amini et al., 2017). The exploitation of the fossil resources not only brings about declination of the reserves, but also contributes to the environmental problems especially greenhouse gas emissions (Naik et al., 2010). The swelling population in turn is causes an excessive use of natural or non-renewable sources (Jabeen, 2018), leading to a threat of exhaustion of non-renewable fossil fuel resources, environmental problems and future energy security. Numerous incentives are under way to substitute non-renewable resources with renewable resources and reducing fossil fuel reliance, and ecological concerns. The attention is shifting towards alternative sources of energy, such as waste to energy conversion and biomass energy production (Kumar and Samadder 2017).

Biomass has the key role among all the resources in the production of sustainable energy in a diverse and widespread energy crises condition. It can serve as a better alternative to meet present and future energy requirements. Currently, 10-14% of the world energy demand is fulfilled by biomass utilization, along with supporting energy need of 80% of the world rural communities (Steven B. Kennedy 2018). The total percent of the basic energy provided by biomass resources varies from developing to developed countries. In the developed countries the share of world energy is 14% by biomass resources which is equal to 72 EJ and approximately 40% of the total energy in the developed countries. Half of the world population is living in rural areas of developing countries, using most of the biomass for the energy purpose, such as Kenya, Brazil, India, China, and Pakistan use 68%, 25%, 47%, 13% and 27% biomass for energy, respectively.

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