Chapter 14
Energy from Waste:
Present Scenario, Challenges, and Future Prospects towards Sustainable Development

Kalpana Arora
Indian Institute of Technology, India

Ashwani Kumar
Indian Institute of Technology, India

Satyawati Sharma
Indian Institute of Technology, India

ABSTRACT

Considering the confrontation of waste disposal and minimizing Green House Gas (GHG) emission, technologies of Waste To Energy (WTE) production seem appealing. It provides one key solution for two major concerns regarding energy crisis and waste management. Energy from biomass can be seen as a promising alternative for fossil fuels, which are getting scarce and more costly day by day. Since a significant amount of organic waste from agriculture, industries, and community sources is collected annually, it can be convertible to useful energy forms like biohydrogen, biogas, bioalcohols, etc., through various Waste-To-Energy Routes (WTERs) for sustainable development. The adoption of this WTE technology will help the world not only in saving the traditional energy resources, but also in reducing GHG emission, and lowering environmental impact. With all these advantages, WTE industry is expected to experience a noticeable growth in the coming years and make greater contribution in supplying renewable energy. The review presents the technical, economical, and environmental aspects of various WTE techniques and focus on the benefit that this thermochemical conversion is a step forward towards sustainable development.

DOI: 10.4018/978-1-4666-1625-7.ch014

INTRODUCTION

Lowering the severity of climate change by appeasing Green House Gas (GHG) emission and reducing fossil fuel based power production in a sustainable way are the prime concerns for the environmentalists. Enormous increases in energy demand due to developing social, economic, and industrial status leads to the degradation of the environment at threatening levels (Caton, et al., 2010). Synchronically, the waste generation is also aggrandizing continuously. Therefore, explorations of alternative energy strategies have recently become important, particularly for future world stability.

Considering above all apprehensions and a willingness to expand the domestic renewable energy base have driven the need for buttress energy and environmental strategies across the world. Renewable waste materials from agriculture (Mahamat, et al., 1989; Jain, et al., 1992; Abbasi, et al., 1991; Bardiya, et al., 1996), industries (Deivanai & Kasturi Bai, 1995; Lay, 2001; Shin, et al., 2004; Yu, et al., 2002; Yokoi, et al., 2001), and domestic (Van Ginkel, et al., 2005; Okamoto, et al., 2000; Lay, et al., 1999; Lay, 2001; Kalia, et al., 1994; Grady, et al., 1999) sources are convertible to useful energy forms like biohydrogen, biogas, bioalcohols, etc., through Waste-To Energy Routes (WTERs) a viable waste treatment option capable of delivering clean energy as compared to conventional fossil fuels (Kothari, et al., 2010).

Waste-To-Energy (WTE) processes recover the energy from the waste through either direct combustion (e.g., incineration, pyrolysis, and gasification) or production of combustible fuels in the forms of methane, hydrogen, and other synthetic fuels (e.g., anaerobic digestion, mechanical biological treatment, and refuse-derived fuel). Incineration and gasification are the two primary WTE technologies that have been used successfully throughout the world. It is estimated that about 130 million tonnes of MSW are combusted annually in over 600 WTE facilities worldwide, producing electricity and steam for district heating and recovered metals for recycling (Themelis, 2003). WTE incineration has long been accepted as a solid waste management option, complementing landfilling and composting (American Society of Mechanical Engineers, 2008; Denison, 1996; Themelis, 2003; United Nations Environment Programme, 1996).

WTE is gaining increasing popularity in throughout the world primarily for its ability to reduce the volume of solid waste that requires landfilling, it also lessens the dependency on fossil fuel and Greenhouse Gas (GHG) emissions. This article provides an overview of the situations and the development of WTE routes and its future potentials. The chapter is structured as follows. The next section Background provides an overview of the waste generation, its composition, and utilization techniques until now. Further, it gives an outlook about the issues, controversies, and problems related to the waste to energy conversion. Future research directions were discussed later proving that different WTE routes having potentials towards the energy crisis and sustainable environment.

BACKGROUND

Waste Generation and Energy Crisis: Global Problem

A clear appreciation of the quantities and characteristics of the waste being generated is a key component in the development of robust and cost-effective solid waste management strategies. Although amongst some of the more developed countries within the region the quantification and characterization of waste forms the basis for management and intervention, elsewhere little priority is given to the systematic surveying of waste arising and the quantities, distinctiveness, seasonal variations and future trends of waste generation are poorly understood.