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Environmental Friendly Ways to Generate Renewable Energy from Municipal Solid Waste

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Abstract

Economic growth and rapid urbanization are resulting into increase in generation of municipal solid waste (MSW). In India, approximately 68 MT of MSW generated annually in urban areas and more than 80% is disposed in unhygienic manner leading to problems of health and environment to inhabitants. To manage MSW, there is a need to plan infrastructure development. There are many technologies available for handling MSW which treat plastic to convert fuel oil by gasification, pyrolysis, biomethanation and catalytic conversions. The useful products like liquid fuels, chemicals and power are being generated through these processes.

The final products need to comply with environmental regulations and demand a lot of technological improvement. Based on MSW/feed quality, there is a need to identify the suitable technology for converting MSW into useful products, which can meet the statutory regulations. Hence, treating MSW, converting into useful products and selection of suitable technology is a big challenge.

The present paper focuses to compare:

- All suitable treatment technologies and products generated from MSW.
- Types of thermal treatments like combustion/incineration, gasification and pyrolysis.

It also highlights development of a systematic approach to comply with all environmental regulations to create value for all types of MSW and reduce landfill.

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1.0 Introduction

Increasing global population has led to an increase in the levels of waste produced worldwide. Due to rapid urbanization levels of Municipal Solid Waste (MSW) has increased drastically in last two decades in India. Management MSW is very important from the perspective of public health and the environment. The management of MSW is an organizational, technological and economic challenge. In the hierarchy of objectives, public health is the prime priority. Selection of technology has also to pass the filter of public health responsibility. For sustainability the selected technology should be financial viable. Currently in India two proven means of procedure are being followed for MSW disposal, one is burying MSW in landfills and another one is combusting it in specially designed chambers at high temperatures, thereby reducing it to one tenth of its original volume.

For effective MSW management selection of advanced technologies and methods that helps in keeping our cities clean, prevent pollution and protect the environment and at the same time minimize the cost through recovery of resources and energy. Generation of energy from municipal solid waste in the form of energy or heat either through combustion or production of combustible fuels/ methanol/ethanol or synthetic fuels comes under the category of process defined as waste to energy (WTE). Waste to energy conversion technologies can be employed to convert residual wastes into clean energy, rather than sending the generated waste directly to landfill. There are different technologies to convert solid waste to energy.

2.0 Technologies for MSW Conversions

Selection of appropriate technologies for processing of MSW waste is very much essential; these technologies can be classified into two broad categories namely:

- 1) Bio-chemical processes
- 2) Thermo-chemical processes

Bio-chemical conversion of biodegradable MSW covers technologies such as composting and biomethanation, whereas thermal technologies include gasification, pyrolysis, incineration and mass burning. Refuse Derived Fuel (RDF) can also be prepared from combustible MSW and used as a feedstock for WTE plants. Technology for production of syngas also merits consideration (Leena Singh, et al, 2014).

Besides conventional technologies, converting polymeric wastes to liquid fuel called "catalytic conversion of waste plastic to liquid fuel" can also be used for profitably utilizing plastic wastes which are not currently recycled. Figure-1 shows the WTE technologies being adopted worldwide.

2.1 Bio-chemical processes

Bio-chemical processes can be broadly classified in to two categories composting or biomethanation and fermentation.

A. Composting

Composting is an aerobic process in which biologically degradable wastes of MSW are well segregated through a systematic waste segregation process like trommel and magnetic separations, and are converted through solid state biochemical transformation to produce manure/fertilizers or soil nutrients. This is mostly done by two methods:

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