Chapter 11
Recovery and Regeneration of Energy From Wastes

Syed Maqbool Geelani
Sher-e-Kashmir University of Agricultural Sciences and Technology, India

Moonisa Aslam Dervash
Sher-e-Kashmir University of Agricultural Sciences and Technology, India

S. J. A. Bhat
Sher-e-Kashmir University of Agricultural Sciences and Technology, India

ABSTRACT

Management of domestic and industrial wastes is of great concern to all sections of society. Huge quantities of solid wastes are generated from cities, industries, agricultural activities, markets, and hotels on a daily basis. Inadequate management of these wastes poses a serious risk to environment. Generation of energy from these wastes could be helpful for proper management of waste. Recovery and generation of energy from wastes isn't only of economic importance but also could be a boon for conserving natural resources.

INTRODUCTION

The energy recovery from waste, energy from waste or waste to energy is used to describe a number of technologies and treatment processes adopted for generating a usable form of energy from discarded or waste materials. The energy generated is usually in the form of electricity, heat and fuels (WEC, 2013). The technologies of waste processing for energy recovery develop a fuel, gas which can be combusted to generate heat or electricity. The material generated can also be converted to transport fuels, synthetic natural gas, or other products (Reinhard, 2015). The fuel replacement or co-combustion involves the opportunities for adapting industrial and power generation to use fossil fuels (coal, oil or gas) and accept a proportion of alternative fuels derived from wastes (Bogner *et al.,* 2007). This facility occurs in power plants, brick works and cement kilns (Ali, 2012). The other indirect energy from waste pathways include the processing of waste to produce combustible Refused derived fuels (RDF), which is achieved using

DOI: 10.4018/978-1-7998-0031-6.ch011

mechanical sorting and processing techniques like screening, crushing and grinding facilities known as Materials recovery facilities (MRF), Mechanical Heat Treatment (MHT) if it involves a thermal pre-treatment, mechanical heat treatment. Mechanical Biological Treatment (MBT, separates organic material for biological processing like anaerobic digestion (EPA, 2013). The other technologies which fall outside the scope of energy recovery includes, thermal combustion of waste for disposal, or flaring of biogas from landfill without energy recovery (DOELWP, 2016).Aerobic conversion of waste to create outputs without energy recovery like composting, bioenergy where purpose grown energy-crops (non-waste materials) are used as feedstock and treatment of contaminated soil or other hazardous waste without energy recovery (EPA, 2017).

The waste hierarchy (EPA, 2017b):

- **Avoidance**: "Practices which prevent the generation of waste all together"
- **Reuse**: "Direct reuse of materials without additional processing"
- **Recycling**: "Using valuable components of waste in other processes"
- **Recovery of Energy**: "Extraction of calorific value to create usable energy"
- **Treatment**: "Reduce volume or change composition to reduce hazard or nuisance"
- **Containment**: "Long-term storage of wastes requiring a high degree of control to prevent contamination"
- **Disposal**: "Deposit of materials, typically into landfill"

The energy from waste is divided in two broad categories:

1. Biological processing of biodegradable waste (anaerobic digestion or fermentation to produce biogas or alcohol).
2. Thermal treatment of Residual waste which include direct combustion, gasification and Pyrolysis (Direct combustion of waste to create heat, which can be used directly or to generate electricity).

The technologies adopted for the generation of energy usually include:

- Combustion for producing heat.
- Gasification, which includes plasma gasification or plasma assisted gasification for producing a combustible syngas
- Pyrolysis for producing syngas, oil or char.

TECHNIQUES FOR WASTE TO ENERGY GENERATION

The classification and methodology of waste to energy generation are discussed as:"

Thermo-Chemical Conversion

It is a thermal treatment process in which the energy content of waste is extracted at high temperatures and utilized. The process depends on the choice of the fuel used.