International Journal of Engineering Works
Kambohwell Publisher Enterprises
ISSN: 2409-2770 Vol. 3, Issue 6, PP. 52-54, June 2016
www.kwpublisher.com

An Environmental Friendly and a High Efficient Energy Production Technology from MSW by using Air Fed RDF Gasification

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***Abstract*—** Waste is the discard matters that comes from human activity and require proper disposal to avoid harmful effects to the environment.Though, there is still energy hidden inside the disposal and one need to recover that method because it is considered a green and clean renewable energy that can reduce greenhouse gas emission and lessen the effect of global warming. This paper provides an overview of the basic principle, steps involved in extraction of valuable energy from municipal solid waste (MSW) by using Air Fed Refuse derived fuel (RDF) gasification, benefits of gasification on environment and how gasification advances over incineration. MSW gasification is measured as the most prospective technology to replace incineration, because of the advantages, such as the strict control of pollution, significant volume reduction and enhances recycling rates.

***Keywords*—** Municipal Solid Waste, Refuse Derived Fuel, Gasification, Incineration, Renewable Energy, Disposal

I. INTRODUCTION

Waste is the discard matters which comes from human activities in the diary life and its amount increases with population growth. It is predictable to study and search for a suitable disposal technology. This technology should also include the efficient recovery of energy from waste without impacts on the environment for viable development and economic adequacy.With an integrated solution for waste management and energy production, a municipality can reduce the environmental impact of waste and increase revenue recovery and energy distribution [1]. An integrated approach starts with an effective sorting of waste to separate recyclers and wet organic waste.Remaining waste is pretreated in a recycling facility to recover remaining recyclers and yield a fuel derived from waste (RDF) for effective energy regaining. Also energy intensive industries seeking to use RDF to replace fossil fuels.The main advantage of RDF-Gasification technology is the combination of high fuel flexibility, high power making proficiency and good environmental concert.Faced with the problem of millions of dollars of waste discarding, a rising number of municipalities are turning to gasification, a time-tested and environmentally sound means to convert the energy enclosed in the MSW into valuable products such as power, fertilizers, shipping fuels and chemicals [2].

The waste gasification concept transform RDF into clean gas for combustion and provides greater efficiency of energy production from waste.Refuse Derived Fuel (RDF) is a clean and efficient method, an environmentally friendly and an alternative fuel for power generating industries that operate on coal fuel [3].The main operations in RDF involved sorting, casting or grinding, removal of metals, glass and dirt.The gasification process provides significant progress on incineration because in the gasification process, the MSW is not a fuel but raw material for a chemical conversion process at high temperature.Instead of making only heat and power, as carried out in a waste-to-energy plant using incineration, the synthesis gas (syngas) produced by gasification can be replaced in higher value commercial products such as fuels, chemicals, fertilizers and natural gas replacement.On average, conventional waste-to-energy plants that uses incineration can transform one ton of MSW to about 550 kilowatt-hours of electricity and with gasification technology can convert that amount of MSW to about 1000 kilowatt-hours of electricity which is more efficient and cleaner methodto utilize this energy source [4].

II. BASIC PRINCIPLE OF AIR FED RDF GASIFICATION

Gasification is a unique procedure which converts any carbon-based material,such as MSW, into energy without burning it.Instead, gasification transformsthe materials into a gas by generating a chemical reaction.The main steps involved in RDF gasification is shredding and sorting out of the MSW to allow the separation and recovering of materials, such as metals and glass which have no calorific value and then combusting the resulting RDF with small amounts of air or oxygen, resulting a mixture of carbon monoxide and hydrogen, and removing pollutants and impurities.What remains is a clean "synthesis gas" which can be transformed into electricity and valuable products.With gasification,MSW and other types of waste are not useless, but the raw materialsfor a gasifier.As a substitute of giving to dispose of and manage the waste for years in a landfill, using it as a feedstock for gasification decreases disposal charges and landfill space, and transforms those wastes into power and fuels.

III. EXTRACT VALUABLE ENERGY FROM MSW BY USING AIR FED RDF GASIFICATION

Fig. 1 shows the basic steps involved in clean and efficient energy production from MSW are Pre-Processing and Production of RDF from MSW and then the resulting RDF and controlled amount of air or oxygen is injected into the gasifier, this resulting in the formation of clean syngas that can be converted into electricity and valuable products. The

Flow diagram of steps involved in extraction of valuable energy from MSW by using Air Fed RDF Gasification is shown below in Fig. 1.

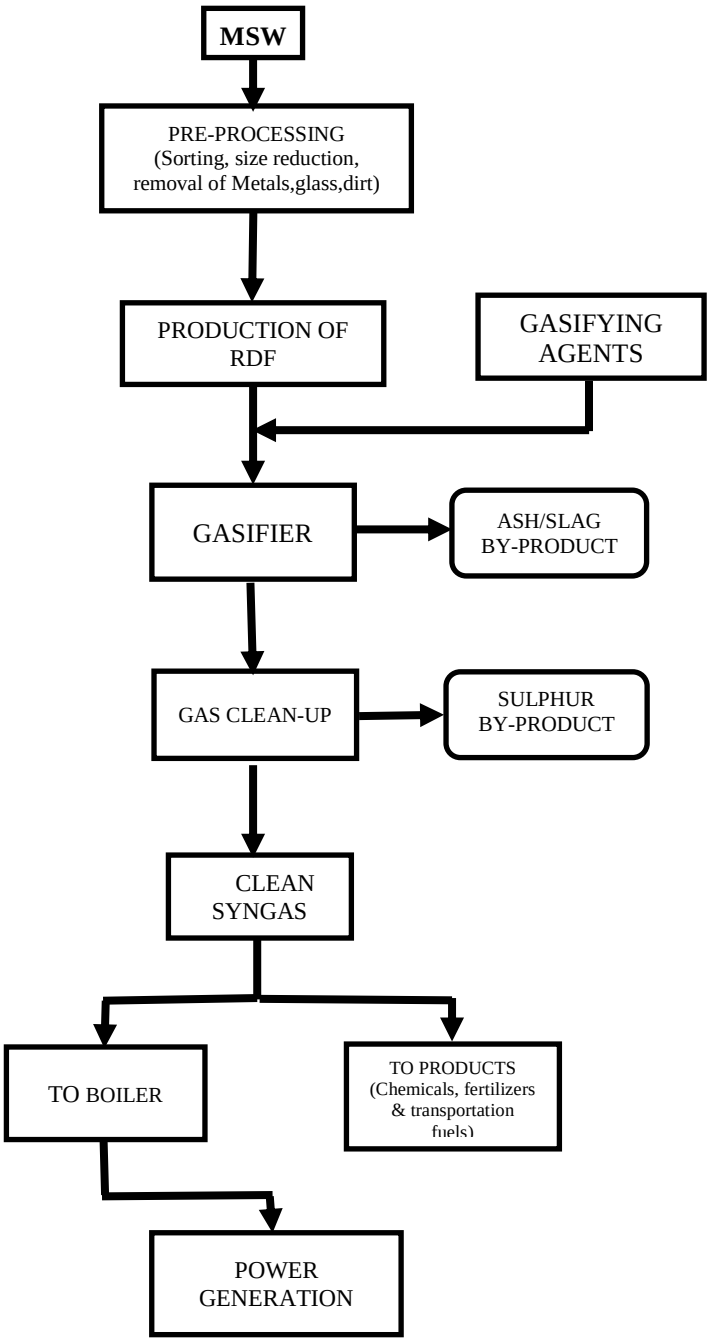

Figure 1. Flow Diagram of Air Fed RDF Gasification

A. Pre-Processing and Production of RDF from MSW

The main steps involved in the production of RDF are shredding and separation of metals (Fe,Al) and glass which have no calorific value then the resulting RDF is combusted with small amounts of air or oxygens which are known as Gasifying agents.

B. Gasifier

The resulting RDF is then allowed to enter into gasifier with controlled amount of air or oxygens which are known as gasifying agents. Temperatures in a gasifier for MSW normally in the range of 1100 to 1800 degrees Fahrenheit [5].

C. Cleaning of SYNGAS

Some downstream methods need that the syngas be cleaned of traces of impurities.Trace elements, particles, sulphur, mercury and unreactedcarbon can be removed to very low levels by using processes which are similar to chemical and refining industries.

D. Generation of Electricity and other Products

The clean syngas can then be sentto a boiler, combustion engine or gasturbine to generate electricity or further transformed into chemicals, fertilizers andfuels.

IV. Gasification Environmental Benefits

There are substantial environmental advantages of MSW gasification, enhances recycling and thus reduces the need for landfill space, decreasing methane emission from decomposition of MSW in landfills,and thus decreases the threat of surface water and ground water pollution from landfills and also reduces waste transport costs that does not need to be sent hundreds of miles for disposal.

V. Advancement of Gasification Over Incineration

The gasification process provides major advances over incineration, because incineration utilizes MSW as a fuel, burning with large volumes of air to form carbon dioxide and heat. In the gasification process, the MSW is not a fuel but raw material for a chemical conversion process at high temperature [6]. Instead of simply making heat and electricity,as carried out in a waste-to-energy plant using incineration,the syngas produced by gasification can be converted to higher value of commercial products such as transportation fuels, chemicals, fertilizers, and replace them with natural gas. In incineration the toxic dioxins and furans form or reform due to sufficient oxygen while in gasification, the oxygen deficient atmosphere in a gasifier doesn't allow the formation or reformation of dioxins and furans [7]. When the syngas is mainly used as fuel for producing heat, it can be cleaned as necessary prior to combustion, this cannot happen in incineration. The RDF gasification technology enhances recycling rates of valuable metals before production of syngas while incineration doesn't allow recycling of valuable metals and thus RDF gasification taking advantage over incineration [8].

ISSN: 2409-2770

CONCLUSION

To accomplish the best available approach of the thermal processing wastes, it is essential to meet the priorities especially environmental limits set by law, and to consider such a method which would be economically suitable.RDF Gasification provides a future substitute to the waste incineration for the thermal treatment of MSW.The RDF Gasification technology offers significant energy recovery and reduces the emission of potential pollutants.

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