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SOLID WASTE INTO FUEL

C.Sakthivel, P.Thangavel, S.Soundhar rajan
Shree Venkateshwara Hi-tech Engineering College, Gobi.

Abstract: The present rate of economic growth unsustainable without saving fossil energy like crude oil natural gas and coal. Waste management is very important aspect in recycling the solid waste into fuel. This technology is not complicated because plastics are heated at 400 degree Celsius. Plastics boil has separated out and often reused fuel machine itself .The fuel is distilled and filtered. Because entire process take place by vacuum plastic melt and all gas are reused in fuel machine.

When hydrocarbon burn it produce polyethylene, polypropylene fuel fairly clean but by burning PVC large amount of chlorine will corrode reactor environment .HPPE and LDPE are basically poly ethylene usable fuel just slightly thicker fuel created. HPDE into clean diesel.

INTRODUCTION

The amount of SW generated worldwide in 2006 was 2.02 billion tons, 251million tons of which was generated in the U.S., with 138.2 million tones (55.1% of total generation) land filled. Landfills are reported as the largest single source of an thropogenic methane emission in the U.S., accounting for 132 million tons of CO_2 equivalent sin 2005, which was nearly 2% of total GHG emission.

The shortage of fossil fuel and the environmental problems arising from their use in combustion processes have attracted great attention in relation to the exploitation of clean renewable energy sources. For example, thermo-chemical transformation via paralysis gasification of SW is desirable in terms of an essential part of greenhouse-gas-neural energy production as well as sustainable waste management. Growing amounts of solid waste and the need for its disposal is currently generating worldwide concern regarding the environmental, health and economic issues. Waste plastic represent a large fraction o f solid waste. In the UK, the quantity of plastic waste produced yearly is almost 3 million tonnes. European legislations require reducing the amount of organic waste sent to land fills and encourage recycling and energy recovery. In addition to environmental and economic benefits, it greatly improves the recycling of waste. Consequently recycling go waste plastics Is carried out in many ways. According to a 2001 UK Environment Agency report, 80% of plastic waste was sent to landfill , 8% to incinerator and the amount recycled was about 7-10%. Recently, there have been promising developments in recycling plastic waste by thermal treatment techniques. Besides avoiding the risk out comes from landfill sand incinerators, thermo chemical recycling produces cheap resources of energy & chemical feed stock.

OBJECTIVES

The main objective of this study is to convert waste plastic into valuable hydrocarbon fuel and raw chemical feedstock by investigating the effects of a zeolite catalyst, temperature and residence to ascertain the optimum conditions necessary for the desired proportions of products.

PLASTIC TO FUEL

Our plastic-to-fuel process converts, or “reverses,” petroleum made plastic solids into liquid-form petroleum products, namely high quality diesel and unleaded gasoline fuels.

The process takes place in a stainless steel cylindrical reactor with an opening at each end of its upper section one opening for raw material feeding and the other for waste removal. It is operated in ambient pressure at temperatures lower than 500 degree Celsius. A hydraulic auto-feeder delivers a continuous supply of raw materials and catalyst to the feeding end of the reactor.

A vacuum discharging system removes and separates waste from the opposite end. A by-product of chlorine gas is separated from mixed gas by a separation system.

The crystalline solids that constitute 10 to 15 percent of the process waste are environmental contaminants from plastics that will never reach a landfill. Moreover, as much as 10 to 15percent of C1-C5 waste gas, a secondary pollutant, will be returned to the reactor to heat naturally.

Raw materials are heated and gradually converted from solid to liquid and then to gas. The gas flows through a settler to remove fine condensates and condenses into a hydrocarbon liquid. The liquid hydrocarbon mixture is then pumped into an oil mixture storage tank to separate water and other impurities from the product.

After the purified liquid is heated in a tank to 400 degrees Celsius, it is allowed to vaporize at an ambient pressure The vaporized product then

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passes through a stripping system, and into fractional distillation where it is condensed and separated into its gasoline and diesel components.

After further treatment to remove water and impurities, the gasoline and diesel flow to a "semi-product tank," for more complete distillation. The gasoline is heated again and sent to a "rectification tower" to produce high quality gasoline. The completely distilled gasoline and diesel are then treated with an equilibrium medium to stabilize the distillates.

Water is used as the cooling medium in a circulating system consisting of a pump, pipeline, cooling tower and heat exchangers.

The entire process is protected by personnel safeguards and fail-safe pressure relievers.

Solid Fuel Production

Scope of solid fuel in this compendium
Solid fuel, as referred in this compendium, is prepared from both municipal and industrial non-hazardous waste. Additionally the solid fuel outlined here excludes coal and coal-derived fuels as well as solid bio fuels such as firewood and dried manure but it may contain bio fuels as a component.
This compendium differentiates two types of solid fuel: refuse derived fuel (RDF), also called solid recovered fuel (SRF) and refuse-derived paper and plastic dandified fuel (RPF).

RDF is mainly produced from municipal kitchen waste, used paper, waste wood and waste plastics. Due to the presence of kitchen waste, prior to the conversion to a fuel, a drying process is required to remove the moisture from such waste to allow the solidification of the waste in suitable shapes and densities. This process is seen as a disadvantage due to the large amount of energy that the process requires. Solid recovered fuel (SRF) is defined in the European Committee for Standardization technical specification (CEN/TS 15359:2006).

On the other hand RPF (Figure 3.1) is prepared from used paper, waste plastics and other dry feed stocks. Within the plastics, the thermoplastics play a key role as a binder for the other components such as thermosetting plastics and other combustible wastes, which cannot form pellets or briquettes without a binding component. Approximately 15wt% of thermoplastics is the minimum required to be used as a binder to solidify the other components; however excessive amounts, higher than 50wt%, would cause a failure in the pellet preparation.

The components of RPFs are mainly sorted from industrial wastes and are sometimes also obtained from well-separated municipal waste. This type of solid fuel is set to be standardized in the Japanese Industrial Standards (JIS).

In both cases, the plastic contents can be varied (within a range) to meet the needs of fuel users. The shape of the fuel will vary according to the production equipment (e.g. a screw extruder is often used to create cylindrical-shaped fuel with a variable diameter and length). The example of Figure 3.1 contains RPF samples 40 mm in diameter and 50 mm in length.

In the production of solid fuel, the contamination of the targeted plastics with other plastics

Figure 3.1: Example of RPF

Containing nitrogen, halogens (Cl, Br, F), sulphur and other hazardous substances may cause air and soil pollution by the flu gas emission and the incineration ash disposal (e.g. inorganic components such as aluminium in multilayer film of food packages produces fly ash and bottom ash). Other contaminants such as hydrogen chloride might cause serious damage to the boiler by corrosion.

Production method

The solid fuel production process usually involves two steps, pre-treatment and pellet Production.

Pre-treatment includes coarse shredding and removal of non-combustible materials.

Pellet production comprises secondary shredding and pelletization (<200°C).

However, pre-treatment is not required if the solid fuel producer can collect waste with suitable properties.

Two types of commercial production systems are described as follows. One is a large-

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scale model with pre-treatment for the separation of undesirable contamination such as metals and plastics containing chlorine. The other is a small-scale model without pre-treatment equipment.

3.2.1 Large-scale model (3 ton/hour)

Industrial waste plastics, which have been separated and collected in factories, are ideal to be used for solid fuel production.

A fuel production facility consists of a waste unloading area, stockyard, pre-treatment equipment, pelletizing equipment and solid fuel storage. The pre-treatment process includes crushing and sorting for the removal of unsuitable materials from incoming wastes. A schematic diagram of the pre-treatment process is shown in Figure 3.2. Figure 3.3 presents a photograph of a pre-treatment process.

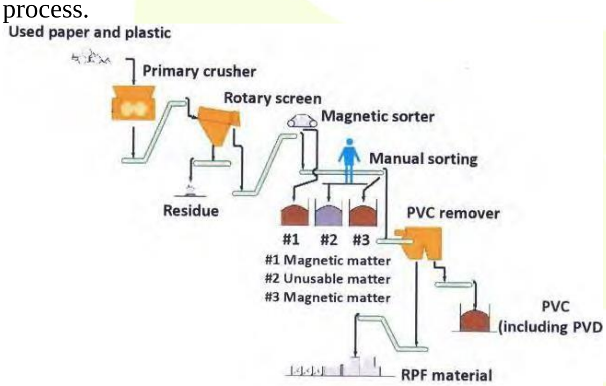

Figure 3.2: Schematic diagram of pre-treatment process

After pre-treatment, a suitable mixture of paper and plastics are further processed in a secondary crusher and sorting process (conveyor and magnetic separator) and the resulting mixture is pelletized to produce solid fuel. The resulting solid fuel is cooled in an air-cooling system to prevent natural ignition during storage and it is further stored for shipping. The output of the process is usually solid fuel pellets of dimensions between 6 to 60 mm in diameter and 10 to 100 mm in length. The heating value of the pellets will change depending on the content of the plastics.

A mixture of paper and plastics of a 1:1 weight ratio gives a heating value of approximately 7,000 kcal/kg or higher. Figure 3.4 shows a pelletizing process a typical pelletizing process facility with a 1 ton/h capacity.

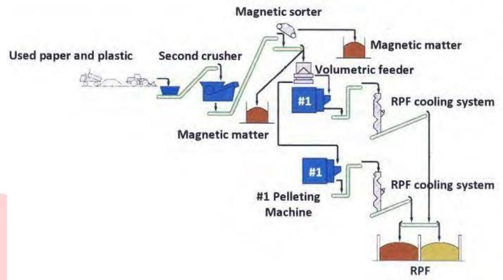

Figure 3.3: Schematic diagram of a pelletizing process

3.2.2 Small-scale model (150 kg/hour)

This small-scale model is a system for solid fuel production with a 150-kg/h capacity. In this case the facility does not have a pre-treatment process, (as aforementioned, a sorting process is not required if properly segregated waste can be collected) so the combustible wood, paper and plastic waste is directly fed into the crusher of the facility. This is carried out by using a handling machine as shown in Figure 3.4 where the operator must control and feed into the crusher a suitable ratio of each type of waste in order to maintain the fuel qualities such as the heating value. After crushing the materials, they are transported through a pipe conveyor and are introduced into a twin-screw pelletize.

Figure 3.4Heavy duty machine to feed wastes (150 kg/h capacity)

3.3 Product and by-product

Heating value is an important characteristic of solid fuels. Some examples of heating values of several types of waste and solid fuel are listed in Table 3.1.

Table3.1:Heatingvaluesofvariousfuelsandwastes

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Fuel or waste	Typical heating value (kcal/kg)
RDF	4000 – 5000*1
RPF	6000 – 8000*2
Coal	6000 – 8000*3
Heavy oil	9500
Wood/paper	4300
Plastics	11000
Typical municipal wastes	1000 – 1500*1

The heating values of solid RDFs and RPFs may vary depending on the composition of the materials they contain. Especially in RDF, fluctuations in the heating values are often observed due to changes in the composition of the municipal waste (which is difficult to control) and -according to the degree of drying of the municipal waste used in the production process. RPF heating values can usually be controlled easily due to the use of dry and sorted plastics, paper and other combustible waste, which have been collected from companies. Other important features of the solid fuels are its content of ash, moisture and the content of potential hazardous substances like nitrogen, chlorine, sulphur and heavy metals.

Fuel suppliers should have an agreement with fuel users regarding the solid fuel qualities.

Special attention is required in order to avoid self-ignition and methane evolution during the RDF storage.

Other Technologies

Instead of installing a new waste plastic conversion facility, some types of industrial infrastructure provide optional methods for using waste plastics as fuels. Some use solid fuel prepared from waste plastics and other combustible wastes while others involve placing the waste plastics into conversion equipment without pelletization. Some applications in the steel, lime and cement manufacturing industries are as follows:

In the steel industry, some countries commercially treat waste plastics in blast furnace and coke ovens. Pioneering work has been done in the area of blast furnace treatment in the UK and Germany. Currently, some steel manufacturers adopt similar treatment methods4. The key aspects of the technology are the preparation of the waste plastics pellets at a constant quality and subsequent injection of the pellets into a blast furnace. Contamination by chlorine-containing plastics and some other materials is prohibited in order to prevent any adverse effects to the steel quality.

Lime is used for steel production and solid fuel from waste plastics is used as fuel in lime kilns. Preparation of solid fuel (RPF) with a heating value of 8[illegible]00 kcal/kg and a method for injecting it into a kiln have been developed and commercially utilized in Japan.

In cement production, shredded waste plastics are injected into a cement kiln for use as fuel. Chlorine-containing plastics should be removed prior to the injection so as to maintain nt cement quality. In all the lime, cement and steel uction production processes, the de chlorination of rine-Chlorine-containing mixed plastics is an essential pre-treatment process. In some cases this pre-treatment is carried out using an extruder or screw-type equipment at about 350 °C.

For specific types of plastics, compaction and volume reduction can also be important.

Volume reduction of expanded polystyrene is performed by thermal melting or by a solvent dissolution method. The resulting ingot is a raw material for recycled resin production.

Such pre-treatment contribute to the reduction of transport costs and improvement of processing efficiency by increasing the feeding rate. Similarly, granulation of plastics such as films and bags using a granulator can be an essential tool to improve transport efficiency, feeding to equipment and processing.

Coke oven treatment was developed by a Japanese steel manufacturer6. Agglomerated plastics are charged into cokes ovens together with coal at around 1 %, resulting in the formation of gaseous products and other chemicals under pyrolytic conditions. These products are used within steel works or by chemical companies. Similar to blast furnace treatment, chlorine-containing plastics are not allowed into the mix. Under actual operation, the agglomerate charged into the coke oven contains about 3% chlorine but, unlike in blast furnaces, the amines from the coal seem to neutralize the hydrogen chloride released from waste plastics without affecting the coke quality.

Heat recovery using municipal waste incinerators is also a valuable option for the users who require heat supply. In this case, the waste in its original form, or crushed, is introduced in an incinerator or a boiler aiming to obtain the heat of combustion of such waste as a form of steam or hot water. It must be highlighted that this is a non-storable heat source and therefore the supply of such hot water or steam is to be for the industry itself or to nearby users.

This technology requires a large stock yard for the bulkiness of the waste and attention to potential fires and odour issues due to the stock of waste should be paid. Operation schedule should

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also be carefully planned due to the fluctuations of the waste generation, their calorific value and to match the heat demand of the users with the supply hours to the users.

Additionally, due to the variety of feedstock that can be used, flue gas quality should be controlled and incineration ash should be well managed.

MATERIALSSOURCES

Recyclable plastic packaging
Garbage's or ting plant and landfills
Paper mills t hat take waste papers raw materials
Tirere cycling centers

FACTS & NUMBERS

• The equipment processes all types of plastic, from code 1 to code 7.
• One single unit of equipment processes 30tons of waste plastic daily, totalling 10,000 tons annually.
• 50%-70% of output is fuel oil, which can be further refined into diesel and gasoline.
• 15%-25% of output is solid residue, which can be used as raw materials for regenerative carbon black and bricks.
• 15%-25% is combustible gas which is
recycled back to the furnace as heat.

CONCLUSION

The time is becoming ripe for waste gasification. The world is facing profound problems in the search for new sources of energy, in addition to facing ongoing environmental degradation. Plasma gasification of waste can be part of the solution to both problems. Using toxic waste materials, as feed stocks for producing renewable fuels, transforms liabilities into assets. As a municipal or publicly funded operation, a waste gasification plant can help balance budgets and provide a hedge against future increases in energy prices. The complexity and expense make plasma gasification a challenge for private investors and for municipalities.