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Make Fuel Pellets from Solid Wastes

key words
solid waste pellets, refuse derived fuel(RDF), fossil fuel alternative, MSW pellet, MSWbriquette, MSW pellet mill,MSW pellet plant

Abstract: Converting municipal solid waste(MSW) into fuel pellets or briquettes is environmental and energy saving. We supply MSW pellet mill with various capacities.
The number of solid waste increases as the growth of population enlarges, creating fuel out of trash could significantly reduce the amount of solid waste that goes into landfills and could offset fossil fuel use.

Why Make Municipal Solide Waste into Fuel Pellets?

Almost in every country in the world, the disposal of trash is a big problem because of its large amount. According a survey, Americans produce more than four pounds of trash per person per day, amounting to 20 percent of the world's waste. For another, we must find renewable and environmental friendly fuel to replace the fossil fuel, as the storage volume in the world is finite. For many years, opposition to the use of municipal solid waste as an energy resource has been nearly universal among activists and regulators because of bad experiences with traditional garbage incineration which are associated with high level of toxic emissions. While with the development of technology, solid waste is potential raw material as renewable energy while reducing greenhouse gas emissions and the need the for landfill space.

Classification of Solid Waste

Solid waste is classified into the three main types by making reference to the sources of waste and the institutional arrangements for waste collection and disposal. These three types of solid waste are municipal solid waste, construction waste and special waste. Municipal solid waste includes domestic waste, commercial waste and industrial waste. (figure.1 classification of solid waste)

Most of the special waste, such as chemical waste can cause pollution to the environment or become a risk to heath, so that they can no be used as the raw material of fuel.

Important Properties of MSW Pellet or Briquette

Producing energy from trash is known as a “waste-to-energy” option. Several such options have existed for many years and are in extensive use throughout Europe and limited use in the United States. One of the more exciting options that has been proposed within the last decade is to convert waste into solid recovered fuel(SRF), refuse derived fuel(RDF) or process engineered fuel(PEF). The most common forms of this kind of fuel are pellets and briquettes.
Rubbish briquetting and pelletizing is a technology to change idle rubbish into useful and valuable energy. The technology is an agglomeration process that can be categorized as densification technology which makes the bulk density of rubbish to be compact and dense. Physical and chemical behavior of raw material has significant influence of the briquette quality as a fuel.

Strength

Material composition has great influence on the final quality of the produced fuel(the density and strength of the briquettes or pellets). Sometimes the raw material dose not have suitable composition from good adhesion binding. Then mixing the binding agent into the shredded MSW can be used. If the binder is cheap or unnecessary material, it is an advantage. The binding additives can be cartoon paper, cement and wood sawdust. It was proven that the usage of organic binders(cartoon paper, wood sawdust) influence the final strength of briquettes. Organic materials contain binders, the so-called ‘nature glue’(lignin) which is able to join the non-organic particles of pressed material (PET bottles, textile, foils, plastics, etc)

Density

The density is an important parameter at producing. The higher the density, the higher is the energy ratio. Hence, high-density products are desirable in terms of transportation, storage and handling. The density of biowaste briquettes or pellets depends on the density of original biowaste, the producing pressure and, to a certain extent, on the briquetting or pelletizing temperature and time. The calorific value of raw MSW is around 1000 kcal/kg while that of fuel pellets is 4000 kcal/kg. On an average, about 15-20 tons of fuel pellets can be produced after treatment of 100 tons of raw garbage.

Pre-treatment before MSW Pelletizing

Separation

The manufacture starts with the collection of un-segregated municipal waste, including organic waste(primarily food waste) and materials like paper, cloth, plastic and wood that provide thecalorific value required to burn. Before these can be formed into pellets or briquettes, however, the combustible wastes must be separated from non-combustibles such as glass and metal, and the larger items must be broken into smaller pieces. Ideally, during the separation stages, hazardous materials would be removed completely. (figure.2 manual separation)

Drying

This important step in the process differs in each facility depending on the investment or land availability. Solar drying is not possible during rainy seasons, and most facilities run at a fraction of their capacity during the rains, sending most of the waste to landfills. Mechanical drying, on the other hand, requires significant amounts of energy that could easily render RDF plants unprofitable without huge government subsidies.

Screening

Size separation usually happens at two or more stages in the process. It is done by passing the waste through trommel screens, most commonly rolling drums with different mesh sizes. Trommels are attached to the conveyors at various stages of processing and are inclined to allow oversize materials to pass along them.

Size reduction

hammer mills are the most commonly machine used in this process. Hammer mills consist of rotating sets of swinging steel hammers through which the waste is passed. The hammers need frequent resurfacing or replacement, so that it’s very important to choose the quality hammer mill.

Once all of the steps are complete, the final RDF product can be formed into bricks or pellets. (figure.3 RDF pellets)

MSW Fuel Pellets Properties

- Composition: Mixture of organic and plastic material
- Biomass Content: App. 45-85% depending on plastic content, lower CO2 emission as compared to coal
- Calorific Value: App. 22 - 26 MJ/kg, depending on the plastic and biomass contents
- Ash Content: App. 12%, depending on the paper contents in CCF Fuel
- Carbon Content: App. 20% less Carbon compared to coal, giving a direct lower CO2 emission reduction next ..to the reduction gained by avoiding coal
- Moisture Content: <2%
- Chlorine Content: Compared to other biomass fuels the CCF Fuel contains low chlorine contents
- Sulphur Content: Compared to high volatile bituminous coal, the sulphur content is very low
- Nitrogen Content: CCF Fuel is NOx reducing, the N content is lower than that of coal and it has a higher ..burning reactivity
- Copper content: Copper (Cu) will be separated by using a so called Eddy Current machine.
- Grindability: Powder grindable like wood pellets
- Handling: Open air storable and transportable, just like coal

Fossil Fuel Alternative

An experimental results showed that the RDFs had a predictable energy content of about 12500 British thermal units per pound (25million Btu per ton). Bituminous coal, the type normally used at this particular cement kiln, has almost exactly the same energy density, leading to a nearly one-to-one displacement opportunity. The RDF produced for the experiment were also 40 percent more energy dense than sub-bituminous coals and 80 percent more so than lignite.

When the whole production, transportation and combustion life cycle of the RDF is considered, large fossil fuel energy savings can be realized. Extrapolating the fossil fuel displacement rate of one ton per hour that we used in the experimental demonstration over an entire year, RDF would reduce total fossil fuel energy use by 6 percent annually in the cement kiln. This reduction equates to about 9,000 tons of coal, enough to provide electricity to 1,500 average U.S. homes for a year and reduce 14,000 tons carbon dioxide per year. And that's just one cement kiln. Through the test, we can see RDF can be the fossil fuel alternative.

Obstacles During MSW Pellet Production

Paper or plastics are easy to be contaminated by other materials like food and liquids. Because of contamination and imperfect sorting, between 5 and 25 percent of a materials recovery facility's incoming recyclables are discarded and sent to landfills. The waste, called "residue" in the waste management business, is a valuable mixture of paper and plastics that is currently lost to the ground.

It is impossible to remove all the hazardous materials such as PVC plastics. In many countries, laws strictly prohibit thermal destruction of PVC due to its harmful emissions, but with so many different forms of PVC in the waste stream it is virtually impossible to eliminate it.

Considerable Success having Achieved in Solid Waste Management

In Germany, with the introduction of the so-called recycling bin, it is estimated that seven kilograms per capita per year of high-grade material of metal and plastic other than packaging can additionally be material recycled.

An important non-market-based initiative contributing to increasing recycling rates for MSW in the UK was the establishment of WRAP UK in 2001, in response to the 2000 Waste Strategy for England and Wales. WRAP is an enabling organisation whose core activity is establishing voluntary partnerships between producers and recyclers of waste, and between them and users of products containing recycled materials. One example of a WRAP initiative is the Cortauld Commitment, a voluntary agreement for retailers to engage them in reducing food waste and optimising the use and recycling of packaging.

In Japan: The gold standard for MSW will be to integrate it into a materials management approach known as a “circular economy,” which involves a series of policies to reduce the use of some materials and to reclaim or recycle most of the rest. Japan has made the circular economy a national priority since the early 1990s through passage of a steady progression of waste reduction laws, and the country has achieved notable successes. Resource productivity (tons of material used per yen of gross domestic product) is on track to more than double by 2015 over 1990 levels, the recycling rate is projected to roughly double over the same period, and total material sent to landfills will likely decrease to about a fifth of the 1990 level by 2015.

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