PLASMA ARC TECHNOLOGY IN WASTE DISPOSAL

SEMINAR REPORT

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Certificate

*This is to certify that the Seminar Report entitled **"Cool Pavement"** is a bonafide record of the work done by **AJIN RAJ P R (Register No:2101010010)** during the academic year **2021-2024** under our guidance and supervision towards the partial fulfilment of the requirements for the award of **Diploma in Civil Engineering** under the Department of Technical Education, Government of Kerala.*

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ABSTRACT

Cool pavement refers to pavements paved with a range of emerging materials. These materials enable lesser heat absorption on the pavement and help to address the problem of urban heat islands, which is often a result from increased temperatures in paved surfaces in a city. One of the possible ways is to improve solar reflectivity of pavements, whereby ordinary Portland cement is substituted with white cement to create a whiter surface. Alternatively, the addition of titanium oxide into conventional concrete mix can achieve similar effects. Titanium oxide additives also helps in mitigating the international pollution problem due to its self cleansing properties When infused in concrete, it can break down and render harmless the air pollutants. However, considerations such as cost, physical and thermal properties of the element's dosage need to be considered thoroughly to achieve optimum results. To further enhance the durability of pavements, conventional concrete was replaced wholly with engineered cementitious composites (ECC). This reduces the effect of brittle fracture failure due to repeated loadings. In this study, the above alterations were applied to create the composite (cool pavement) specimens and a temperature prediction model was created. Validation of model was done by comparing the experimental and modelled temperatures. Based on the validation of different composites coupled with parametric study, the suitability of the prediction model for this pavement type was concluded.

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INTRODUCTION

Waste is anything, which is unacceptable to an owner and directly has no monetary value but its proper utilization can make a business. Municipal Solid Waste (MSW)includes waste from households, nonhazardous solid waste from industrial commercial, institutional establishment (excluding bio-medical waste in present context), Market waste, Yard waste, Agriculture waste & Street Sweepings. Industrial and community hazardous waste is not considered as MSW and should be collected and processed separately. MSW (Management and Handling) Rules 2000 defines MSW as commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding hazardous wastes but including treated biomedical wastes. Various other definitions related to MSW, which are defined in MSW Rules 2000, are given in MSW management encompasses the functions of collection, transfer and transportation, processing and recycling, and disposal of MSW. Plasma technology was introduced in the 1950s; adaptation of this technology to large-scale waste destruction, including gasification of waste and recovery of energy from the generated gas is new. Plasma gasification of municipal solid waste (MSW) is a fairly new application that combines well-established sub-systems into one new system. Plasma Gasification, the MSW is gasified in an oxygen-starved environment to decompose waste material Into its basic molecular structure. As opposed to incinerators, the waste does not combust in the gasifying Plant. Plasma may be created in a variety of ways, including passing a gas between objects with large differences in electrical potential, as in the case of lightning, or by exposing gases to high temperatures, as in the case of arc welding or graphite electrode torches. Plasma arc torches utilize a combination of these techniques. A relatively small quantity of ionized gas is produced by an "arc igniter" and introducedBetween the electrodes contained in the body of the torch. The extremely intense energy produced by the torch is powerful enough to disintegrate the waste material into its component elements. The subsequent reaction produces syngas and byproducts consisting of a glass-like substance used as raw materials for construction and also reusable metals. Syngas is a mixture of hydrogen and carbon monoxide and it can be converted into fuels such as hydrogen, natural gas or ethanol. The Syngas generated is fed into a heat recovery steam generator (HRSG) which generates steam. This steam is used to drive a steam turbine Which in turn produces electricity. The cooled gas is then compressed and used to drive a gas turbine which in turn produces additional electricity. The integrated gasification combined circle (IGCC) energy thus produced is used partly for the plant load, while the rest can be sold to the utility grid. Essentially the inorganic materials such as silica, soil, concrete, glass, gravel, including metals in the waste are vitrified and flow out the bottom of the reactor. There are no tars, furans or ashes enough to pollute the environment. Municipal solid waste is believed to be a source of renewable energy, and plasma arc gasification technology is one of the leading-edge technologies available to harness this energy (PouraliM. 2010). The Waste is a sustainable fuel source and increasing day by day as population increases. Therefore Plasma Gasification may be proven as a sustainable source of clean energy and environmentally safe solution for waste management.

2 WAYS OF DISPOSAL OF WASTE

2.1 •Composting

Composting is the natural process of recycling organic matter, such as leaves and food scraps, into a valuable fertilizer that can enrich soil and plants. Anything that grows decomposes eventually; composting simply speeds up the process by providing an ideal environment for bacteria, fungi, and other decomposing organisms (such as worms, sowbugs, and nematodes) to do their work. The resulting decomposed matter, which often ends up looking like fertile garden soil, is called compost. Fondly referred to by farmers as "black gold," compost is rich in nutrients and can be used for gardening, horticulture, and agriculture.

Organic discards can be processed in industrial-scale composting facilities, in smaller-scale community composting systems, and in anaerobic digesters, among other options. This guide focuses primarily on home composting, which is a great way to keep your organic discards out of the waste stream and producea valuable soil amendment for your own use.

2.1.1 Benefits of Composting

Reduces the Waste Stream

Composting is a great way to recycle the organic waste we generate at home. Food scraps and garden waste combined make up more than 28 percent of what we throw away. Not only is food waste a significant burden on the environment, but processing it is costly. The average cost to landfill municipal solid waste in the United States was around $55 per ton in 2019. With the United States generating morethan 267 million tons of municipal waste in 2017 and sending two-thirds of that to landfills and incinerators, we spent billions of dollars on waste management. Composting at home allows us to divert some of that waste from landfills and turn it into something practical for our yards

2.2 sanitary landfill

method of controlled disposal of municipal solid waste (refuse) on land. The method was introduced in England in 1912 (where it is called controlled tipping). Waste is deposited in thin layers (up to 1 metre, or 3 feet) and promptly compacted by heavy machinery (e.g., bulldozers); several layers are placed and compacted on top of each other to form a refuse cell (up to 3 metres, or 10 feet, thick). At the end of each day the compacted refuse cell is covered with a layer of compacted soil to prevent odours and windblown debris. All modern landfill sites are carefully selected and prepared (e.g., sealed with impermeable synthetic bottom liners) to prevent pollution of groundwater or other environmental problems. When the landfill is completed, it is capped with a layer of clay or a synthetic liner in order to prevent water from entering. A final topsoil cover is placed, compacted, and graded, and various forms of vegetation may be planted in order to reclaim otherwise useless land—e.g., to fill declivities to levels convenient for building parks, golf courses, or other suitable public projects. See also solid-waste managemen

2.3 Incineration

Incineration is a waste treatment process that involves the combustion of substances contained in waste materials.[1] Industrial plants for waste incineration are commonly referred to as waste-to-energy facilities. Incineration and other high-temperature waste treatment systems are described as “thermal treatment”. Incineration of waste materials converts the waste into ash, flue gas and heat. The ash is mostly formed by the inorganic constituents of the waste and may take the form of solid lumps or particulates carried by the flue gas. The flue gases must be cleaned of gaseous and particulate pollutants before they are dispersed into the atmosphere. In some cases, the heat that is generated by incineration can be used to generate electric power.

Incineration with energy recovery is one of several waste-to-energy technologies such as gasification, pyrolysis and anaerobic digestion. While incineration and gasification technologies are similar in principle, the energy produced from incineration is high-temperature heat whereas combustible gas is often the main energy product from gasification. Incineration and gasification may also be implemented without energy and materials recovery.

In several countries, there are still concerns from experts and local communities about the environmental effect of incinerators (see arguments against incineration).

In some countries, incinerators built just a few decades ago often did not include a materials separation to remove hazardous, bulky or recyclable materials before combustion. These facilities tended to risk the health of the plant workers and the local environment due to inadequate levels of gas cleaning and combustion process control. Most of these facilities did not generate electricity.

Incinerators reduce the solid mass of the original waste by 80–85% and the volume (already compressed somewhat in garbage trucks) by 95–96%, depending on composition and degree of recovery of materials such as metals from the ash for recycling.[2] This means that while incineration does not completely replace landfilling, it significantly reduces the necessary volume for disposal. Garbage trucks often reduce the volume of waste in a built-in compressor before delivery to the incinerator. Alternatively, at landfills, the volume of the uncompressed garbage can be reduced by approximately 70% by using a stationary steel compressor, albeit with a significant energy cost. In many countries, simpler waste compaction is a common practice for compaction at landfills.

Incineration has particularly strong benefits for the treatment of certain waste types in niche areas such as clinical wastes and certain hazardous wastes where pathogens and toxins can be destroyed by high temperatures. Examples include chemical multi-product plants with diverse toxic or very toxic wastewater streams, which cannot be routed to a conventional wastewater treatment plant.

2.4 Gasification Process

Gasification is a technological process that can convert any Carbonaceous (carbon-based) raw material such as coal Into fuel gas, also known as synthetic gas (syngas for Short). It occurs in a gasifier, generally a high Temperature/pressure vessel where oxygen (or air) and Steam are directly contacted with the coor other feed Material causing a series of chemical reactions to occur That convert the feed to syngas andash/slag (mineral Residues).

3.PRINCIPLE

Relatively high voltage, high current electricity is passed between two electrodes, spaced apart, creating an electrical arc. Inert gas under pressure is passed through the arc into a sealed container of waste material, reaching temperatures as high as 13,900 °C in the arc column. The temperature a few feet from the torch can be as high as 2,760-4,427 °C. At these temperatures, most types of waste are broken into basic elemental components in a gaseous form, and complex molecules are separated into individual atoms.Use of plasma arcs (from electrical input) as part of waste disposal/destruction has been in use for many years. By raising the waste to very high temperatures, such as 3000-4000 °C for example, organic components are broken down into simpler atoms/molecules and inorganics are melted into a glassy slag. If conducted in an atmosphere containing oxygen (or air), the organic components will burn to produce CO2 and water. If carried out in the absence of oxygen, the process is referred to as ‘plasma gasification’ and will produce a combustible gas, made up mainly of carbon monoxide (CO) and hydrogen which can be cooled and treated for use in other equipment. Some metals, always including mercury but also others (cadmiumlead, for example), will be evaporated at the high temperatures and will leave with the exit gas stream from which they will need to be condensed/removed. Precursors to dioxins/furanes will be destroyed at the high operating temperatures, though care is necessary to avoid them reforming as the gas stream is cooled. In the latest systems the temperature level has been reduced to optimise power use, which gives favourable conditions for volume reduction of ash (as an inert glassy slag for beneficial use) and destruction destruction of toxic components in flue gases(Mott MacDonald, 2008).

4• Process of Plasma Gasification Process

Plasma gasification is an emerging technology which can Process landfill waste to extract commodity recyclables And convert carbon based materials into fuels. It can form An integral component in a systemto achieve zero waste And produce renewable fuels, whilst caring for the

Environment. Plasma arc processing has been used for years to treat hazardous waste, such as incinerator ash And chemical weapons, and convert them into non-Hazardous slag.Plasma gasification is a multistage process that feeds Inputs ranging from waste to coal to plant matter, and can Include hazardous wastes. Steps of this process are as Follows.

1. Waste feeding system
2. Plasma gasifier
3. Plasma generating devices
4. Waste processing facilities
5. Yields and byproducts
6. cleaning facilities

4.1. Waste feeding system

The feedstock for plasma waste treatment is most often Refuse-derived fuel, biomass waste, or both. Feedstock May also include biomedical waste and hazmat materials. Content and consistency of the waste directly impacts Performance of a plasma facility. Pre-sorting to extract Treatable material for the gasification provides Consistency. Too much organic material such as metal and Construction waste increases slag production, which in Turn decreases syngas production. However, a benefit is That the slag itself is chemically inert and safe to handle (certain materials may affect the content of the gas Produced, however). Shredding waste to small uniform Particles before entering the main chamber is generally Required. This creates an efficient transfer of energy which Enables sufficient breakdown of the materials. Steam is Sometimes added into gasification processes to increase The generation of hydrogen (steam reforming).

4.2. Plasma gasifier

Plasma gasification plant

The plasma arc furnace or plasma gasifier or plasma Reactor is a device to melt a substance by low- temperature Plasma flow, typically created by an electric arc heater (plasmatron). It can be constructe with different Materials, which in turn decide the life of operation. It is a Vertical refractory lined vessel into which the Contaminated waste material is introduced near the top. It Contains plasma generating devices which helps to Produce plasma which converts wastes into useful By product

4.3. Plasma generating devices

Most thermal plasma is generated by either an electric arc Or by a radio frequency induction (RFI) discharge. In this, Plasma torch is used, which is powered by an electric arc Is used to ionize gas and catalyze organic matter into Syngas, with slag remaining as a by-product.

Types of plasma torches are;

a. DC Plasma Torches
b. RF Plasma Torches
c. AC Plasmas Torches

DC torches are the most commonly used and researched, Because when compared to AC. There is less flicker Generation and noise, a more stable operation, better Control, a minimum of two electrodes, lower electrode Consumption, slightly lower refractory (heat) wear and Lower power consumption.

4.4. Waste processing facilities

Small torches typically use an inert gas such as argon Where larger torches require nitrogen. The electrodes vary From copper or tungsten to hafnium or zirconium, along With various other alloys. A strong electric current under High voltage passes between the two electrodes as an Electric arc. Pressurized inert gas is ionized passing Through the plasma created by the arc. The torch's Temperature ranges from 2,000 to 14,000°C (3,600 to 25,200ºF). The temperature of the plasma reaction Determines the structure of the plasma and forming gas.The waste is heated, melted and finally vaporized. Only at These extreme conditions, molecular dissociation occur by Breaking apart molecular bonds. Complex molecules are Separated into individual atoms. The resulting elemental Components are in a gaseous phase (syngas).

4.5 Syngas cleaning facilities

In any gasification process, the production of clean Synthetic gas (syngas) –free of contaminants such as Particulates, sulphur, ammonia, chlorides, mercury, and Other trace metals, and possibly carbon dioxide is crucial To final product quality, to protecting downstream units Such as gas turbines, catalytic reactors, and fuel cells, and To ensuring low environment emission levels. Therefore, Gas cleanup steps are indispensable, but do have a sizeable Impact on plant economics, as they can account for a Substantial portion of the overall capital cost and Operational costs. Although raw syngas leaving the gasifier Is at high temperature, conventional gas cleaning is Typically carried out at low temperature by scrubbing the Syngas using chemical or physical solvents (these require Cooling the gas to typically below 100º F). The cooling Equipment required, and the need to reheat the syngas Before making use of it in a combustion turbine or Synthesis reactor, result in economic and thermodynamic Penalties that decrease the efficiency of a gasification Plant. Accordingly, gas cleanup that would operate at high Temperature while still removing contaminants would Provide a significant efficiency improvement in Gasification-based processe

5.The essential components of a plasma gasification plant are:

1. TRITURATION AND CONVEYOR SECTION

2. PLASMA TORCH

3. CHAMBER

4. GAS REFORMER AND HEAT EXCHANGER

5. GAS CLEANUP FILTER

5.1 TRITURATION AND CONVEYOR SECTION

Consists of a grinder for breaking the trash into manageable size

5.2 PLASMA TORCHES

Convert organic material into syngas with hydrogen and carbon monoxide content through an extreme thermal process.

4.3 PYROLYSIS CHAMBER

It is an air-locked chamber with one or more plasma torches. It allows the garbage in but prevents hot gases from escaping in to the atmosphere. The chamber is lined with heat-resistant refractory material.Towards the bottom side of the chamber is drainage system for slag. It also incorporates a water- cooling system. Towards the top of the chamber is the exit vent for the gases

5.4 GAS REFORMER AND HEAT EXCHANGER

•Reforms hydrocarbon fuel into a reformate gas Such as hydrogen-rich gas known as syngas.

•Heat ex-changer, the hot gases heat water to Produce steam turbine generator to produce electricity.

5.5 GAS CLEANUP FILTER

•As the gases produced by pyrolysis mainly comprise carbon monoxide, hydrogen and hydrocarbons and carbon dioxide and nitrogen

- The next step is to ‘clean’ the syngas or producer gas. It is done using gas cleanup filter.
- The gas is burned in internal combustion engine generator turbines to produce electricity.

6. PROCESS

First of all, the waste is passed through crusher and grinder, so that the size can be reduced to a manageable size. The crushed waste is fed in to the pyrolysis chamber from the top. One or more plasmatorches are installed in the chamber.

A plasma reactor operates in an oxygen starved environment and hence combustion process does not take place. With core temperature running up to 10,000 °C, plasma is able to breakdown toxic compounds within milliseconds, avoiding the formation of secondary combustion products including the polluting flue gas. The molecular dissociation starts above 2700 “C. Any temperature below this will produce incomplete dissociation. Thus with the temperatures achieved in a system(above 2700 °C), all the molecules are totally dissociated.For waste processing, the plasma arc is not applied to the waste itself, but used as a source of very high temperature heat for the waste. Nearby which is therefore heated rapidly and substantially by radiation, though not to the full temperatures of the plasma.

Both organic and inorganic wastes including industrial, biomedical, nuclear and e wastes can be processed at atmospheric pressure using this technology. The extreme temperatures generated using a plasma torch system, transform the organic matter into basic gases such as synthetic gas (syngas) a mix of hydrogen and carbon monoxide gas. This synthetic gas is almost a green fuel, which is used by advanced gas turbines for the generation of electrical power.

The inorganic materials are simultaneously melted into molten slag, which upon cooling becomes a vitrified, inert glass-like material (through magmavication process) that can be used by the construction industry. The homogenous and sulphuric products contained in the feed are transformed to hydrochloric acid (HCI), hydrofluoric acid (HF) and hydrogen sulphide (H_2S). Suitable neutralization techniques for these three products are employed. No ashes are produced in the process.

Syngas is made up of carbon monoxide, hydrogen, water and nitrogen. Small amounts of chlorine, hydrogen sulfide, particulate, carbon dioxide and metals with boiling points less than 2280° F are contained in the gas. Because of the low oxygen atmosphere and high temperature, the base elements of the gas cannot form toxic compounds such as furans, dioxins, NOx, or sulfur dioxide in the reactor. As the gas exits the reactor it first goes to a gas reformer and then it is cooled in a series of high temperature heat exchangers. The sensible heat is reduced to about 270° F and is used to generate high-pressure steam that is fed to a steam turbine to produce electricity.

7. OPERATION COST

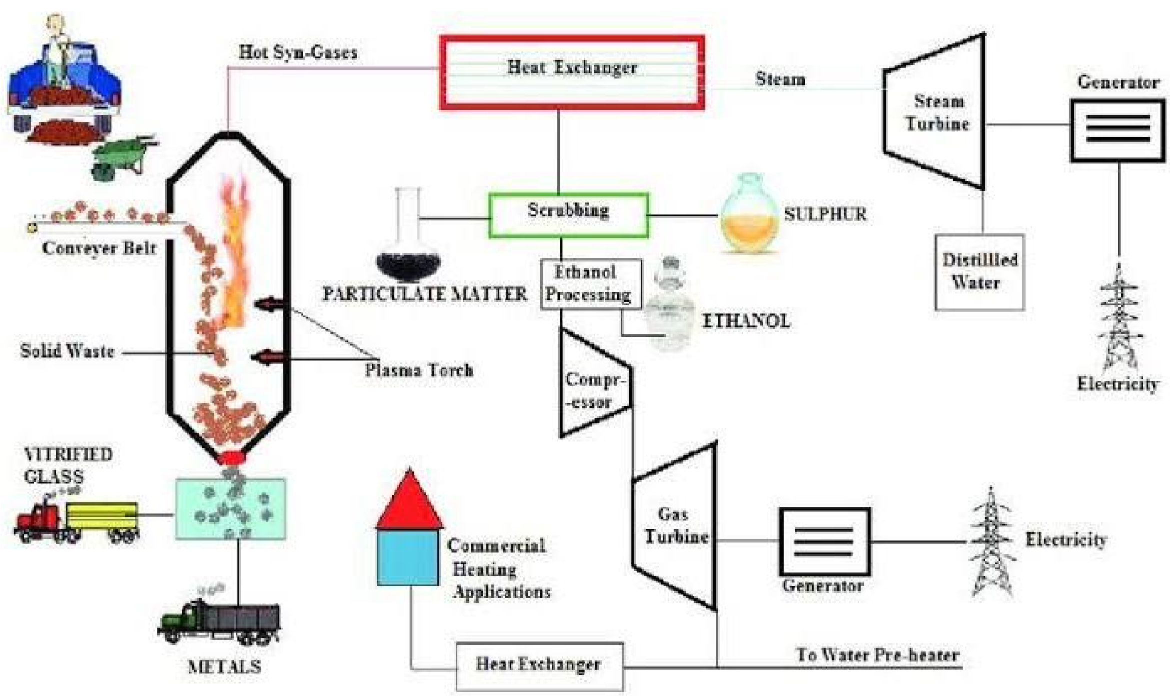
The electrical power requirement for conversion of one tonne of municipal solid waste into vitrified solids and metals, hydrogen and carbon monoxide gas averages around 670 units (kWh). At Rs 3 per unit, the cost of conversion works out to be Rs 2000 per tonne. Although one may be able to reduce the running

cost by, say, 75 per cent, after selling the byproducts, the net cost of the plant would still be Rs 750 per tonne.

As an example, let us consider Delhi with its current population of over 15 million. The average garbage generation may be assumed to be 0.7 kg per person per day (against Americans' average of about 2 kg per person per day). Accordingly, Delhi would be generating around 10,500 metric tonnes of garbage per day. The net operational cost would thus be Rs 7.875 million per day (at Rs 750 per tonne) or Rs 2870 million per annum. This is in addition to garbage collection and transportation and other infrastructure costs. A Startech plasma converter that could handle 2000 tonnes of waste daily costs roughly $250 million. Delhi would require eight such huge plants at a whopping cost of $1000 million (roughly Rs 40 billion).(Bhasin, K. C., 2009)

8. ENVIRONMENTAL IMPACT

Plasma gasification uses an external heat source to gasify the waste. Almost all of the carbon is converted to fuel gas. Plasma gasification is the closest technology available to pure gasification. Because of the temperatures and drastic conditions involved all the tars, char and dioxins are broken down. The exit gas from the reactor is cleaner and there is no ash at the bottom of the reactor, while there are no by- products that end up to landfills provided that there are available markets for the produced slag. On the other hand, the use of plasma gasification processes reduce methane emissions produced from the disposal to landfill sites while as a waste to energy treatment method, enables the displacement of CO, that would have been emitted had the electricity been generated from fossil



9. WORKING

- The crushed waste is fed in to the pyrolysis chamber from the top where one or more plasma torchesare installed in the chamber.
- Hot air is injected to chamber heating a bed of coke and limestone
- Hot gases break down the fuel to produce syngas
- Remaining inorganic components are converted into slag and cooled into a glass like product
- The syngas exit the top of chamber and enters a heat recovery unit Cooled syngas move to cleanup filter,separate particular matter from syngas
- moves to gas turbine,spins the generator to produce electricity.
- heat from gas turbine is then used to create steam in the heat recovery steam generator.
- This steam drive steam turbine which spins another generator to create additional clean energy through
an efficient combined cycle process

10. BY PRODUCTS

The three major by products of the plasma gasification process are syngas, vitrified glass and electricity. The by products are explained below:

•SyngasSyngas (from synthesis gas) is the name given to a gas mixture. It consists primarily of hydrogen, carbon monoxide, and very often some carbon dioxide, and has less than half the energy density of natural gas. Syngas is combustible and often used as a fuel source or as an intermediatefor the production of other chemicals.

•Vitrified GlassFrom the inorganic fraction in the waste, an inert vitrified glass is formed that has excellent applications in the construction industry, including concrete aggregate, road bed/fill and sandblasting.

•ElectricityHigh-pressure steam from the heat exchanger goes to a steam turbine where it is converted to electricity. The electricity generated with this steam source provides most of the power needed for internal power requirements. The system is capable of generating all its own internal requirements.Other minor by products are metals, sodium bisulphate, hydrochloric acid, ethanol and distilled water

11. Comparison between plasma gasification and Incineration

Incineration	PPV
Combustion of wastes with air excess.	Thermal decomposition of wastes with absence of air, in an inert atmosphere, at closed reactor, with substantially higher temperatures.
System treatment conditioned to some kind of solid wastes, due to atmospheric emissions released.	System treatment applied to any kind of solid wastes.
Air volume very high.	Air volume 20 to 50 times below at incineration.
Production of ashes and slag's, which have to be treated.	Ashes and heavy metals are vitrified in a hardness solid structure, without lixiviation.
Production of several dangerous organic compounds with high stability, like dioxins, furan's and PCB's.	Destruction of organic compounds almost complete, leading to the release of pyrolysis gas, with H_2, N_2, CO, CO_2, H_2O, CH_4 and other hydrocarbons in track amounts.
In the dedicated incineration, the gases can be valorised in the production of electric energy.	The pyrolysis gas can be valorised in energy production or used in the steam production, convertible in electric energy. However, due to the gap temperatures used, the energy production can represent 20%-80% plus than the energetic consumption.

12 . Advantages of plasma gasification

a) Syngas used to generate “green electricity”.

b) Slag can be used for road aggregate and building Materials.

c) Does not produce hazardous bottom ash and fly Ash

d) Very little maintenance and unlike traditional Power plants.

e) Efficient in smaller scale systems

f) Can provide a high degree of flexibility over the Longer term

g) Does not make difference among input wastes

h) Reduces emissions far below conventional coal Plants

k) Limited space requirement

i) Lower carbon footprint.

13. Disadantages of plasma gasification

a) The lack of standards by national and International organization

b) **Initial cost and return of investigation**

c) Skepticism on environment effects

d) **Confusion between plasma gasification and Incineration**

e) Complex process control & highly skilled Professionals are required

14 .CASE STUDY

SACROMENTO, CALIFORNIA

• This case study shows the current domestic barriers in moving forward with this new Waste to Energy technology.

• The failure of plasma gasification in Sacramento is representative of two main domestic barriers: a discouraging lack of precedent and a lack of financial security.

•Internationally, plasma gasification plants are rewarded by recovering' energy from waste, while in the United States, plasma gasification is seen in the same unhealthy vein as incineration, which leads to a lack of subsidies and public disapproval.

MIHAMA AND MIKATA,UTASHINAI CITY, JAPAN

•A 165 ton per day plant in Utashinai City, and a 28 ton per day plant in the twin cities of Mihama and Mikata

• Was one of the first plasma gasification facilities worldwide

•It now processes a mixture of auto shredder residue and municipal solid waste.

• The primary concerns at Ecovalley were an improperly sized gasifier, a low quality refractor, and excessive particulate carryover which led to cease its operation for short time The new gasifiers have all taken into account these issues and plants without these problems

•It is successful and still operate to this day

15 . CONCLUSIONS

Amount of municipal solid waste is increasing day by day, Therefore its management and disposal is becoming Difficult. Nowadays, although there are several disposal Techniques for all types of waste, new techniques have Started to be considered. One of these new techniques is Plasma gasification; it is a more innovative and Environmentally friendly method than others. Gasification Could now be proposed as a viable alternative solution for Waste treatment with energy recovery. Independently-Verified emissions tests indicate that gasification is able to Meet existing emissions limits and can have a great effect On thereduction of landfill disposal options. Government Should take the required initiatives to develop this Technology for alternative power generation to address Power shortages and reduce the use of fossils.There is a huge gap between demand and supply mainly inIndia for this technology. Large capacity systems are Available but in order to make this technology advanced And widely accepted smaller capacity systems of Pico Range i.e. 1-2 MW should be encouraged particularly for Rural areas. Such kind of technological advancement can Cater to huge gaps .

16. REFERENCES

[1] Nallapaneni Manoj Kumar, "Petrochemical Waste Treatment using Plasma Technology" International Journal of Engineering Computational Research and Technology (IJECRT), ISSN: 2456 – 9852; Volume 3, Issue 1, June 2018.

[2] Carpinlioglu Melda Ozdinc, Aytac Sanlisoy,"Performance assessment of plasma gasification

For waste to energy conversion: A methodology for Thermodynamic analysis" International Journal of Hydrogen Energy (IJHE), 43.25: 11493-11504; Volume 43, Issue 25, 21 June 2018.

[3] Özge YAZICIOĞLU and T. Yaşar KATIRCIOĞLU, "Applications of Plasma Technology in Energy Sector" Kirklareli University Journal of Engineering and Science , Volume3 ,18-44,(2017)

[4] Gamze,"Disposal of municipal solid waste by plasma Gasification",International journal of engineering and Technology,vol 2,sep 2009

[5] Vyas,"Plasma Pyrolysis : An Innovative Treatment to Solid Waste of Plastic Material",International journal of Environmental science and technology,vol 4,2012

[6] Vijay bhujpal, "Plasma technology: A solution to waste Management and power generation", International Journal of Innovations in Engineering Research and Technology,Vol 3,March 2019,PP 146 to 149

[7] Elba Helen George ,"Review on Plasma Arc Technology In Waste Management", International journal of Engineering and advanced technology, vol 8, 2010,PP 104 107

[8] Rahul Baidya," Plasma Gasification Technology for Energy Recovery from Waste", Journal of Solid Waste Technology and Management,Vol 42,2016