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SOILD WASTE MANAGEMENT BY INCINERATION

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Abstract

Municipal Solid Waste is the waste generated from residential houses, offices, hotels, canteens, etc. It mainly consist of Dry leaves, grass, tree branches, Waste paper and cardboard, Packaging material like polythene and wood, thermocol, jute etc Kitchen waste, PVC and plastic waste. Currently, it is being collected, transported and Disposed at dumping yard. These practices attract lot of public and Academicians objection in view of open dumping of MSW, obnoxious odour and flies menace etc. It also poses great risk of ground water contamination due to percolation. Finding a Scientific solution to the MSW disposal problem is prime consideration of the Government. It is connected with public health issues. As per the Municipal Solid Waste (Management and Handling) Rules, 2000, waste disposal Methods prescribed includes Composting, Vermin Composting, Anaerobic Digestion, Incineration. The term 'Incineration' is used to describe processes that Combust waste and recovers energy. Incineration is the most common thermal treatment process. This is the combustion of waste in the presence of oxygen. After incineration, the wastes are converted to carbon dioxide, water vapour and ash. This method may be used as a means of recovering energy to be used in heating or the supply of electricity. In addition to supplying energy incineration technologies have the advantage of reducing the volume of the waste, rendering it harmless, reducing transportation costs and reducing the production of the green house gas methane.

Keywords**: *Incineration, energy-from-waste, Energy recovery, Managing waste Combust waste***

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1. INTRODUCTION

Municipal Solid Waste is the waste generated from residential houses, offices, hotels, canteens, etc. It mainly consist of Dry leaves, grass, tree branches, Waste paper and cardboard, Packaging material like polythene and wood, thermocol, jute etc Kitchen waste, PVC and plastic waste. Currently, it is being collected, transported and Disposed at dumping yard. These practices attract lot of public and Academicians objection in view of open dumping of MSW, obnoxious odour and flies menace etc. It also poses great risk of ground water contamination due to percolation. Finding a Scientific solution to the MSW disposal problem is prime consideration of the Government. It is connected with public health issues. As per the Municipal Solid Waste (Management and Handling) Rules, 2000, waste disposal Methods prescribed includes Composting , Vermin Composting, Anaerobic Digestion, Incineration. The term 'Incineration' is used to describe processes that Combust waste and recovers energy. Incineration is the most common thermal treatment process. This is the combustion of waste in the presence of oxygen. After incineration, the wastes are converted to carbon dioxide, water vapour and ash. This method may be used as a means of recovering energy to be used in heating or the supply of electricity. In addition to supplying energy incineration technologies have the advantage of reducing the volume of the waste, rendering it harmless, reducing transportation costs and reducing the production of the green house gas methane.Municipal solid waste (MSW) incineration plants tend to be among the most expensive solid waste management options, and they require highly skilled personnel And careful maintenance. For these reasons, incineration tends to be a good choice only when other, simpler, and less expensive choices are not available. Because MSW plants are capital-intensive and require high maintenance costs and comparatively Higher technically trained operators, they are commonly adopted by developed countries. However, high capital and maintenance costs may make MSW incineration Beyond the reach of many of the lesser developing countries

1.1 Need Of Study

After plastic articles are entered into human life, the composition of plastic Wastes in MSW increased .As plastic wastes are non-degradable and mix with other biodegradable wastes; it defeated the composting process of waste disposal. Presence of plastic wastes in MSW increased its total calorific values and made viable for Incineration. Incineration is imagining only as an option for Disposal of waste not as a energy recovery but also power generation project. The energy Content of the waste is suitable for incineration. To ensure financial viability of Incineration plants, the supply of waste feed should be at least 500 TPD of segregated Waste with a LCV not less than 1500 kcal/kg of waste. Incineration of MSW is technically, economically and environmentally possible method.

1.2Hierarchy Of Municipal Solid Waste Minimization

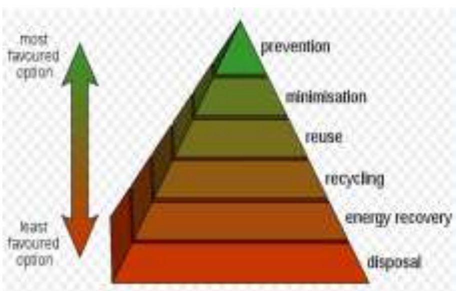

Fig1. Solid Waste Minimization

The management of waste materials represents a challenge throughout the world. Since we are all more aware of the necessity to reduce waste but at the same time we find ourselves striving for material wealth. Many methods of waste management are practiced around the world, from the most basic type of recycling in the form of waste scavengers to high tech incineration. The top level is "prevention" or "avoidance". This waste is prevented in the most obvious way: by avoiding its production entirely. For example, we can prevent plastic carrier bags from going to a landfill by using long-life bags, such as canvas bags, which last virtually forever. In green chemistry, completely different routes for chemical synthesis are developed, with new reagents that cut down on waste and improve efficiency. Alternatively, we just completely avoid the source entirely by just not making the end product, like disposable novelty gadgets that don't do anything and just get thrown away anyway.

Reducing waste is self-explanatory, and relies on making a process more efficient. This option often applies industrial processes far more than the common domestic environment. Generally, improved efficiency is synonymous with economic possibility as well as more useful output can be gained from the same input, and less waste is less expensive to dispose of.

Reuse is simple; reduce waste by not wasting something, but reusing it. This can be combined with the top level by replacing something disposable with something reusable. But most commonly, it means to quite literally reuse something. Plastic bags being, again, the most obvious example. Do not throw these things away! Polyethylene bags (at least the ones that haven't had silly degradation additives put into them) are extremely strong and durable for their weight and thickness. You can reuse these dozens upon dozens of times before they break and avoid accumulating hundreds of them, or use them as bin bags rather than buying new bits of plastic. Creative Reuse or Up-cycling is the reuse of unwanted items by re-purposing them into new end use items. A further extension to the reuse idea is refilling. Ink cartridges are an example, in which the only bit replaced is the stuff that is used up (i.e., the ink). Glass milk bottles are also often collected, washed, refilled and delivered many times in their life. Reuse is often measured in terms of the amount of material diverted from landfills, or the value of the material retained.

It often surprises people how far down the hierarchy recycling is. Despite it being a very visual and pleasing way of waste management (it makes people feel like they're doing something) it's not incredibly efficient as a general process. Recycling is defined as putting energy into a waste item to convert it to something else entirely, sometimes with lower grade and value. It is the preferred option when reuse is not an option, if an item is broken, or in a poor condition that means it can't be reused. Recycling contrasts with reuse in the fact that recycling tends to break an item down to its raw materials before making them into something else. In the milk bottle example, reusing involves washing and refilling, while recycling would involve grinding the glass and melting it again, turning the raw material into a different grade of glass. Recycling saves on processing or extracting of raw materials so is useful when materials are limited and reuse is difficult. “Energy recovery" is really a euphemism for "burn it". This may seem odd, but waste materials still have entropy that can be burned down and harnessed as electricity. This saves burning oil or coal, although other oxidised pollutants, namely sulphur-containing products and dioxins produced can cause more damage. Burning waste in this manner needs to be tightly controlled. Energy recovery can also be achieved with bio-mass waste. We can either burn it directly, or compost it to capture methane, which can be burned to produce energy (biogas).

"Disposal" is also known as "burying it". This is the last resort method for waste disposal and the least favoured (in waste reduction terms), although still the most common. Mostly it is least favoured because we don't get anything back from what we put in the ground. Once something is in a landfill and buried (provided the landfill is set up and lined properly) there is no real harm the waste can do as it degrades naturally - although this can take thousands of years. Some CO_2 or other greenhouse gases may be released, however. Overall, sending something to a landfill should be the last resort when the above five options have been tried. Unfortunately, it is the most common, mostly because of laziness or ignorance on behalf of the public to follow the above, or the lack of research in reuse and recycling things efficiently - hopefully, this should improve in the future, with added awareness and incentives for commercial operations to follow real waste management strategies, rather than simply green washing their image. Many landfills also work towards "energy recovery" by salvaging methane and other gases to be used for energy and heating. This is vastly preferable to simply allowing methane to leak out, as it is a significant greenhouse gas. While methane will eventually decompose in the atmosphere to less harmful carbon dioxide, burning it for useful purposes accelerates the decomposition for a net benefit (or rather, net less-harmful), and produces energy that would otherwise have to be acquired by other means.

2. INCINERATION PROCESS

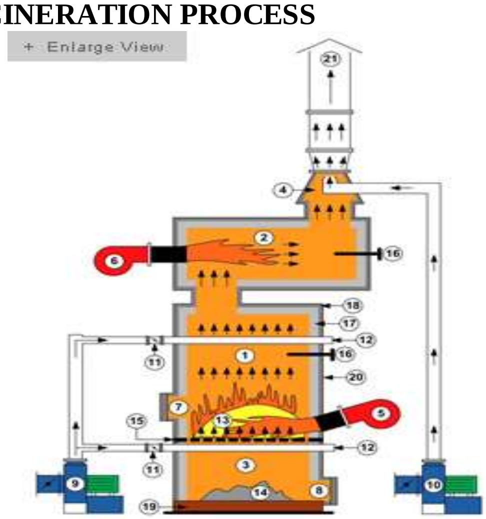

Fig2. Blackhole incinerator

01. Primary Combustion Chamber (PCC)
02. Secondary Combustion Chamber (SCC)
03. Ash Collection Chamber
04. Venturi Ejector
05. Primary Burner
06. Secondary Burner
07. Waste Charging Door
08. Ash Removal Door
09. Combustion Air Fan
10. Ejector Fan
11. Combustion Air Control Dampers
12. Combustion Air Jackers
13. Waste
14. Ash
15. Grate Bars
16. Temperture Probes
17. .Fire Castable
18. Insulating Castable
19. Fire Bricks
20. Fire Bricks
21. Flue Gas Outlet

The procedure of incineration involves feeding the waste through the Charging Door in the Primary Combustion Chamber (PCC) where the Primary Burner heats it and completely degasifies it under sub-stoichiometric conditions. The gases and volatiles that are formed then proceed to the Secondary Combustion Chamber (SCC) where these are completely incinerated by the Secondary Burner at very high temperature with excess combustion air. A key role is played by Ejector and Combustion Air Fans. The former cools down the flue gases that emanate from the SCC before they are released into the environment. This rapid cooling prevents the formation of dioxins and furans. The fan is also connected to a Venturing Ejector which maintains negative draft in the incinerator thus allowing the incinerator to be loaded while in opeSSration. The Combustion Air Fan provides the combustion air in the incinerator. A separate Ash Chamber is provided in the PCC for wastes which have high ash content. The ash leftover in the PCC is sterile and can be removed through the Ash Removal Door. A separate Ash Chamber is provided in the PCC for wastes which have high ash content.

3. IMPACTS OF INCINERATION

This section provides some details regarding the potential environmental impacts of incineration on air, water, land and human health and amenity. Methods to minimize the impacts are presented where appropriate.

Air Potential Impacts

The flue gases from incinerators generally contain: CO2, dioxins, NOx, furans, sulfur dioxide, hydrochloric acid, heavy metals and fine particles. CO2 – Municipal Solid Waste (MSW) contains approximately the same mass fraction of carbon as CO2 itself (27%) therefore incineration of 1 ton of MSW produces approximately 1 ton of CO2.

Dioxins – Older generation incinerators that were not equipped with adequate gas cleaning technologies were significant sources of dioxin emissions.

NOx – A side effect of breaking the strong molecular bonds of dioxin is the potential for breaking the bonds of nitrogen gas (N2) and oxygen gas (O2) in the supply air. As the exhaust flow cools, these highly reactive detached atoms spontaneously reform bonds into reactive oxides such as NOx in the flue gas, which can result in smog formation and acid rain if released into the environment. Particulates –have the potential to contribute to smog.

Water – Potential Impacts

If the strong molecular bonds of dioxins are not effectively broken down by heat then they may escape into the atmosphere or leach into the soil and groundwater from ash or clinker. Where sufficient data is available to determine the 95% species protection level for Dioxins it is as low as 0.03 micrograms per litre15. Ash from modern incinerators is vitrified at temperatures of 1,000°C to 1,100°C, reducing the leach ability and toxicity of residue. The bottom ash residue remaining after combustion has been tested for ecotoxic metals and has been shown to be a non-hazardous solid waste that can be safely put into landfills or recycled as construction aggregate.

Land & Soil

As previously noted, incineration may reduce the volume of solid waste by approximately 90% thereby increasing the life of the landfill. In addition, ash from modern incinerators is vitrified at temperatures of 1,000°C to 1,100°C, reducing the leach ability and toxicity of residue. As a result, special landfills may not be required for MSW incinerator ash thus existing landfills gain an increased life expectation. As noted above, dioxins remaining in solid residue have the potential to negatively impact soil quality if the molecular bonds are not effectively broken down by heat or not properly disposed of in a clay lined landfill.

4. APPLICABILITY OF INCINERATION

MSW incineration projects are immediately applicable only if the following overall criteria are fulfilled.

1. A mature and well-functioning waste management system has been in place for a number of years.
2. The supply of combustible waste will be stable and amount to at least 50,000 metric tons/year.
3. The community is willing to absorb the increased treatment cost through management charges, tipping fees, and tax-based subsidies.
4. Skilled staff can be recruited and maintained.
5. The planning environment of the community is stable enough to allow a planning horizon of 15 years or more.

5. ADVANTAGES OF INCINERATION

1. Incineration is an efficient way to reduce the waste volume and demand for landfill space.
2. Incineration plant can be located close to the center of gravity of waste generation, thus reducing the cost of waste transportation.
3. Using the ash from MSW incinerators for environmentally appropriate construction not only provides a low cost of waste containing heavy metals and so on should be avoided to maintain a suitable slag quality
4. Incineration provides the best way to eliminate methane gas emissions from waste management processes.
5. Incineration process is that it can be used to reduce the original volume of combustibles by 80 to 95 percent.
6. Waste incineration plants can be located near where waste is generated, which decreases the costs and energy associated with transporting waste.
7. Through Waste-to-Energy processes, incineration can be used to produce electricity and heat that can be used to power and heat nearby buildings, and the ash produced can be used by the construction industry.
8. Incineration also eliminates the problem of leach ate that is produced by landfills.

6. DISADVANTAGES OF INCINERATION

1. An incineration plant involves heavy investments and high operating costs and requires both local and foreign currency throughout its operation.
2. The composition of waste in developing countries is often questionable in terms of its suitability for auto combustion.
3. The complexity of an incineration plant requires skilled staff. Plus, the residues from the flue gas cleaning can contaminate the Environment if not handled appropriately, and must be disposed of in controlled and well-operated landfills to prevent ground and surface water pollution.
4. Incineration facilities are expensive to build, operate, and maintain.
5. The high costs associated with this method of waste disposal may encourage waste generators to seek other alternatives for dealing with their waste. These facilities also require skilled staff to run and maintain them.
6. Smoke and ash emitted by the chimneys of incinerators include acid gases, nitrogen oxide, heavy metals, particulates, and dioxin, which is a carcinogen.
7. While incineration pollution control technology is evolving to reduce these pollutants, it has been found that even with controls in place, some remaining dioxin still enters the atmosphere.
8. Some critics of incineration claim that incineration ultimately encourages more waste production because incinerators require large volumes of waste to keep the fires burning, and local authorities may opt for incineration over recycling and waste reduction programs.
9. It is has been estimated that recycling conserves 3-5 times more energy than Waste-to-Energy generates

10. In developing countries, waste incineration is likely not as practical as in developed countries, since a high proportion of waste in developing countries is composed of kitchen scraps.

7. CONCLUSION

Recycling and waste reduction must be considered as our first line of defence to reduce our overall waste stream, and this also must include composting our organic waste instead of throwing it away. When we think about it, there truly is no "away," as all waste must go somewhere. Many of the materials that are thrown away have the potential to be used to produce new items, and not reusing these materials is a large waste of resources. We can use incineration technology where appropriate as part of a sustainable, all-encompassing waste management and energy production system. Each individual community must decide whether the advantages outweigh the disadvantages and the associated costs. Waste incineration should be only one source among many energy sources that are even cleaner.

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