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REVIEW PAPER ON HANDLING OF SOLID WASTE

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***Abstract**:* "Nothing is waste until you think"
This paper deals with the review on handling of solid waste using incineration, composting and landfilling. These are the safe methods to deal with increasing rate of waste.
Different types of waste needs to treated by different method that helps to maintain the good environment. As solid waste is one of the major problem across the world so it is necessary to handle the waste as soon as possible. In this paper we focus on the methods and treatments that helps to manage the waste generated from different field.

Index Terms **– Waste management, Incineration, Composting, Vermicomposting, Landfilling.**

I. Introduction

Increasing rate of population is one of the major reason for increasing rate of waste generation and it is very necessary for handle that waste. Many different types of waste are generated, including municipal solid waste, agricultural and animal waste, medical waste, radioactive waste, hazardous waste, industrial non-hazardous waste, construction and demolition debris, extraction and mining waste, oil and gas production waste, fossil fuel combustion waste, and sewage sludge. These waste are the major problem for these days and directly impact on environment, so it is necessary for handle the generated waste technically as no or less environmental problems will occur.
"Solid waste handling" means the storage, collection, transportation, treatment, utilization, processing, and final disposal of solid wastes, including the recovery and recycling of materials from solid wastes, the recovery of energy resources from such wastes or the conversion of the energy in such wastes to more useful forms or combinations thereof.
Handling of waste are a follows-

II. Waste management

Waste management is maintaining the density of waste. In this reducing the use of materials and reusing them to be the most environmental friendly Source reduction begins with reducing the amount of waste generated and reusing materials to prevent them from entering the waste stream. Thus, waste is not generated until the end of "reuse" phase. Once the waste is generated, it needs to be collected
Reducing and Reusing are the most effective ways to prevent generation of wastes. It is known that as much as 95% of a product's environmental impact occurs before its discard, mostly during its manufacturing and extraction of virgin raw materials
Recycling however requires a separated stream of waste, whether source separated or separated later on after the collection. Due to limitations in source segregation, wastes are collected in a mixed form which is referred to as municipal solid waste (MSW). Mixed waste is difficult to separate. The separation done manually of paper, plastic, glass and metal can then be recycled. It is highly energy and time intensive to separate these materials from SW and generally is not carried out. Therefore, mixing of waste will always result in a fraction of residues, which can neither be recycled nor composted and needs to be combusted in RDF or WTE plants to avoid landfilling and generate energy.

III. Incineration

Incineration is a waste treatment process that involves combustion of waste at very high temperatures in the presence of oxygen and results in the production of ash, flue gas, and heat. Incineration is a feasible technology for combustion of unprocessed or minimum processed refuse and for the segregated fraction of high calorific value waste. The potential for energy generation depends on the composition, density, moisture content, and presence of inert in the waste (about 65% – 80% of the energy content of the organic matter can be recovered as heat energy, which can be utilized either for direct thermal applications or for producing power via steam turbine generators). Incineration of MSW helps to reduce landfill volumes. Incineration is feasible when there are no better options of processing of waste, shortage of land for landfilling. On the downside, incineration is expensive and ash remaining after the process completion can be harmful for the environment if not treated properly.

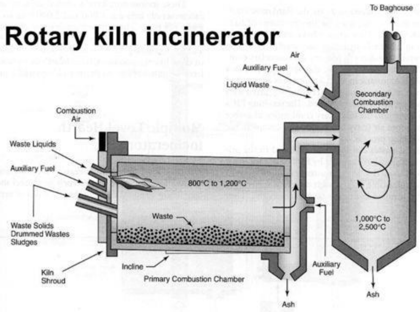
TYPES OF INCINERATORS

There are three main types of combustion technologies in commercial practice:

1. Rotary Kiln, 2. Moving Grate, 3. Fluidized Bed

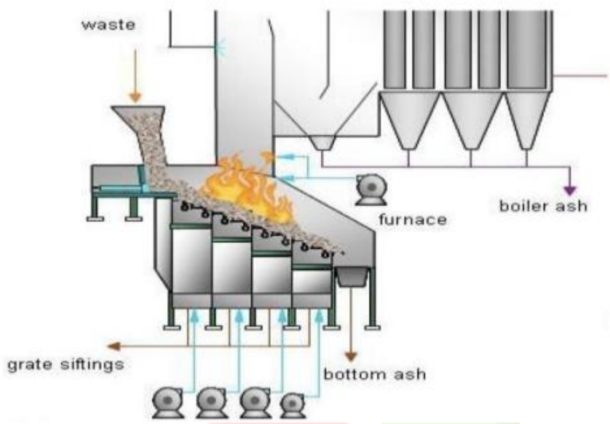
1. Rotary kilns:

Rotary kilns A rotary kiln are commonly used for combusting industrial and hazardous wastes, but is also used in some municipal solid waste incinerators. The principle design consists of two thermal treatment chambers: a slightly inclined primary chamber where waste is fed in (together with inlet of hot exhaust air with oxygen), rotated and thermally decomposed by the heat radiation from the secondary chamber: the re-combustion chamber positioned at the rear of the kiln where the decomposition air and the rest waste is completely burnt with the supply of secondary air. Rotary kiln has the advantage of producing a low level of NOx and thermal destruction of hazardous chemicals.



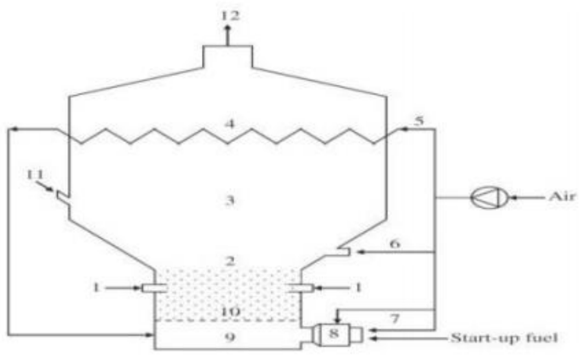
2. Moving Grate:

A moving grate is a typical combustion design of a municipal solid waste incinerator. Waste is dropped by a crane on to the descending grate, which moves into the combustion chamber and eventually moves down to drop the burnt residuals into an ash pit at the other end of the grate. The moving grate is a metallic porous bed, allowing primary combustion air to flow through from the bottom. Secondary combustion air is supplied by nozzles from above the grate, facilitating a complete combustion by the introduction of turbulence.



3. Fluidized Bed:

Fluidized bed combustion has recently increased in application in municipal solid waste incinerators, although it is still mainly used for the combustion of hazardous waste. There are different types of fluidized bed combustors (bubbling, rotating and circulating fluidized bed), but the principle of the design remains the same: waste particles are suspended by the upward flow of combustion air injected from beneath so that it seems like a fluid, by which the turbulence created enhances uniform mixing and heat transfer hence an increased combustion efficiency. The advantage of fluidized bed technology is the enhanced combustion efficiency, however the pre-condition of that is the homogenization of waste inputs in size as well as in heat value, which requires extensive pre-treatment of waste including typically size reduction and mixing.



IV. Composting

The composting process The composting of agricultural waste and municipal solid waste has a long history and is commonly used to recycle organic matter back into the soil to maintain soil fertility. The recent increase in composting, however, it has been arisen due to the need for an environmentally sound waste treatment technology. Composting is seen as an environmentally acceptable waste treatment method. It is an aerobic biological process which uses naturally occurring microorganisms to convert biodegradable organic matter into a humus like product. The process destroys pathogens, converts N from unstable ammonia to stable organic forms, reduces the volume of waste and improves the nature of the waste. It also makes waste easier to handle and transport and often allows for higher application rates because of the more stable, slow release in nature of the N in compost. The effectiveness of the composting process is influenced by factors such as temperature, oxygen supply (i.e. aeration) and humidity content.

Types of composting

There are two fundamental types of composting aerobic and anaerobic:

1. **Aerobic composting**

Composting is the decomposition of organic waste in the presence of oxygen (air); the process includes CO2, NH3, water and heat. This can be used to treat any type of organic waste but, effective Composting requires the right combination of ingredients and conditions. These include the moisture contents around 60-70% and Carbon to Nitrogen (C / N) ratios of 30/1. Any significant variation inhibits degradation process. In general, wood and paper provide an important source of carbon, while sewage sludge and food waste provides nitrogen to ensure an adequate supply of oxygen at all times. Ventilation of waste, either forced or passive is essential.

2. **Anaerobic composting**

Anaerobic Composting is the decomposition of organic wastes in the absence of O2, the products being methane (CH4), CO2, NH3 and trace amounts of other gases and organic acids. Anaerobic composting was traditionally used to compost animal manure and human sewage sludge, but recently it is become more common for some municipal solid waste (MSW) and green waste to be treated in this way

Important Parameters of composting process
- Water content.
- Nutrients.
- pH.
- Oxygen Demand.
- Temperature.
- Time.

Methods of Composting
- Static pile
- In-vessel
- Bin Composter
- Windrow
- Vermicomposting

Using of Compost
1. Soil Conditioning
2. Lawn Dressing
3. Vegetable Gardens
4. Flower Gardens
5. Trees and Shrubs
6. House Plants

Compost Quality

Compost quality is measured by several criteria, including the following:
- Moisture Content
- Heavy Metal
- Stability
- Nutrient Content
- Particle Size Distribution
- Pathogen Levels
- Product Consistency over Time

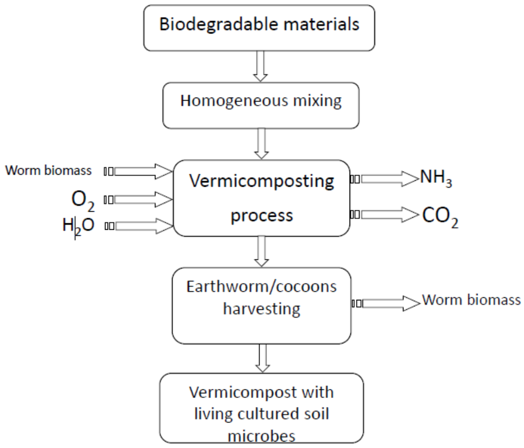
V. Vermicomposting

Vermicompost is the product of the decomposition process using various species of worms, usually red wigglers (*Eisenia fetida*), white worms (*Enchytraeus buchholzi*), and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. Vermicast (also called worm castings, worm humus, worm manure, or worm faeces) is the end-product of the breakdown of organic matter by earthworms. Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner.

Vermicomposting is a green technology that converts organic wastes into plant available nutrient rich organic fertilizer. It has also found to reduce heavy metal concentration in contaminated feeding materials. Vermicompost (VC), when used as fertilizer, not only bears positive impact on soil quality, plant growth and yield but also enhances nutritional value of crops produced. Use of VC on soil improves its physiochemical (aggregation, stability, pH, EC, bulk density, water holding capacity (WHC), organic matter

(OM), micro-and macro-nutrients.) and biological properties (microbial population, enzymes). It also increases soil structural stability and reduces vulnerability of soil to calamities like erosion. Use of VC in plant growth enhances their development in early as well as latter stages of plant growth but proper concentration of VC must be considered for optimum plant growth and production.

Mechanisms of vermicomposting



VI. Landfilling

Landfills are the physical facilities used for the disposal of residual solid wastes in the surface of the earth. Landfilling is the process by which residual solid waste is placed in landfill. Landfilling includes monitoring of the incoming waste stream, placement and compaction of waste, and
installation of landfill environmental monitoring and control facilities.
Types of landfill:

- Sanitary landfill: engineered facility for the disposal of municipal solid waste
- Secured landfill: for the disposal of hazardous wastes

Design Life

Life of a sanitary landfill comprises of an active period and a closure and post-closure period. Active period may typically range from 20 to 25 years depending on the availability of land area. Closure and post-closure period, for which a sanitary landfill will be monitored and maintained, will be 15 years and more after the active period is completed.

Status of MSW management India

Parameter Status House-to-house collection of waste	18 states (of 29)
Segregation of waste at the source	5 states 5 states (of 29)
Number of unsanitary landfill sites identified	1,285
Number of sanitary landfill sites constructed	95

Types of municipal solid waste (MSW) to be accepted at landfills

Waste categories suitable for sanitary landfills are the following:
i. Non-biodegradable and inert waste by nature or through pretreatment.
ii. Commingled waste (mixed waste) not found suitable for waste processing.
iii. Pre-processing and post-processing rejects from waste processing sites.
iv. Non-hazardous waste not being processed or recycled.
Landfilling of construction and demolition (C&D) waste, where processing options are not available, will be done in a separate landfill or cell where the waste can be stored and mined for future use in earthwork or road projects.
C&D waste can be used as a daily cover or for road construction at the MSW sanitary landfill.

LANDFILLING METHODS

The principal methods used for the landfilling of MSW are:
1. Excavated cell/Trench
2. Area
3. Canyon/depression

LANDFILL SITING CONSIDERATION

1. Haul distance: Close to generation
2. Location restrictions: 20 km away from airport, 200 m away from highways, 500 m from habitation, 300 m from public park, 500 m from water supply well, 200 m from pond, 100 m from rivers
3. Available land area: minimum for 20-25 years
4. Site access: should have proper access
5. Soil condition and topography: the soil, if used as cover material, should have low porosity. The topography decides the extend of work required to make the site usable
6. Climatology conditions
7. Surface water hydrology: to establish the existing natural drainage or runoff.
8. Geologic and hydrogeological conditions: to ensure that the leachate or landfill gas will not impair quality of local groundwater or subsurface or bedrock aquifers
9. Local environmental conditions
10. Potential ultimate uses for the complete site

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