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MUNICIPAL SOLID WASTE MANAGEMENT AT INDIA

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ABSTRACT

The result of chemical analysis of MSW shows variation in are samples collected from different zones. The analysis result of samples collected from industrial zone and dumping site shows presence of heavy metals, such as Ni, Cr, Pb, Zn, Cu etc. Varanasi is a fast growing city, having a population of 16 lacs. About 75% of population under Municipal Corporation of Varanasi is a attended regularly for sweeping. It generates 690 t of MSW per day @ 538 g/capita per day. Unscientific methods of disposal is causing environment pollution. Preliminary studies show that treatment of waste by land fill gas technology, composting or biomethanation is financially viable option, however, incineration is still economically non viable.

INTRODUCTION

Solid waste arising from human activity has become one of the major environmental problems causing extensive pollution and threat to human health. Solid waste management (SWM) has emerged as a major environmental issue. Today more than 45 million tonne of waste is generated from the urban centres of India which are collected poorly (average collection efficiency at about 72%), transported inadequately (70% cities lack required transportation capacities) and disposed unscientifically (no sanitary landfill exists) (TERI, 1998). The problem of waste management could be mitigated through adoption of improved methods of collection and transportation and active community involvement. Scientific and environment friendly technologies for disposing the waste will reduce the quantity of waste to be finally dumped besides generating substantial amount of manure and energy. Kirpalani *et al*. (2005) have worked on municipal solid waste management whereas Kansal (2002), Jha *et al*. (2003), Shivashankara (2005) and Goswami *et al*. (2007) have studied on urban solid waste management in India.

Municipal Solid Waste (MSW)

According to environment protection agency (ERA) report, MSW comprises waste from residential, commercial, institutional and some industrial sources. MSW does not include the wide variety of non hazardous wastes, such as municipal sludge, construction and demolition waste, combustion ash from

Dower plant and industrial process waste. The sources of MSW generation, their quantification and characterization have been discussed in detail in later in this communication.

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Different Zones in City

Municipal Corporation of Varanasi has been divided into 3 zones as discussed below.

Residential zone - This zone includes purely residential areas, wherein no commercial or industrial activity is expected. Residential area is approximately 75.00% of total area. The MSW from such area includes food waste, house and street sweeping, rubbish and garden trimmings, etc.

Industrial zone - This zone includes marked industrial area, wherein industries of different kinds and sizes are located. Industrial area at Varanasi approximately 5.0% of total area. MSW from this zone includes, packaging material, food waste and rubbish, etc., excluding discarded solid waste from different industrial processes.

Mixed zone - This zone includes, such as shops, restaurants, office building, institutions, etc. Small scale industries are spread in residential areas of lower and lower middle income groups throughout the city. Such areas have also been included in this zone. At Varanasi approximately 20.00% of total area come under this zone. MSW from this zone includes food and vegetable waste.

Physical and Chemical Analysis of MSW

Physical and chemical analysis of the sample was carried out at ITRC, Lucknow and BHU, Varanasi. The samples collected from different zones were taken for chemical analysis. The result of physico-chemcial analysis shows, variation in result for samples collected from different zones .The pH of MSW is an indication of its age. Calorific value is important when the MSW is to be incinerated. The nitrogen, phosphorus, potassium value and carbon contents gives an idea about fertility of organic matter. The analysis result of sample collected from industrial zone and dumping site shows presence of heavy metals, such as nickel, chromium, lead, zinc, copper, etc.

Table . Average chemical composition of MSW

Parameter	Value (%) except pH
pH	8.04
Non-volatile matter, kcal/kg	1616.18
Volatile matter	70.05
Nitrogen	29.95
Phosphorus	2.51
Potassium	0.31
Carbon	0.49
Hydrogen	10.38
Calcium	1.20
Magnesium	1.15
Sulphate	0.63
Iron	0.60
Manganese	7.06
Nickel	0.15
Chromium	0.03
Lead	0.11
Zinc	0.03
Copper	0.06

Management of MSW

Municipal solid waste (MSW) management in Varanasi is carried out by Municipal Corporation. Various technological options employed for treatment and disposal of MSW in Varanasi as follows :

- Landfill technology
- Compositing
- Biomethanation
- Incineration Landfill gas technology:

The landfill gas technology can very effectively be utilized for disposing MSW that has relatively high organic contents. In this technology landfill sites act as a bio reactor in which gas is generated by decomposition of organic matter. It has been estimated that over a period of 10 years, one tonne of MSW can produce gas more than 100 times of its own volume. This gas consists of about 40-50% methane (CH_4) and 50-60% carbon dioxide. The gas is extracted through the well, it is taken to a filter, compressor, monitoring units and then piped to the end user. This can be used directly for kiln, boilers and furnaces or to generate electricity.

Composting

The current practice in composting is aerobic type, which is operated manually either or mechanically. In tropical regions, like Varanasi with higher ambient temperature, stabilization and open window type of composting is preferred.

Biomethanation

It is one of the most innovative technique for treating MSW in which resource recovery is in the form of biogas and organic manure. The biogas can be used for heating or power generation whereas the sludge from treatment plant is used as organic manure. Economic recovery in the form of biogas and organic manure provides good prospects for self-sustainability of the treatment plant. High organic content in the MSW from Varanasi favour this technology.

Incineration

Incineration technology is used for energy recovery from MSW, having calorific value. Incineration achieves maximum volume reduction. In many developed countries, any reference to energy from waste in municipal sector implied combustion was viewed as rendering harmless municipal and other waste, there minimizing the negative impact associated with the land filling. These power stations were seen to reduce the waste that needs to be disposed on the one hand and save fossil fuel on the other hand.

RESULTS AND DISCUSSION

Varanasi is fast growing city, having a population of 16 lacs. About 75% of population under Municipal Corporation of Varanasi is attended regularly for sweeping. It generates 690 tonne of MSW per day @ 538 gm/ capita /day. MSW from Varanasi contains 44.55% moisture and 29.95% volatile matter. Various types of vehicles are used for transportation of waste out of which dumper placer is suitable for congested area, refuse collector and tipper for less congested area. MSW is disposed off through open land dumping without any treatment. Unscientific method of disposal is causing environment pollution. Preliminary studies show that treatment of waste by land fill gas technology, composting or biomethanation is financially viable option, however, incineration is still economically non viable.

To restrict waste problems in future, reduction in waste generation would be an important factor. The industry, business as well as the general public all have a key role to play by recycling, reusing and reducing their waste. Examples of possible reduction at the consumption level includes reuse of containers and bags, selective buying habits, less use of disposable products, and less use of packaging. Alternative technologies can also play a role in source reduction, for example rapid advances in information technology would promote communication and information dissemination by electronic media instead of printed material, paper consumption and in turn it's percentage in waste might be greatly reduced.

According to Marcin *et al*. (1994) source reduction can be accomplished in 3 ways: (1) Fees and tax incentives to promote market mechanisms to effect source reduction, (2) mandatory standards and regulation, and (3) education and voluntary compliance with policies by business and consumers. However, source reduction strategies need to be sensitive to concerns about loss of business and jobs in affected industries. Quantity reduction for MSW could affect employment, tax revenues and economic activity in unpredictable ways (Marcin *et al*. 1994). Alexander (1993) points out some rationale of garbage as a necessary byproduct of a consumer economy and the need for considering the effects of source reduction on economic activity. Since waste is an integral part of modern economics and social life, any policy to reduce and dispose it should involve everyone.

CONCLUSION

Thus, in India specially in urban areas, the following technical components need urgent consideration. F'roper collection of waste, its treatment and disposal. Proper segregation would lead to better options and opportunities for scientific disposal of waste. The biodegradable matter could be disposed off either by aerobic compositing, aerobic digestion or sanitary land filling. Depending upon land availability and financial resources, either of these disposal methods could be adopted.

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