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STATUS OF MUNICIPAL SOLID WASTE MANAGEMENT IN INDIA: CURRENT OPTIONS AND FUTURE PERSPECTIVE

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Abstract

In last few decades as a result of increased population and industrialization the generation of MSW and its treatment and disposal has become a serious problem for the government. At present, India produces 42.0 million tons of municipal solid waste annually and per capita waste generation has increased by 1.3% per annum with urban population increased between 3 – 3.5% per annum and yearly increase in waste generation is around 5% annually. The main reasons for improper management of MSW in India include lack of planning, technically trained manpower, community involvement and awareness creation mechanism etc. In recent years government has taken strict decision to handle this problem in a safe and environment friendly manner. Organic fraction of the waste (biodegradable as well as non-biodegradable) can also be converted into energy using thermo-chemical conversion and bio-chemical conversion. Various environment friendly and economic technologies are being adopted in India to handle this problem like incineration, pyrolysis, Biocomposting, vermicomposting and Sanitary landfills. In this paper, efforts have been made to summarize the current status, disposal and treatment methods in India.

INTRODUCTION

The generation of municipal solid waste in India is a serious environmental problem for its disposal. As we know that the need of energy is also increasing day by day and to full fill this growing energy need research interest has been shifted towards green energy. Conversion of Municipal solid waste into energy using microorganisms can be considered as an environment friendly and cheap technology. At present, the main feedstock for the generation of electricity and heat from biomass are forestry, agricultural and municipal residues, and wastes. For the production of liquid befouls sugar, grain, and vegetable oil crops can be used as feed stocks in small quantities. Approximately 55 million tons of MSW are generated in urban areas of India annually (1.5 lake tones per day**) ((1) Kumar et al, 2010).** Today, biomass supplies some 50 EJ1 globally, which represents 10% of global annual primary energy consumption. This is mostly traditional biomass used for cooking and heating. India is an agriculturally based country with a present population of approximately 1020 million **((2) Union Health Ministry, 2004**). There are 28 states and seven union territories in the country. Due to rapid industrial growth, the urban population is increasing rapidly. As a result, the 677 Class I cities and Class II towns existing in 1991 have increased to more than 700 by 2001 **((3) Central Pollution Control Board (CPCB), Annual Report 2002-2003).** The quantity of MSW has also increased tremendously with improved life style and social status of the populations in urban centers **((4) Sharholy et al., 2007).** The annual waste generation has been observed to increase in proportion to the rise in population and urbanization, and issues related to disposal have become challenging as more land is needed for the ultimate disposal of these solid wastes **(5) Idris et al., 2004**). Solid waste can be defined as no liquid material that no longer has any value to the person who is responsible for it. The words *rubbish*, *garbage*, *trash*, or *refuse* are often used as synonyms when talking about solid waste. In urban areas, solid waste is generated by domestic households, commercial and industrial enterprises, and health care and institutional activities, as well as on the streets. Street refuse contains a mixture of refuse from many sources, because streets are used as dumping grounds by all generators of waste. Where sanitation facilities are lacking and a large animal population roams the streets, street refuse contains a lot of human fecal matter and manure. Streets are also often used for extensive dumping of construction and demolition debris—attracting further dumping of solid waste.

Adverse impact on all components of the environment and human health occurs due to unscientific disposal of MSW **[6-9].** The MSW amount is expected to increase significantly in the near future as India strives to attain an industrialized nation status by the year 2020 **[10-12].**

There is a potential for generation of over 2600 MW of power from urban wastes in the country. The potential of energy from MSW is estimated to be 3650 and 5200 MW, by the end of 11th and 12th five year Plans, respectively. Estimated energy recovery potential from solid and liquid waste from industrial sector is about 1300 MW. The energy recovery potential of industrial waste is expected to increase to about 1600 MW by 2012 and 2000 MW by the year 2017 (MNRE, 209-10). It is clear that technology options for waste-to-energy are increasing and there will be teething problems. Appropriate incentives and regulatory frameworks can provide scope for experimentation and application of technology to find environment-friendly ways of converting waste to energy. By encouraging municipal waste-to-energy projects, we can clean our cities by scientifically disposing of solid waste and generating electricity and at the same time; help reduce the large electricity deficit in the country.

Table 1: Total Municipal Solid Waste Generation in Major Cities of India

Sr. No.	Name of City	MSW generation Tones Per Day (TPD)
1	Delhi	7400
2	Chennai	3036
3	Kolkata	2653
4	Mumbai	5320
5	Bangalore	1669
6	Hyderabad	2187
7	Ahmedabad	2187

Table 2. Physical Characteristics of Municipal Solid Wastes in Different Cities of India

Population Range (in million)	Paper	Rubber, Leather and Synthetics	Glass	Total Compostable matter	Inert	Metal
0.1to0.5	2.91	0.78	0.56	44.57	43.59	0.33
0.5to1.0	2.95	0.73	0.35	40.04	48.38	0.32
1.0to2.0	4.71	0.71	0.46	38.95	44.73	0.49
2.0to5.0	3.18	0.48	0.48	56.67	49.07	0.59
>5.0	6.43	0.28	0.94	30.84	53.90	0.80

Source: Background material for Manual on SWM, NEERI, 1996

TREATMENT TECHNOLOGIES FOR MSW IN INDIA

The various treatment and disposal technologies which are currently in used for MSW are as follows:

(1) Anaerobic Digestion (AD)

In this process, also referred to as bio-methanation, the organic fraction of wastes is segregated and fed to a closed container (biogas digester) where, under anaerobic conditions, the organic wastes undergo bio-degradation producing methane-rich biogas and effluent/ sludge. The biogas production ranges from 50-150m3/ tonne of wastes, depending upon the composition of waste. The biogas can be utilised either for cooking/ heating applications, or through dual fuel or gas engines or gas / steam turbines for generating motive power or electricity. The sludge from anaerobic digestion, after stabilisation, can be used as a soil conditioner, or even sold as manure depending upon its composition, which is determined mainly by the composition of the input waste.

(2) Incineration

In India the incineration is a poor option as the waste consists mainly high organic material (40–60%) and high inert content (30–50%) also low calorific value content (800–1100 kcal/kg), high moisture content (40–60%) in MSW and the high costs of setting up and running the plants [18]. The first large-scale MSW incineration plant was constructed at Timarpur, New Delhi in 1987 with a capacity of 300 t/day and a cost of Rs. 250 million (US$5.7 million) by Miljotecknik volunteer, Denmark. The plant was out of operation after 6 month and the Municipal Corporation of Delhi was forced to shut down the plant due to its poor performance. Small incinerators, in many cities in India, are being used for burning hospital waste however **[9, 13, and 14].**

The RDF and the fuel pelletisation were the first generation waste-to-energy products, which were not environment friendly and therefore not welcome. Burning these products in an uncontrolled manner (without requisite pollution control equipments for energy) released harmful gases in the environment. The second round of waste-to-energy plants faced the challenge from the mixed nature of Indian waste, which had very low calorific value. The Timarpur plant in the 1980s failed mainly because the technology was designed for segregated waste but it had to handle mixed waste. The Lucknow biomethanation plant in the 1990s failed because, again, it could handle only wet segregated waste but had to cope with mixed waste. Fortunately, in more recent years, the technology options in converting Indian solid waste into energy have expanded.

(3) Paralysis

Paralysis converts portions of municipal solid wastes, hazardous wastes and special wastes such as tires, medical wastes and even old landfills into solid carbon and a liquid or gaseous hydrocarbon stream. The typical paralysis process heats a carbonaceous waste stream to 290 - 900°C in the absence of oxygen and reduces waste volumes by 90% and waste weights by 75%.

The solid carbon char has existing markets as an ingredient in many manufactured goods and as an adsorbent or filter to sequester certain hazardous waste components. Paralytic gases may be burned as fuel by utilities or liquefied for use as chemical feedstock or constituents of low-pollution motor vehicle fuels.

(4) Sanitary Landfills

11 secure landfills exist in India and additional 74 sites are identified. Municipal Solid Waste is simply dumped without any treatment into land (depressions, ditches, soaked ponds) or on the outskirts of the city in an unscientific manner with no compliance to regulations .A preliminary assessment of the potential for an LFG utilization project was performed for the Hyderabad Landfill (Landfill) in Hyderabad, India, based on information provided by the Landfill engineer and observations made during a site visit on February 19, 2007. A preliminary assessment of the potential for an LFG utilization or flaring only project was also performed for the Okla. Landfill in Delhi based on information provided by the City and observations made during a site visit on February 21, 2007. So far at present only one largest Sanitary Landfill site is planned in India at Gaspar Ahmedabad.

(4.1) Land filling as per MSW Rules, 2000

Disposal Of Residual Solid Wastes On Land In A Facility Designed With Protective Measures Against Pollution Of Ground Water, Surface Surface Water And Air Fugitive Dust, Wind-blown Litter, Bad Odor, Fire Hazard, Bird Menace, Pests Or Rodents, Greenhouse Gas Emissions, Slope Instability And Erosion

MSW Rules 2000, Government of India

MSW rules 2000 made by the Government of India to regulate the management and handling of municipal solid wastes (MSW) provide a framework for treatment and disposal of MSW. These rules were the result of a 'Public Interest Litigation (PIL)' in the Supreme Court of India (SC). The MSW rules 2002 and other documents published by the Government of India (GOI) recommend adoption of different technologies, which include biomethanation, gasification, paralysis, plasma gasification, refuse derived fuel

(RDF), waste-to-energy combustion (WTE), sanitary landfills (SLF). However, the suitability of technologies to Indian conditions has not been sufficiently studied, especially with regard to the sustainable management of the entire MSW stream and reducing its environmental and health impacts.

CONCLUSION

India produces annually around 960 MT of solids wastes from different activities like industrial mining, agricultural and domestic, the requirement of large land area for its disposal is not only matter of great concern but it poses serious environmental problems also. This huge quantity of wastes can be used in secondary industries to produce construction materials using this waste as minerals or resources, this will not only solve the problem of its disposal but also help to minimize the generation of solid waste from secondary industries. The Municipal Solid Waste (Management and Handling) Rules of the Government of India had laid down the norms for collection, segregation, processing and disposal of waste in 2000. Thirteen years have elapsed, but the rules are still observed more in the breach. Door-to-door collection of municipal waste covers at most only about a half of the total waste, and segregation at the household level is a rarity. Collection from the community bins is not regular, and scientific processing is limited to a very small portion of the waste.

Finally, solid waste provides enormous benefits and can contribute significantly in the national energy mix at least economic, environmental and social costs and it is expected that the share of solid waste in the total Bioenergy generation capacity will increase in future.

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