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WAYS TO PREVENT ENVIRONMENTAL DEGRADATIONBY SOLID WASTE MANAGEMENT

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Abstract

Environmental degradation is a term used to describe the many ways in which our natural environment is compromised. The direct consequences of this process are the significant reduction of biological diversity, as well as the destruction of the general health of the environment. Even though environmental degradation can also have natural origins, human intervention often makes the situation much worse. Environmental degradation is recognized by many international organizations as **a** leading threat to our planet**.** Earth is the only planet we have, and compromising its natural environment could eventually mean the end of human existence. Due to enhanced economic activities and rapid urbanization, waste generation has increased dramatically in the last few decades. Municipal solid waste management (MSWM) is a challenging problem for developing countries. India produces 42.0 million tons of municipal solid waste annually at present. Annual increase in overall quantity of solid waste is assessed at about 5% and nearly three-fourths of the waste is generated in urban areas. MSW amount is expected to increase significantly in the near future as the country strives to attain an industrialized nation status by the year 2020. Municipal Solid Waste (MSW) generation in Mumbai is highest being 5,355 (tpd) followed by Delhi and Kolkata being 4000 and 3692 (tpd) respectively. When solid waste is disposed off on land in open dumps or in improperly designed landfills (e.g., in low lying areas), it causes an adverse impact on the environment, such as ground water contamination, generation of inflammable gases, acidity to surrounding soil, release of green house gases etc. The paper discusses the environmental impacts of improper solid waste management, structure and sources of MSW generation and regulations and also deals with the technical details of waste processing method. A brief description of MSW management problem and present scenario in India is also included in the paper, along with health hazards and impact on Environment.

Keywords: *Urbanization, Municipal*

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1. INTRODUCTION AND PRESENT SCENARIO

Solid waste generation is a continually growing problem at global, regional and local levels due to rapid industrialization, urbanization and rise in living standards of people. Solid wastes are those organic and inorganic waste materials produced by various activities of the society, which have lost their value to the first user. A society receives energy and raw material as inputs from the environment and gives solid waste as output to the environment. In the long-term perspective, such an input-output imbalance degrades the environment (Ramachandra and Bachamanda, 2007). MSW generation in India is increasing due to increasing urbanization, increasing population and changing lifestyle. The MSW generation in India is about 90 million tonnes per year. The per capita increase in MSW generation is projected at a rate of 1-1.33 % annually (Seema and Anju, 2010; Singhal and Pandey, 2001). With increasing population of 3-3.5% per annum, the yearly waste generation is expected to increase by 5 %. The generation rates in different cities of India are shown in

The management of solid waste is going through a critical phase, due to the unavailability of suitable facilities to treat and dispose of the larger amount of SW generated daily in metropolitan cities. In some cities, industrial, residential and commercial areas are mixed and thus all waste gets intermingled. Therefore, it becomes necessary that the local bodies along with State Pollution Control Board (SPCB) work out requisite strategy for organizing proper collection and disposal of solid waste**.**

Table 1.

Table 1. Waste generation rate in different cities of India

S.No	City	Population (>20 lac)	Waste generation (TPD)
1.	Pune	25,38,473	1175
2.	Mumbai	1,63,70,000	5320
3.	Delhi	1,03,06,452	5922
4.	Kolkara	45,72,876	2653
5.	Chennai	43,43,645	3036
6.	Bangalore	43,01,326	1669
7.	Hyderabad	38,43,585	2187
8.	Ahmedabad	35,20,085	1302
9.	Kanpur	25,51,337	1100
10.	Nagpur	20,52,066	504

Source: (CPCB 2004).

2. ENVIRONMENTAL IMPACTS OF IMPROPER SOLID WASTE MANAGEMENT

Improper solid waste management causes all types of pollution: air, soil, and water. Indiscriminate dumping of wastes contaminates surface and ground water supplies. In urban areas, solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. Uncontrolled burning of wastes and improper incineration contributes significantly to urban air pollution. Greenhouse gases are generated from the decomposition of organic wastes in landfills while untreated leachate pollutes surrounding soil and water bodies. These negative environmental impacts are

only a result of solid waste disposal; they do not include the substantial environmental degradation resulting from the extraction and processing of materials at the beginning of the product life cycle. In fact, as much as 95 percent of an item's environmental impact occurs before it is discarded as MSW.

Fig.1

3. REGULATIONS

Municipal Solid Waste (Management and Handling Rules) 2000: Rules lay emphasis on seeking participation of citizens in waste segregation, prohibiting littering of garbage, proper storage of waste and efficient transportation of waste for its processing and final disposal.

Hazardous Waste (Management and handling Rules) 1989: To put in place an effective mechanism to regulate the generation, collection, storage, transport, treatment and disposal of hazardous wastes both indigenously generated and imported.

RCRA- Nation's primary laws governing disposal of solid and hazardous waste. Passed on Oct 21, 1976. Hazardous and Solid Waste Amendments to RCRA came in 1984.

Bio-medical Waste (Management and Handling Rules) 1998: Adopted and notified with the objective to stop the indiscriminate disposal of hospital waste/ BMW and ensure that such waste is handled without any adverse effect on human health and environment. Recycled Plastics Manufacture and Usage Rules: Notified in 1999, with an amendment in 2003. The objective of rule is to ensure proper collection, segregation, transportation and disposal of plastic waste.

4. WASTE PROCESSING TECHNIQUES

4.1 Non-Engineered Disposal

This is the most common method of disposal. In many Indian cities, open, uncontrolled and poorly managed dumping is commonly practiced, giving rise to serious environmental degradation. More than 90% of solid waste in cities and towns are directly disposed off on land in an unsatisfactory manner.

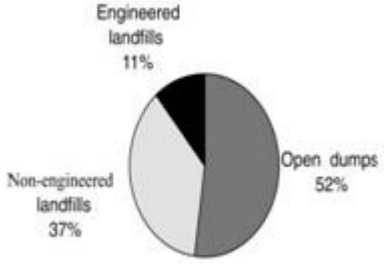

Fig-: 2

4.2 Sanitary Land filling

Sanitary landfill is a fully engineered disposal option, which avoids harmful effects of uncontrolled dumping by spreading, compacting and covering the wasteland that has been carefully engineered before use. It also isolates the refuse, minimizing the amount of surface water entering into and gas escaping from the waste, it appears that landfilling would continue to be the most widely adopted practice in India in the coming few years, during which certain improvements will have to be made to ensure the sanitary landfilling (Kansal, 2002).

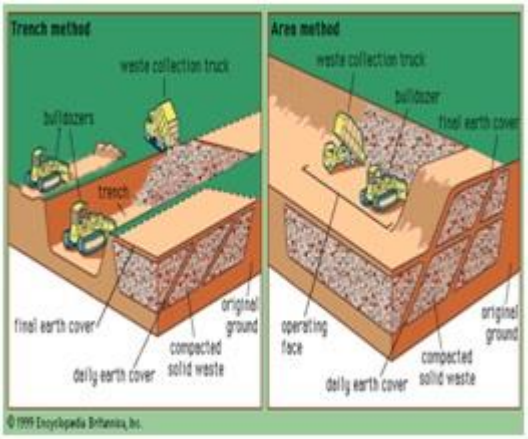

Fig-: 3

An extensive analysis of both organic and inorganic constituents in leachate samples collected from landfills located throughout the United States was conducted in this study. Ratios of certain parameters of leachate, such as COD/TOC, BOD_5/COD, FA-C/TOC VS/FS, etc., and the known age of the landfills can be used to predict the effectiveness of various biological and physical-chemical processes for leachate treatment. Some of these ratios, such as COD/TOC, are also used as an internal check on the reliability of the chemical analysis of leachate samples. The study showed that leachate from a recently leaching fill is best treated by aerobic and anaerobic biological treatment processes. And reverse osmosis treatment were effective in removing organic matter in leachate from stabilized fills, or to remove organic matter in effluent of biological units treating leachate.

4.3 Composting

Fig-4:

Composting is the microbial degradation of organic solid material that involves aerobic respiration and passes through a thermophilic stage. It yields the stabilized end-product compost. Various solid waste management objectives can be achieved through composting, including sanitation, mass and bulk reduction, and resource recovery. Compost plays a unique role in certain specialized practices, including hotbed gardening, which requires self-heating organic matter, and as a

substrate for edible-mushroom cultivation. For these purposes compost derived from municipal solid waste can substitute for the traditional horse manure preparation. Compost can be an economic soil conditioner for high-value crops, such as vegetables and flowers grown out of season. Composting is a biological process of decomposition carried out under controlled conditions of ventilation, temperature, moisture and organisms in the waste themselves that convert waste into humus-like material by acting on the organic portion of the solid waste. Many large-scale compost plants with capacities of ranging from 150 to 300 tonnes/day were set up in the cities of Bangalore, Baroda, Mumbai, Calcutta, Delhi, Jaipur and Kanpur (Sharholy et al. 2008). Now, about 9% of solid waste is treated by composting.

Fig-5:

4.5 Incineration

In incineration, combustible waste is burned at temperatures high enough (900-10000C) to consume all combustible material, leaving only ash and noncombustible to dispose off in a landfill. Under ideal conditions, incineration may reduce the volume of waste by 75% to 95%. In Indian cities, incineration is generally limited to hospital and other biological wastes. This may be due to the high organic material (40-60%), high moisture content (40-60%) and low calorific value content (800-1100 Kcal/Kg) in solid waste. In modern incineration facilities, smokestacks are fitted with special devices to trap pollutants, but the process of pollutant abatement is expensive.

4.6 Pyrolysis

In pyrolysis, the chemical constituents and chemical energy of some organic wastes is recovered by destructive distillation of the solid waste. It is a form of incineration that chemically decomposes organic materials at high temperature in the absence of oxygen. Organic materials are transformed into gases, small quantities of liquid, and a solid residue containing carbon and ash.

5. REUSE AND RECYCLING OF WASTE MATERIALS

Recycling is the reprocessing of discarded materials into new useful product. The process of reusing of cans can save money. Recycling of paper will reduce of cutting of trees. Reuse of metals will reduce the mining activities. In India about 40-80' %of plastic waste is recycled compared to 10-15% in the developed nations of the world. However the recovery rate of paper was 14% of the total paper consumption, while the global recovery rate was higher at 37% (CPCB 2004; Pappu et al. 2007).From the viewpoint of environmental preservation and effective utilization of resources, it is beneficial and necessary to reuse waste concrete as recycled concrete aggregate (RCA) for new concrete, often referred to as recycled aggregate concrete (RAC). In the recent years, intensive researches on this topic have been carried out in China and several successful applications of RAC in practical engineering were also performed. This paper provides an introduction of the background information for the recycling of waste concrete in China and a critical review of the related studies and achievements on the material behaviour of RAC. The following aspects are mainly focused on: the production of RCA, the mechanical behaviour of RAC (both strength and deformation characteristics) and the durability aspects of RAC. Furthermore, a brief introduction to the provisions for RCA and material behaviour of RAC specified in the first standard for RAC in China—Technical Code for Application of Recycled Aggregate Concrete (DG/TJ07-008), issued in 2007, was also presented.

5.1.The Policy of 4R's

Reduce - Reduce the generation of unnecessary waste, e.g. carry your own shopping bag when you go to the market and put all your purchases directly into it (Rajput et al. 2009).

Reuse -Do not throw away the soft drink cans or the bottles; cover them with homemade paper or paint on them and use them as pencil stands or small vases.

5.2. Recycle - Use shopping bags made of cloth or jute, which can be used over and over again. Segregate waste to make sure that it is collected and taken for recycling

Recreate -Instead of buying new containers from the market, use the ones that are in the house. Refuse to buy new items though you may think they are prettier than the ones you already have.

Fig-6:

6. CONCLUSIONS

Due to enhanced economic activity and rapid urbanization solid waste generation has been increased to a large extent. India produces 42 MT of MSW annually at present. The explosion in population is changing the nature of solid waste management from mainly a low priority, localized issue to an internationally pervasive social problem. Risks to the public

health and the environment due to solid waste in large metropolitan areas are becoming intolerable. India currently is facing a municipal solid waste dilemma, for which all elements of the society are responsible. The community sensitization and public awareness is low. There is no system of segregation of organic, inorganic and recyclable wastes at household level. There is an adequate legal framework existing in the country to address SWM. The paper has summarized the solid waste management scenario and various processing techniques to tackle the problem. Government has implemented various rules to ensure proper disposal of solid waste, various awareness programmes are also working for the same.

REFERENCES

[1]. Botkin, D.B. and Keller, E.A. 2000. Environmental Science- Earth as a Living Planet. III Ed John Wiley &Sons. New York. pp. 572-593.

[2]. CPCB. 2004. Management of Municipal Solid Waste. Central Pollution Control Board. Ministry of Environment and Forests, New Delhi, India.

[3]. Gupta, P.K., Jha, A.K., Koul, S., Sharma, P., Pradhan, V. Gupta, V., Sharma, C. and Singh, N. 2007. Methane and nitrous oxide Emission from bovine Manure Management Practices in India. Journal of Environmental Pollution. 146 (1) : 219-224.

[4]. Kansal, A. 2002. Solid Waste management strategies for India. Indian Journal of Environmental Protection. 22(4) : 444-448.

[5]. Pappu, A., Saxena, M. and Asokar, S.R. 2007. Solid waste generation in India and their recycling potential inbuilding materials. Journal of Building and Environment.42 (6) : 2311-2324.