Techniques and Polices for Solid Waste Management

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Abstract

Many types of solid waste have been steadily expanding worldwide in recent decades as a result of rising population, urbanization, and industrialization. Waste is any material that is discarded due to its lack of utility or worth, such as garbage, refuse, or sludge. Domestic, municipal, industrial, agricultural, and other types of hazardous garbage are all examples of solid waste. To safeguard the already overburdened ecosystem, all solid waste generated must be appropriately managed. The mechanism of waste management includes collection, treatment, utilization and disposal in an economic manner consistent with the protection of public health. Swachh Bharat Mission of India was launched in 2014 to manage solid waste and providing clean surroundings. The present study aims to summaries sources, categories, processing, recovery and recycling techniques of solid waste management.

Key words: waste, management, treatment, disposal, recovery, recycling techniques.

Introduction

One peculiar characteristic of man is that he progressively changes his environment to meet his biological and social needs. Man provides himself with material necessary for life which he removes initially as raw material from his surroundings. In doing so worthless and sometimes harmful by products originate. Such products which are the inevitable results of man's interaction with his physical & biological surroundings make up wastes of all types. Thus wealth & waste are interrelated & directly proportional to one another. As wealth increases, waste automatically increases. According to some scientist waste is a valuable raw material located at wrong places, unless removed or properly disposed, the waste reduces the wholesomeness and quality of surroundings. One of man's oldest pursuits is to remove the waste from this environment. According to Darling (1970) "Pollution comes from getting rid of waste at the least possible cost" Wastes are not necessarily pollutants in themselves but all have the capacity to be so. Waste may be solid, semi solid, liquid, gas or sub molecular particle. Some scientist defines waste as "any unwanted or discarded material from residential, commercial industrial, mining, & agricultural etc. that cause environmental problems may be termed as waste".

Those wastes which have been rejected for further use & which can neither be transported by water into streams nor can readily escape into the atmosphere are called solid wastes. Wastes can be converted into useful products by making use of appropriate processing technology. A country like India with limited resources can hardly afford to ignore any kind of resource material. Thus, national waste contributes significantly towards national wealth through sustainable national policy and planning. Thus, proper disposal, management and utilization of wastes have assumed greater importance in order to prevent environmental pollution and to conserve the resources. Solid waste management involved systematic control of the generation, storage, collection, transport, separation, processing, recycling, recovery and its disposal.

In order to make a sustainable environment which is free from garbage- zero waste by 2050, Indian government launched a program “Swachh Bharat Abhiyan” (clean India mission) in 2014. It includes all the procedure of waste management from collection at source, safe transportation and disposal, recycling and other techniques for reuse. The aim of this mission is to monitor all the mechanism by government bodies of urban and rural area and to collect data for making policies of waste management.

Sources of solid wastes

More than 4000 tons per day of solid waste is generated in Delhi alone. Solid waste may be organic or inorganic waste material produced by household, commercial, institutional and industrial activities. We must always think that what is a waste for one industry may be a resource to another industry. Collection, transportation and final disposal of such large volumes of waste require a high level of management and technical expertise. With, use and throw, concept in present civic society, the generation of solid waste has been considerably increasing day by day.

Methods of Disposal of Waste

Methods of solid waste disposal and management depend on the composition, energy content and density of the waste. The main objective of solid waste disposal & management is to collect control, treat, utilize and dispose of solid waste in cheaper manner keeping in view of the public health. The main considerations during solid waste management besides economy involved in collection, transportation and disposal include public health, waste separation for recovery and recycling. The final disposal of solid wastes can be carried out by several methods including sanitary land filling, incineration and composting.

1. Composting: It consist of waste preparation, digestion and product up gradation. Composting is aerobic and thermophilic biodegradation method of organic matter present in solid waste by micro-organism e.g., bacteria, fungi etc. During composting organic matter is transformed into stable humus like substance. The reactions while occur during composting generate heat & hence compost temperature rises & waste volume is reached by about 30-60%, depending on composition & nature of waste. Composting is a biological process carried out naturally under controlled conditions or in mechanized composition plants.

For many centuries throughout the world farms & gardens have been practicing composting by placing vegetable manures and animal manures in piles or pits for decomposition prior to use. Conditions are quite different today and mechanized process of composting is in use. In natural composting solid materials like (metals, glasses etc) are removed from garbage, it is mixed with a nutrients source like right soil, sewage sludge, animal manure etc. and a filler like wood clips or ground corn cobs etc., which permits air to enter to piles. The mixture is maintained with 50% moisture content in tanks, pits at some depth for sometimes. After 6-8 weeks, temperature falls, color darkens & a musty odor develops. The filler is removed & humus like material is used as soil conditioner. To obtain optimum composting operation following parameters are used Temperature 40-50°C (> 65°C temp. will reduce bioactivity), pH 4.5 9.5, (better to maintain pH < 8.5 to minimize loss of N2 in the form of NH3). Moisture 40- 70% (optimum about 55%) particle size 0.63-2.54 cm.

In composting bio-degradation occurs in which organic matter degrades in presence of air into CO_2 and compost. Biogas production is an alternative technique successfully used in India may rural areas. An anaerobic digestion process based on biotechnology has been developed to treat solid waste to produce methane used as fuel for power generation & organic manure as a byproduct. Earthworm family called vermiculture is another bio-technique for converting solid waste into manure.

2. Sanitary Land filling: Land filling is the most common and economic method of solid waste disposal in many countries. Since times MSW (Municipal Solid Waste) were dumped in low lying areas near a waste course creating open dumps. These open dumps resulted in water pollution, bad odors, fires, flies, rats etc. and was unsanitary. The sanitary landfill differs in a way from unsanitary opened dump, that in practice waste is packed in layers and covered with soil at the end of waste disposal every day. Sanitary filling requires compacting and covering operations. It also includes proper site selection, controlled deposition, better methods of compaction. In sanitary landfill organic wastes are slowly degraded by aerobic, anaerobic and facultative

bacteria, fungi and soil micro-organism resulting in the formation of humus, CO_2 and water. Drawback of this process is that occasionally anaerobic methane bacteria accumulate in landfills generating methane gas which somehow escapes in the atmosphere and poses a serious problem of potential fire hazard.

3. Incineration: It is an industrial combustion process designed to reduce unwanted materials to simple solid and gaseous residues. In this process solid organic wastes are subjected to controlled combustion so as to convert them into in combustible residues and gaseous products. Incinerator converts solid waste into liquid and then to gaseous form and releases it into the atmosphere. Sometimes toxic chemicals like dioxins and furan are generated during incineration of chlorinated products like surgical gloves & catheters. These toxics are carcinogenic in nature. Incineration has been planned for its serious side effects including air pollution. Incinerators may be of various type, municipal waste incinerator, hazardous (industrial) was incinerator, and medical waste incinerator. The ash which is left after incineration contains lot of toxic elements too. The main advantage of incinerations is that they reduce the bulk of waste. Reduction in waste volume up to 90% and weight up to 70%. Emission of Hg into atmosphere by incinerators is one of the biggest problems being faced in the world. In Germany 20 tons of Hg per year is being emitted into atmosphere by incinerators. The furnace temperature in incinerators is usually 760-980°C. Here noncombustible fractions like metal and glass are melted and drained as molten slag resulting in about 97% volume reduction of waste. Incinerations are biggest producer of dioxins which disrupts normal body functions as that off certain hormones. The dioxins are called environmental oestrogen which disrupts functioning of reproductive system and is the most potent carcinogen known.

Waste Management: Techniques and Policies

Mankind has used the resources of this earth so lavishly and recklessly, that the whole life supporting system has been endangered. Huge amounts of solid, liquid and gaseous wastes have been produced by man in the process of obtaining food, energy, cloth and shelter. These wastes accumulate as pollutant and poison the environment. Industrialization and urbanization is taking place at the cost of life supporting systems and human health, ignoring all ecological norms and principles. Since all these wastes are badly damaging environment, there is immediate need of the hour to develop suitable and sustainable technologies for the effective management of waste. Keeping in mind, "what is a waste in one industry may be a resource to another industry" a national policy is needed to cope with waste management, waste generation & waste disposal.

1983 In Indian government has enacted a technology policy which has devoted a good deal on waste management activities in the country. In the objectives of this policy, it is stated that "recycling waste material and make full utilization of by products and ensure harmony with the environment preserve the ecological balance and improve the quality of habitat".

The Indian technology policy clearly says that development should not upset the ecological balance for short as well as long term considerations. In January 1990 a "National Waste Management Council" has been setup by Ministry of Environment and Forests, Govt. of India New Delhi. The Ministry of Non conventional Energy Sources (MNES) has launched a national pilot programme on energy recovery from urban, municipal & Industrial wastes. India has a power generation potential of 1600 MW out of 0.2 million tons of MSW per day. Thus MSW is not a nuisance only. It is a resource for producing energy It may be gas, electric, heat etc

Recycling and reuse of waste reduces waste disposal problems. Resource recovery of solid waste is becoming more common. About 70% by weight MSW from domestic and commercial areas is combustible. One tone of such waste is approximately equal to 65 gallons of fuel oil or 9000 cubic feet of natural gas or 9 million British Thermal Units (BTU) of heat. But till date only a small percentage of the resources is being recovered. Thus, combustible is separated from non-combustibles solid waste and burnt to produce primary fuel or supplement to

fossil fuel. Such solid waste processing operation is called Refuse-Derived Fuel (RDF) system. RDF supplements often fossil fuel in the ratio 20:80. It was repeated that in 1983, 29 RDF systems were operated in USA for power generation incineration and RDF technologies are competitive in cost. Disposal of rubber tyers poses problems. Heat content of burning rubber is equal to that of coal. Some systems of burning rubber as fuel are successful. Production of fuel from rubber by pyrolysis is also successful.

Reclamation of reusable materials e.g., paper, metal, glass, plastic etc. from MSW has received considerable attention. Paper constitutes 50% by wt. of MSW. Its complete recycling is not possible so far. Unrecoverable paper is burnt by controlled incineration producing CO_2 and water vapors which are non-polluters. Ferrous metals, aluminum and some non-ferrous metals are recycled and reused. Glass contains in MSW are reused. Plastics are recycled. New technologies are developed to prepare biodegradable plastic using biopolymers and adding starch from tapioca, a food crop available in plenty in Kerala.

Co-disposal of solid waste and sewage sludge is done as part of waste management. Organic solid wastes decompose under landfill conditions to CO_2 and methane. It is bio-conversion. A bioconversion plant has been set up in Pompano Beach, Florida 1978 in which methane produced from RDF & sewage sludge, NEDA (Non conventional Energy Development Agency) in US keeping in view power potential of MSW has chalked programme of power generation in big cities.

MSW energy plants are being installed in the world. Unprocessed organic waste loses its resource value in terms of methane potential, responsible for foul smell. A project at Nagpur has been launched to generate electricity from MSW. This is the first project of its kind in the country and its success will serve as a model. The plant is based on biomethamisation, process developed by Belgium and would generate 50 MW electricity. A part from polluting the land and underground water bodies, landfilling and composting constitute outdated methods of waste disposal. Power generation from garbage will help economy by way of revere realization. As estimated garbage from 15 municipal corporation in Maharashtra could generate up to 70 MW power. According to MNES India has a generation potential of generating 1600 MW of electricity out of 0.2 million tons of MSW per day.

An Australia based incineration company has developed a 3-stage incineration process in order to destroy biomedical waste completely. 1st stage involves burning of waste by excess air combustion process. The toxic gases so produced are fed in 2nd chamber having temperature >1000°C. The combustion of these gases results in the removal of toxic dioxin and furan substances. In 3rd phase noncombustible HCI and sulphuric acid gases and ultra-fine residue of the combustibles get absorbed and neutralized. Reduction of waste and selective reuse is other operation.

Wastes from agro based industries are biodegradable. About 425 sugar mills in India bagasse from sugar industry is used in pulp-paper industry. Press mud from sugar industry is useful substrate for biogas generation. Molasses is key raw material for extraction of alcohol by distilleries. Distillery industry waste called spent wash is nontoxic biodegradable having high BOD. Spent wash is subjected to biomethamation, compositing add incineration. Lignins, present in pulp paper industry waste are used for bio gas production. Nowadays, pulp and paper industry waste can be recycled for energy generation.

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Conclusion

The main objectives of solid waste management are to reduce the adverse effects before it becomes too difficult to rectify in the future. Management of waste is the application of techniques which will ensure the orderly execution of the functions of collection, processing and their disposal. Governments of developed as well as of developing countries like India must form a strong Urban Solid Waste Management system. The role and responsibility of the people in ensuring safe and sanitary management of urban solid waste needs to be communicated to the general public, opinion builders, industrialists and civic administrators. Municipal authorities, NGO and citizens organizations could be involved in a multimedia campaign to create awareness on the role of individual in executing appropriate solid waste management.

References

1. Alamgir M. and Ahsan A., (2007) Municipal Solid Waste and Recovery, Potential; Bangladesh Perspective, Iran J. Environ. Health Sci. Eng.,4, (2),67-76.
2. Gaurav K. Singh, (2014), Solid Waste Management: Its Sources, Collection, Transportation and Recycling, International J. of Science and Development,5(4),56-70.
3. Bhatt S., (2004), Environmental Protection and Sustainable Development, APH Publication APH Publication.
4. CHandrappa R. and Das D.B., (2008) Solid Waste Management Principle and Practices, Springer Publication.
5. Khopker S.M., (2007) in Municipal Solid Waste Management, J. of Cleaner Production,186,748-757.
6. Amasuomo Ebikapade and Baird Jim, (2016) The Concept of Waste and Waste Management,J. of Management and Sustainability,6(4),88-96.
7. Mmereki Daniel, Baldwin Andrew Li Bazihan, (2016), A comparative analysis of solid waste management developed, developing and lesser developed countries, Environmental Technological Review,5(1)120-141.
8. Babael AA et. al. (2015), Resources, conservation and recycling, 102,94-100.
9. Kansal A., (2002), Solid waste management strategies for India, Indian J. of Environment Protection,22(4), 444-448.
10. Swachh Bharat Mission, The Economic Times, retrieved 2 oct. (2014).