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Municipal solid waste management in Bhubaneswar: Current practices, challenges and prospects

Arun Kumar Mohanta[1], CR Sahoo[2], KC Sethi[3]
[1] Ph.D Research Scholar, Civil Engineering (Environmental), IGIT Sarang, Odisha, India
[2] Assistant Professor, Department of Civil Engineering, IGIT Sarang, Odisha, India
[3] Assistant Professor, Department of Civil Engineering, KEC, Ghaziabad, Uttar Pradesh, India

Abstract
Over the past decade, generation of municipal solid wastes (MSW) in Bhubaneswar has increased more than 60%. However, MSW management in Bhubaneswar can be considered relatively poor and disorganised. The most preferred of MSW disposal method in Bhubaneswar is through landfilling due to several factors. This method is not sustainable and brings a lot of problems. This paper reviews the characteristics of Bhubaneswar MSW, reports the current practices of MSW management, and provides some suggestions to improve MSW management system in Bhubaneswar. In recent years, management of municipal solid waste has been a serious environmental issue of concern. Unhealthy waste disposal practises pave a way for air, water, soil and land pollution. Sanitary landfills are a great solution for this. Sanitary landfills are engineered means of confining waste to as small an area as possible, Covering it with daily layers of earth and compacting it to reduce its volume. The different techniques for the disposal of solid waste like incineration, composting, recycle, landfilling etc. The collection, transportation and disposal of the waste for Bhubaneswar City is done by Bhubaneswar Municipal Corporation.

Keywords: municipal solid wastes (MSW), MSW management, waste to energy, renewable energy, disposal, sanitary landfills

1. Introduction
Arising quality of life in Bhubaneswar city and high rates of resource consumption patterns have had a unintended and negative impact on the urban environment - generation of wastes far beyond the handling capacities of urban governments and agencies. Bhubaneswar city now grappling with the problems of high volumes of waste, the costs involved, the disposal technologies and methodologies, and the impact of wastes on the local and global environment. But these problems have also provided a window of opportunity for cities to find solutions - involving the community and the private sector; involving innovative technologies and disposal methods; and involving behaviour changes and awareness raising. These issues have been amply demonstrated by good practices from many cities around the world. All solid waste must be stored in a safe, sanitary and nuisance free manner. Garbage must be stored in sturdy, waterproof, animal-proof containers with tight fitting lids; it has to be removed at least every other week. Accumulating solid waste and storing it outside in plastic bags, trailers or pickup trucks is not acceptable. It is illegal to dump or bury solid waste on your own property or anywhere else. Solid waste management is a polite term for garbage management. As long as humans have been living in settled communities, solid waste, or garbage, has been an issue, and modern societies generate far more solid waste than early humans ever did.

2. Overview of Bhubaneswar city

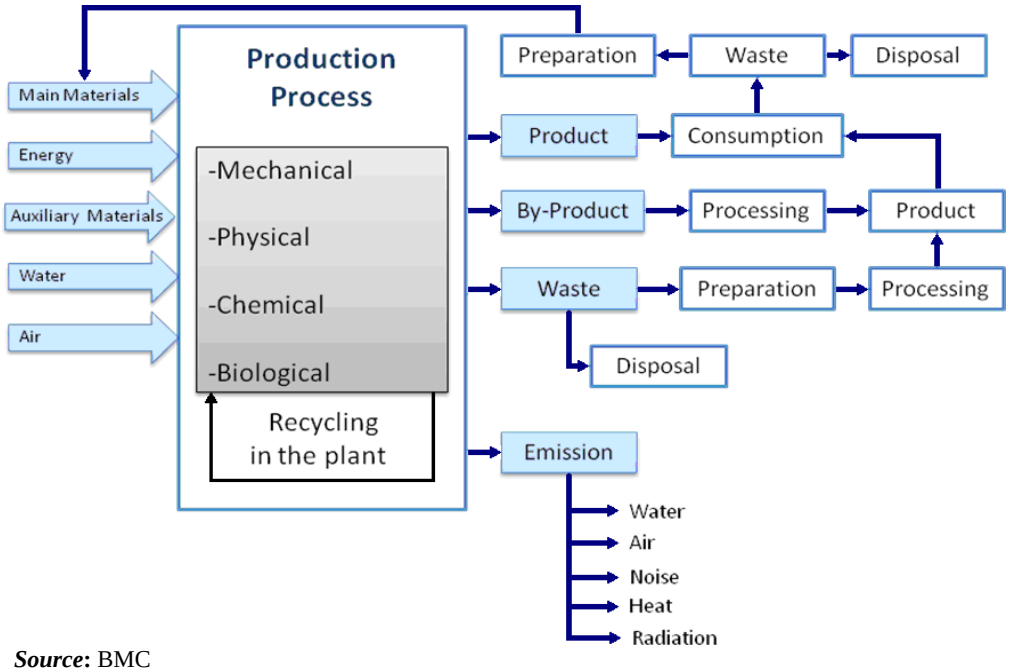
Fig 1: City map showing ward boundaries

Bhubaneswar is is the capital of the state of Odisha in India. The city is centered on latitude 230 15' 20" North and longitude 850 5' 30" East,

3. Functional Elements of Waste Management in Bhubaneswar City

1. Waste Reduction
2. Waste Generation
3. Reuse
4. On-site handling (treatment), storage and processing (near to the location of the generation);
5. Collection
6. Transfer and transport
7. Processing and recovery;
8. Disposal.

Material Cycle Producing Waste



***Source*:** BMC

Fig 2

4. Municipal solid waste management of Bhubaneswar

To analyze the physical and chemical composition of wastes in Bhubaneswar city, wastes generated from different sources, such as, different income-groups, commercial waste, waste from industries, waste from vegetable markets, collection depots and disposal site have been considered. It has also been observed that the average density of municipal wastes in the city based on test results is found to be 480 kg/m3 & 600 kg/m3 wet & dry weather respectively. This average density is close to that in other Indian cities of comparable size whose average waste density is 425 kg/m3 (MOUDPA, 2000). However the possible reasons of variation in density of wastes might be due to the small sample size, and secondly due to the higher amount of cow dung, wet waste and inert materials in the containers at the time of sampling.

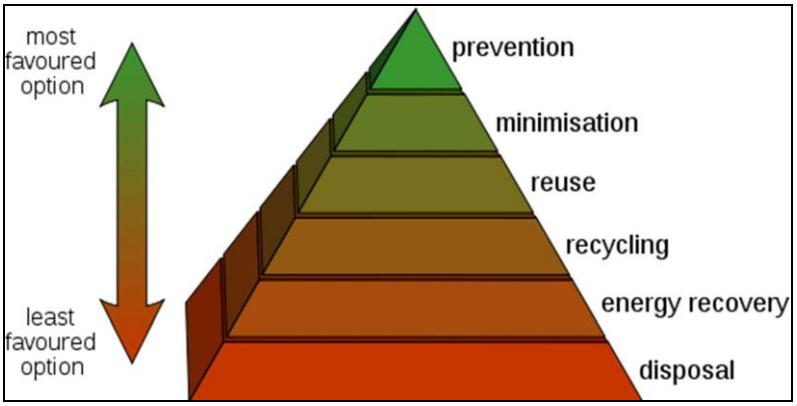


Fig 3: Diagram of Waste Management Hierarchy

Table 1: Generators of waste and types of waste

S. No.	Sources	Types of waste
1	Households and institutions plastics, glass, metals, inert	Mostly organic with some materials and hazardous waste
2	Schools and colleges	Mostly papers
3	Vegetable/fruit markets,	Mostly organic restaurants, etc.
4	Commercial centers	Mostly paper and plastics
5	Healthcare facilities	Infectious and non-infectious waste
6	Industries	Leather wastes, metals, lastics, etc.
7	Slaughterhouses	Bones, blood, intestines, carcasses, etc.
8	Animal husbandry and diaries	Dung and used straw, kanaa used to feed pigs)

Table 2: Source wise chemical composition of MSW

	pH	Conductivity (dsm-1)	Available Nitrogen in %	Available Phosphorus in %	Available Potash in%	Moisture % by weight	Volatile %	% Of Organic Carbon	C/N Ratio
Industrial	6.61	0.93	0.117	0.009	0.064	25.79	5.22	3.34	28.66
Commercial	6.66	1.02	0.144	0.008	0.059	38.43	5.22	3.34	28.66
Institutional	6.73	1.10	0.124	0.007	0.039	36.02	5.88	3.478	27.99
Residential	6.68	1.09	0.143	0.006	0.067	37.76	6.68	2.45	18.30

Municipal Solid Waste: A Typical Ultimate Analysis

Table 3

Element	Range (%dry weight)
Carbon	25-30
Hydrogen	2.5-6.0
Oxygen	15-30
Nitrogen	0.25-1.2
Sulphur	0.02-0.12
Ash	12-30

Raising awareness about a city's municipal solid waste management activities and the benefits of proper solid waste management can result in increases in:

- Use of city waste collection services by the public and private sectors.
- Funding for waste management from local elected officials.

5. Biomedical waste overview

Biomedical wastes (BMW) are potentially hazardous and the environmental impacts of biomedical wastes are interdependent and cumulative. Surveys carried out by various agencies show that healthcare establishments in India are not giving due attention to their waste management. Since notification by the Biomedical Waste (Management and Handling) Rules in 1998 (CPHEEO, 2000), these establishments are slowly streamlining the process of waste segregation, collection, treatment, and disposal. There are 141 healthcare clinics in operation within the city. Many of the larger hospitals have either installed primary treatment facilities or are in the process of doing so. Solid waste from the hospitals consists of human anatomical wastes, microbiological wastes, animal wastes along with bandages, linens and other infectious waste (30–35%), plastics (7–10%), disposable syringes (0.3–0.5%), glass (3–5%), and other general wastes including food waste (40–45%) (Patil and Shekdar, 2001). It is estimated that about 0.33 x 106 t of biomedical wastes are generated annually in India. At Bhubaneswar, the generation ranges from 1 to 1.4 kg of BMW per bed per day, and in district hospitals, it is around 0.4 kg of BMW per bed per day (OPCB, 2006).Previously, BMC collected waste from those BMW generators and disposed of it along with municipal solid waste. Now, a private entrepreneur, M/s. Sani Clean Pvt. Ltd. has established a common incinerator at Tangiapada, Khurda in 2001, with a capacity to treat 3 tons of BMW in 8h. However, it is currently running below capacity

6. Effects of Solid Waste Pollution

Municipal solid wastes heap up on the roads due to improper disposal system. People clean their own houses and litter their immediate surroundings which affects the community including themselves. This type of dumping allows biodegradable materials to decompose under uncontrolled and unhygienic conditions. This produces foul smell and breeds various types of insects and infectious organisms besides spoiling the aesthetics of the site. Industrial solid wastes are sources of toxic metals and hazardous wastes, which may spread on land and can cause changes in physicochemical and biological characteristics thereby affecting productivity of soils. Toxic substances may leach or percolate to contaminate the ground water. In refuse mixing, the hazardous wastes are mixed with garbage and other combustible wastes. This makes segregation and disposal all the more difficult and risky. Various types of wastes like cans, pesticides, cleaning solvents, batteries (zinc, lead or mercury), radioactive materials, plastics and e-waste are mixed up with paper, scraps and other non-toxic materials which could be recycled. Burning of some of these materials produces dioxins, furans and polychlorinated biphenyls, which have the potential to cause various types of ailments including cancer.

7. Limitations and Concerns

The technology requires drying of soil prior to treatment. Limited performance data are available for systems treating hazardous wastes containing polychlorinated biphenyls (PCBs), dioxins, and other organics. There is concern that systems that destroy chlorinated organic molecules by heat have the potential to create products of incomplete combustion, including dioxins and furans. These compounds are extremely toxic in the parts per trillion ranges. The MSO process reportedly does not produce dioxins and furans. The molten salt is usually recycled in the reactor chamber. However, depending on the waste treated (especially inorganics) and the amount of ash, spent molten salt may be hazardous and require special care in disposal.

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