

Review Article

POLLUTION HAZARDS OF MUNICIPAL WASTE AND ANALYTICAL TOOLS FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

A trend of significant increase in municipal solid waste generation has been recorded worldwide due to higher economic growth, industrialization & urbanization. Municipal solid waste generation showed different trend and there is a correlation between waste generation and economic development in term of kg/capita/day solid waste generation at world scale. Trend of urbanization played significant role in enhancement of solid waste generation and in India it was 27.8% in 2001 and expected to reach 41% by 2021. The paper deals with MSW and the trend of its generation in India. It also discusses briefly MSW disposal in India along with health hazards associated with solid waste and its impact on environment.

Keywords: *Pollution, Municipal Waste, Sustainable Development*

INTRODUCTION

Rapid population growth, urbanization and industrial growth have led to severe waste management problems in the cities of developing countries like India. The large quantity of waste generated necessitates a system of collection, storage, transportation and disposal. It requires knowledge of what the wastes are comprised of, and how they need to be collected and disposed. Recycling of waste, energy generation and employment opportunities from waste management also have immense potential. However, it has been widely observed that the municipal corporations in India do not have adequate resources or the technical expertise necessary to deal with the problem Singh (2011). India is one of the fastest growing economies in the world today. Increasing prosperity and standard of living of millions of people will increase consumption of energy and consumer goods. Concurrently, this growth will likely put a strain on the environment and on the availability of natural resources. Already, India has 16.8% of the world's population and only 2.2% of the world's total land area CIA (2007).

Municipal Solid Waste

Municipal Solid Waste is generally termed as "unwanted or undesired" material. Though the term is universal it has different concern depending upon the location and living standard of people. According to Indian MSW, Rules 2000 "Municipal Solid Waste" includes commercial and residential wastes generated in a municipal or notified area in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes Sahu (2007). Different types of solid wastes and their sources are given in Table 1. The first three types of the wastes from this table, namely garbage, rubbish and ashes make up bulk of the MSW Singh (2011).

MSW Generation in India

In the mid-nineties, the average waste generated per capita in urban areas in India was estimated to be approximately 0.46 kg/person/day. Singhal and Pandey (2001), World Bank (1999). In its 2005-06 Annual Report, the Ministry of New and Renewable Energy (MNRE), formerly known as the Ministry of Nonconventional Energy Sources, estimated that approximately 42 million tons¹ of MSW are generated in urban areas of India annually. Ministry of Urban Development (2000). A general estimation of the MSW generation from the Metropolitans of India is listed in Table 2.

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Table 1: Classification of Solid Wastes (RUIDP Report, 2002)

S.No.	Types of Solid Waste	Description	Source
1.	Food Waste (Garbage)	Waste from the preparation, cooking and serving of food, market refuse from the handling, storage and sale of produce, meat and vegetables.	
2.	Rubbish	Combustible (Primary organic) paper, card board, cartons, wood, boxes, plastics, rags, cloth, bedding, leather, rubber, grass, leaves, yard trimming. Non-combustible (Primary inorganic) metals, tins, cans, metal foils, dirt, stones, bricks, ceramics, crockery, glass bottles and other mineral refuse.	Households, institutions and commercial such as hotels, stores, restaurants, markets etc.
3.	Ashes and residues	Residue from fires used for cooking and for heating buildings, cinders, clinkers and thermal power plants.	
4.	Bulky waste	Large auto parts, tyres, stoves, refrigerators, other large appliances, furniture, large creates, trees, branches, palm fronts, stumps.	
5.	Street waste	Street sweeping, dirt, leaves, catch basin dirt, animal droppings and contents of litter receptacles, dead animals	Streets, sidewalks, alley, vacant lots, etc.
6.	Dead Animals	Cats, dog, poultry, horses, cows etc.	Slaughterhouses
7.	Construction and demolition waste	Lumber, roofing, and sheathing scraps, crop residues, rubble, broken concrete, plaster, conduit pipe, wire, insulation etc.	Construction and demolition sites, remodeling repairing sites
8.	Industrial waste and sludge	Solid waste resulting from industry processes and manufacturing operations, such as food processing wastes, boiler house cinder, wood, plastic and metals scraps and shaving etc. effluent treatment plant sludge of industries and sewage treatment plant sludge, coarse screening grit and septic tank.	Factories, power plants, treatment plants etc.
9.	Hazardous wastes	Hazardous wastes: pathological wastes, explosives, radioactive material, toxic waste etc.	Households, hospitals, institution, stores etc.
10.	Horticulture wastes	Tree-trimming, leaves, waste from parks and garden etc.	Parks, gardens roadside trees etc.

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Table 2: MSW generation in Major Metropolitan Cities in India Ministry of New and Renewable Energy Annual Reports 2003-04, 2004- 05, 2005-06.

S. No.	Sate/Union Territory	City	Urban Population in Lakhs (2001)	MSW generated (MT/day)
1	Andhra Pradesh	Hyderabad	3829753	957
2	Andhra Pradesh	Visakhapatnam	982904	246
3	Bihar	Patna	1961532	588
4	Delhi	New Delhi	350000	272
5	Delhi	Delhi	13363471	6000
6	Gujarat	Ahemdabad	4215497	1265
7	Gujarat	Surat City	2433835	730
8	Gujarat	Vadodara	1491045	447
9	Karnataka	Bangalore	1304008	326
10	Kerala	Kochi	275228	69
11	Maharashtra	Mumbai	11914398	7500
12	Maharashtra	Nagpur	2040175	700
13	Maharashtra	Pune	2540000	1000
14	Madhya Pradesh	Bhopal	1482718	445
15	Madhya Pradesh	Indore	1550880	465
16	Punjab	Ludhiana	1429709	500
17	Rajasthan	Jaipur	1870771	561
18	Tamil Nadu	Chennai	4342645	1086
19	Tamil Nadu	Coimbatore	1501373	375
20	Tamil Nadu	Madurai	1233083	308
21	Uttar Pradesh	Kanpur	2725207	954
22	Uttar Pradesh	Lucknow	2262369	792
23	Uttar Pradesh	Varanasi	1250039	438
24	West Bengal	Kolkata	4572876	1143
Grant Total			70924513	27167

Waste generation in India is expected to increase rapidly in the future. As more people migrate to urban areas it is estimated that the amount of waste generated in India will increase at a per capita rate of approximately 1-1.33% annually Singhal and Pandey (2001).

MSW Disposal in India

In India there is no segregation of waste. Municipal Solid Waste is dumped in a mixed form in an unscientific manner on open waste land or low lying areas even near creeks, forests, rivers, ponds and other ecological sensitive regions. This practice is commonly known as 'Open dumping' and does not meet the norms of disposal specified in the MSW Rules Sahu (2007). Most dumps lack systems for leachate collection, landfill gas collection or monitoring, nor do they use inert materials to cover the waste. This results in groundwater contamination from leachate, surface water contamination from runoff and lack of covering, air pollution caused by fires, toxic gases, and odor, and public health problems due to mosquitoes and scavenging animals. It is observed that Cities like Mumbai, Vishakapatanam, Kolkatta, Chennai situated on the sea coast dump their MSW in the nearby creeks. Similarly cities like Kanpur, Delhi etc dump their waste near the river banks. Other cities like Bangalore and Jaipur which do not have access to any water body prefer to dump their waste near the highways. A study made by Centre for Ecological Sciences & Centre for Sustainable Technologies shows that cumulative requirement of land disposal of MSW in India would reach around 1400 km² by 2047 Sahu (2007). Apparently, India is not alone in lack of proper waste management systems. Open dumping is commonly practiced in developing countries. It is estimated that in low-income countries, less than 25% of wastes are sent to regulated

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landfills. Ministry of New and Renewable Energy Annual Reports 2003-04, 2004- 05, 2005-06. Table 3 shows a comparison of disposal methods in some developing countries Cointreau (2006).

Table 3: Methods of disposal of municipal solid waste in selected countries (%) Sahu (2007).

Country	Open Dumping	Landfilling	Composting	Incineration	Other*
India	60	15	10	5	10
Nepal	70	10	5	-	15
Vietnam	70	-	10	-	20
China	No data available				
Sri Lanka	85	-	5	-	10

Effects on Environment Singh (2011)

The adverse effects on environment due to un-scientific management of waste disposal are as follow:

- Ground and surface water pollution
- Air pollution due to bad odour of the waste.
- Green house gases
- Harmful effects of rats, stray animals, flies, mosquitoes, germs and other insects
- Increase in acidity of soil near the garbage heaps
- Probability of diseases and epidemics
- Health related problems for rag pickers

Health Effects Singh (2011)

- The health risks associated with illegal dumping are significant. Areas used for open dumping may be easily accessible to people, especially children, who are vulnerable to the physical (protruding nails or sharp edges) and chemical (harmful fluids or dust) hazards posed by wastes.
- Rodents, insects, and other vermin attracted to open dump sites may also pose health risks Dump sites with scrap tires provide an ideal breeding ground for mosquitoes, which can multiply 100 times faster than normal in the warm stagnant water standing in scrap tire causing several illnesses
- Poisoning and chemical burns resulting from contact with small amounts of hazardous, chemical waste mixed with general waste during collection & transportation.
- Burns and other injuries can occur resulting from occupational accidents and methane gas exposure at waste disposal sites.

CONCLUSIONS

Rapid urbanization, population explosion and industrial growth have led to severe waste management problems in the cities of developing countries like India. India is currently 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 MSWM. What is lacking is its implementation. Public awareness, political will and public participation is essential for the successful implementation of the legal provisions to ensure sustainable management of municipal solid wastes in the country.

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