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Future scenario and problems encountered with the solid waste management in India

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Abstract
A comprehensive study has been done in this paper to analyze the wide range of municipal solid waste management and future scenario of its strategies to treat its solid waste in India. Its urban population grew at a rate of 31.8% during the last decade to 377 million, which is greater than the entire population of US, the third largest country in the world according to population. India is facing a sharp contrast between its increasing urban population and available services and resources. Solid waste management (SWM) is one such service where India has an enormous gap to fill, Proper municipal solid waste (MSW) disposal systems to address the burgeoning amount of wastes are absent. The current SWM services are inefficient, incur heavy expenditure and are so low as to be a potential threat to the public health and environmental quality. Improper solid waste management deteriorates public health, causes environmental pollution, accelerates natural resources degradation. Causes climate change and greatly impacts the quality of life of citizens. The information provided is very useful when planning, changing or implementing waste management systems in cities.

Keywords: Solid waste management, urban population, resource, environmental pollution, and climate.

Introduction

India is the second largest nation in the world, with a population of 1.21 billion, accounting for nearly 18% of world's human population, but it does not have enough resources or adequate systems in place to treat its solid waste

The present citizens of India are living in times of unprecedented economic growth, rising aspirations, and rapidly changing lifestyles, which will raise the expectations on public health and quality of life. An analysis of literature on the work done and reported mainly in publications from 2005 to 2011, related to waste management in developing countries, showed that few articles give quantitative information (LA Guerrero, G Maas, W Hogland - Waste management, 2013) Remediation and recovery of misused resources will also be expected. These expectations when not met might result in a low quality of life for the citizens. Pollution, whether it is of air, water or land results in long-term reduction of productivity leading to a deterioration of economic condition of a country. Therefore. Controlling pollution to reduce risk of poor health, to protect the natural environment and to contribute to our quality of life is a key component of sustainable development the per capita waste generation rate in India has increased from 0.44 kg/day in 2001. 1005 kg day in 2011, fuelled by changing lifestyles and increased purchasing power of urban Indian. Urban population growth and increase in per capita waste generation have resulted in a 50% increase in the waste generated by Indian cities within only a decade since 2001. The total MSW generated in urban India is estimated to be 68.8 million tons per year (TPY) or 188.500 tons per day (TPD) of MSW. Such a steep increase in waste generation within a decade has severed the stress on all available natural, infrastructural and budgetary resources. Big cities collect about 70-90% of MSW generated, whereas smaller cities and towns collect less than 50% of waste generated. More than 91% of the MSW collected formally is landfilled on open lands and dumps, It is estimated that about 2% of the uncollected wastes are burnt openly on the streets. About 10% of the collected MSW is openly burnt or is caught in landfill fires such open burning of MSW and landfill fires together releases 22,000 tons of pollutants into the lower atmosphere of Mumbai city every year. The pollutants include carbon monoxide (CO), carcinogenic hydro carbons (HC) (includes dioxins and furans). Particulate matter (PM), nitrogen oxides (NOx) and sulfur dioxide (SO2). Most of the recyclable waste is collected by the informal recycling sector in India prior to and after formal collection by Urban Local Bodies (ULB). Amount of recyclables collected by informal sector prior to formal collection are generally not accounted. This report estimates that 21% of recyclables collected formally are separated by the formal sector at transfer stations and dumps. Even though this number does not include amount of recycling prior to formal collection, it compares fairly well with the best recycling percentages achieved around the world. Informal recycling system is lately receiving its due recognition world-wide for its role in waste management in developing nations. In India, government policy and non-governmental organizations (NGOs) are expected to organize the sensor present in different regions, and io help integrating it into the overall formal system. Plastic Waste Management and handling Rules, 2011 by the Ministry of Environment and Forests (MOEF) is a step ahead in this direction. These rules mandate ULBS to coordinate with all stake holders in solid waste management.

Material and Methods

In recent years fast population growth, increase in urbanization And industrialization in India has created severe problems for solid waste management in cities. The increased level of

consumption characteristics of the population of cities lead to generation of enormous quantities of solid waste material. The impacts of such pollution are felt both at local, as wellas, at distances from sources. Domestic and industrial discharge leads to contamination of air, land and water (eutrophication) with nutrient and toxic materials which in tum lead to degradation of air, land and affect flora and fauna badly. Since olden times municipal bodies remains responsible for keeping the roads clean. Collect city garbage and to carry out its safe disposal. Most of the elected bodies of the Indian cities employ largest number of employees for the purpose of cleaning the city, but only 50 70% of the waste generated is collected by the staffkeeping aside the tendency of non-working of the employees. Many estimates of solid waste generation are available but on the average it is projected that under Indian conditions the amount of waste generated per capita will rise at a rate of 1-1.33% annually (Shekdar, 1999). So, at present if we follow this presumption the calculated per capita waste generation on daily basis is 583.36 g in 2016. At such a stage solid waste generation will have significant impact in terms of land required for disposal of waste as well as methane emission/such a large quantity of solid waste requires well managed system of collection, transportation and disposal. It is required that we have proper knowledge about the nature of waste material, its collection and disposal along with recycling and energy generation potential.

The traditional routine approach to solid waste management is normally municipal! Bodies handle all aspects of collection, transport and disposal and this has emerged as a reality of mixed success all over the world in advanced or developing cities. The search for more efficient and economical solid waste collection agenda in most of the urban areas has taken shape adopting several directions towards better partnership with communities along with private sector combining adequate economic policies, e.g., recycling credits by paying the recycler, land-fill disposal levies at landfill site designed to minimize the entity of waste being land-filled and product charges like packing tax to disallow over packaging Cities have a wide variety of arrangement under their control to lessen environmental burdens. Legal approach and restrictions on the quantity of pollutants a factory can discharge of minimum air and water quality standards are being particularly proved effective in monitoring pollution in many parts of the globe. The efficiency depends mainly on good enforcement capacities and proper monitoring procedures where urban growth pressures and pollution issues are far greater.

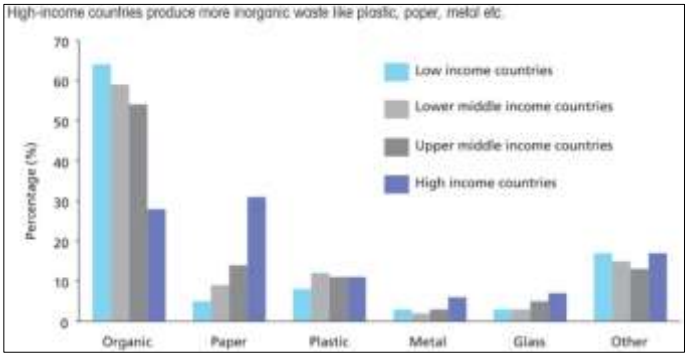
A simple system of solid waste management works normally in the series the sweeper cleans the streets each morning, collect the waste in hand-carts, transfer to large storage bins. Trucks pick up these bins transfer stations and transport to disposal sites. If, due to expansion of city these sites are located at a distance, the municipal vehicles encounter many problems of time limitation, fund limitation for maintenance and operations in proper handling of wastes so in many cities private sector's involvement in solid waste management has become cost-effective and efficient.

The main reason is that due to expansion of the towns and cities into newer areas cover more and more land for specific use which becomes unavailable for waste disposal., The central and state governments have emphasized the importance of developing strategies to work out full environment costs and impacts of solid waste disposal along with material recovery accountable for solid waste management decision making Mowever, waste disposal has remained a neglected field and researches are limited in this field) In present investigation environmental accounting practices and management in Patna city of Rajasthan will be undertaken towork out a better solution of the waste disposal problems. In 2016 Patna has been declared for the next SMART CITY by the central government and it will be so in coming five years, So we have to prepare ourselves to face the challenge to develop this city in real smarter sense. It has been discovered that overall level of direct waste flow and activity accounting is greater than the level of undisclosed and external environmental cost accounting, through local elected bodies say in present case Nagar Nigam, PATNA tend to identify and use more physical information associated with waste flows and activities than relevant monetary information.

Results and Discussion

Once definition of waste is clear, many regulations like Environmental (Protection) Act, 1986, the controlled Waste Regulations 1992, and the Waste Management Licensing Regulation 1994 seek further to define the type of waste because these are legally made clear by the processes or premises from which these are produced:

Controlled waste includes household, industrial and commercial waste, these are further classified and subjected to further regulation because of the nature of waste and required to be handled in different way.



***Sources*:** Anan. 2012, 'Waste composition': What a waste: A Global Review of Solid Waste Management. World Bank

Fig 1: Waste composition on the basis of income of countries

Household waste is that which arises from dwellings of many hands like houses, caravan, houseboats, camp sites, prisons and waste from schools, colleges and universities.

Commercial waste comes out from the premises inuse wholly or mainly for trade, business, sport, recreation or entertainment, but not from household and industrial waste.

Industrial waste is that which arises from a factory or industrial process but it does not include mining or quarry or agricultural waste.

Waste from agriculture (non-natural waste) and mining or quarry recently came into controlled waste regime

Clinical waste such waste arise from hospitals, nursing homes, dentist, surgeries, etc. And it may cover the household waste

Hazardous/special waste are hazardous for a number of reasons like toxicity, explosive nature, etc, these also need special handling different than other handling process.

Municipal solid waste (MSW) is also known as urban solid waste which includes mainly household (domestic) waste with sometimes the addition of commercial waste collected by municipal bodies of a defined area. These are either solid or in semi-solid form and does not contain industrial hazardous waste. Here the term residual waste concerns to waste left from household sources having materials including or sent for re-processing.

Mainly there are 5 categories of Municipal Solid Waste

Biodegradable waste having contents of kitchen (leaves, peelings, scraps, spoiled
food.grass clippings) waste, green waste, paper, beverage containers, packing materials.

Recyclable material having paper, newspaper, police paper, card board, glass, bottles, cans, metals, or certain type of plastics, etc.

Inert waste having construction and demolition waste, dirt, rocky material, debris. Window glass, furniture, etc.

Composite waste including waste clothing, tetra packs, waste plastics, or toys, etc.

Domestic hazardous waste (household hazardous waste)are marketed for home use and toxic waste it includes medical waste, e-waste (computer parts, televisions, cell phones), paints and solvents, chemicals, light bulbs (CFL, LED fluorescent tubes or ordinary bulbs), spray (aerosols/propane) cylinders and cones, fertilizers and pesticides insecticides, herbicides or fungicides) containers, lead batteries and dry cell, caustic and cleaning agents, refrigerant containing appliances, ammunition, shoe polish containers, mercury containing wastes (like home smoke detectors, thermometers, switches) and automotive wastes like used motor oil, anti-freeze, etc.

Table 1: Composition of waste In Indian cities

Biodegradable content of waste in Indian cities is high; non-biodegradable content shows a rise.				
City State	**Biodegradable (%)**	**Non-biodegradable (%)**	**Inert (%)**	**Domestic hazardous (96)**
Cities with population of 1 million-plus				
Bengaluru Karnataka	64	28	5	3
Hyderabad Telangona	55	40	5	
Delhi Delhi	50	35	15	
Indore Madhya Pradesh	50	35	15	
Patna Bihar	51	27	15	
Bhopal Madhya Pradesh	57	30	11	
Mysuru Karnataka	50	35	15	
Cities with population of 0.1-1 million				
Thiruvananthapuram Kerala	60	35	4	1
Goya Bihar	55	34	11	
Muzaffarpur Bihar	55	25	18	2
Imphal Manipur	55	35	5	
Alappuzha Kerala	75	20	5	
Gangtok Sikkim Cities with population below 0.1 million	51	28	21	
Bolaghot Madhya Pradesh	70	25	5	
Bobbili Andhra Pradesh	50	26	20	4
Vaijapur Maharashtra	50	45	5	
Panchgani Maharashtra	70	25	5	
Vengurla Maharashtra	54	40	5	1

***Source*:** CSE, 2018

Consumption of inorganic materials increases, while the relative Organic fraction decreases {(see *Figure 1: Waste composition on the lxtsis of income of countries).*

Conclusion

Data analysis indicates that the growth in municipal solid waste in our cities has outpaced the population growth in last few years. This is so because of our changing life styles. Food habits along with increased living standard. Municipal solid waste in urban centers is collected by local self-government and transported to designated disposal sites, which preferably low lying/outskirts of the city areas. The limited sources of income of the respective body earmarked turn these ill-equipped to provide for high costs required in the collection, storage, treatment followed by proper disposal of municipal solid waste. As a result a substantial part of the municipal solid waste generated remain as it is and turn into heaps of poorly maintained collection centers. The choice of proper disposal site is also looked upon as a matter of availability rather than suitability. Insanitary conditions become serious health concem when disposal of solid waste is improper. Open dumping of garbage leads to breeding of disease vectors like flies, mosquitoes, cockroaches, rats and other pests (CPCB,2000). Hence, the municipal bodies in India face the challenge of reinforcing their available infrastructure for efficient municipal solid waste management and to ensure the scientific ways of municipal solid waste disposal by generation of sufficient funds/revenue.

Municipal solid waste management is a part of public health and sanitation issues, so it is entrusted to the local governments for execution. In the new millennium the system has assumed greater importance due to population explosion in urban areas or freshly urbanized areas, legal interventions, coming up of better technologies and high expectations of the public towards cleanliness. The most prominent consequence of the population

explosion is visible in the form of solid waste disposal problems. This has occurred due to lack of proper evaluation of wastes, its disposal sites, planning policy making and enforcement of legislation.

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