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REVIEW ARTICLE

Analyzing the Problems and Prospects of Solid Waste Management, its Handling and Legal Dimensions in Indian Context

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ABSTRACT

Management of urban solid waste is one of the most neglected areas of urban development in India. Landfill sites and garbage dumps are overflowing in most cities attracting rodents and flies which then spread disease". Among various related events to highlight the MSW issue in the intervening period, there was a seminar on Urban Waste Management – Options For Future, which expressed concern over the environmental challenges posed by the rising waste generation due to expanding population and economic growth and the need "to have the effective-waste management solutions for a cleaner sustainable environment. With migration of population, urban India (Indian Cities) is facing a colossal waste disposal problem today, as well as in the coming years. Till now, the problem of managing solid waste has been seen as one of cleaning and disposing as rubbish. But a closer look at the current and future scenario reveals that waste needs to be treated holistically, recognizing its origin, natural resource, type and well as long term health impacts. Waste can be both wealth; which has tremendous potential not only for generating livelihoods for the urban poor but can also enrich the earth through composting and recycling rather than spreading pollution as has been the case. Increasing urban migration and a high density of population will make waste management a difficult issue to handle in the near future, if a new paradigm for approaching it is not created. Rapid and widespread industrial development, unplanned urbanization, regular flow of persons from rural to urban areas and improper and inadequate action of the authorities entrusted with the work of pollution control and environmental protection have largely contributed to unhealthy and degraded environment. This all, in turn, affected the quality of life of the large number of persons. Unplanned and alarming rate of urbanization has given rise to many environment related problems, such as problem of health and hygiene, sewage, disposal of solid waste, air, water and land pollution, slums, housing, basic amenities and others.

Key words: solid waste, environment, pollution.

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INTRODUCTION

With the increase in the population, the generation of waste increases proportionately. The solid waste is in the form of Hospital waste, industrial waste, household waste and construction and building wastes. They are a source of pollution (air and water) besides nuisance to public. So as to minimize the harmful effects, there is need for solid waste management (management of safe and useful disposal). Storing the waste at the source, collection, transportation and disposal does it. Much of the activities under solid waste management are a subset of the activities under the broader topic of human settlements management.

On solid waste management and sewage related issues comprises of four programme areas: [1]

(a) Waste minimization;
(b) Promotion of waste recycling and reuse;
(c) Promoting environmentally sound waste disposal; and
(d) Extending waste disposal service coverage.

In recent decades there has been significant growth in urban population, paving enough space for related problems to confront with. One such problem is about improving environmental conditions, particularly through solid waste management. Solid waste is defined as the organic and inorganic waste materials generated by household, commercial and institutional establishments. A solid waste management system is the framework within which all activities regarding solid waste take place. Solid waste management is further defined according to the process administered and / or carried out by the local government, i.e., collection, transport and disposal. The associated activities are generation, storage, collection, transfer and transport, processing and disposal of solid wastes. The prime objective of the project was to gain insights into the 'alternatives' or 'innovations' within the formal and informal solid waste management to reduce waste, in terms of minimizing waste, maximizing re-use and recycling activities, and to promote ecological sustainability. [2]

Each household generates garbage or waste day in and day out. Items that we no longer need or they do not have any further use for fall in the category of solid waste. At the household-level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting...

What is Solid Waste?

These are waste products from various sources like households, industries, hospitals, construction, and building sites. They are basically of two types"

- Biodegradable
- Non biodegradable

Some of them can be recycled and used over and over again. Solid wastes like rotten fruits and vegetables, various polythene bags, paper along with fecal matter are from households. Harmful toxic substance like hazardous chemicals, industrial wastes besides poisons forms solid waste from industrial origin. The used needless, used linens, bandages and other unhygienic substances, which are health hazards and causes infectious diseases constitute solid waste of hospitals [3]. Solid waste can be classified into different types depending on their source: [4]

Municipal Solid Waste (Household Waste)

Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes. In 1947 cities and towns in India generated an estimated 6 million tonnes of solid waste; in 1997 it was about 48 million tonnes. More than 25% of the municipal solid waste is not collected at all.

Hazardous Wastes (Industrial Waste)

Industrial and hospital waste is considered hazardous as they may contain toxic substances. India generates around 7 million tonnes of hazardous wastes every year, most of which is concentrated in four states: Andhra Pradesh, Bihar, Uttar Pradesh, and Tamil Nadu. Household wastes that can be categorized as hazardous waste include old batteries, shoe polish, paint tins, old medicines, and medicine bottles.

Hospital Waste (Biomedical Waste)

Hospital waste is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biologicals. This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner. [5]

General Overview of Solid Waste Management

Rapid urbanization and the associated growth of industry and services is a key feature of economic and demographic development in many developing countries. Cities are currently absorbing two-thirds of the total population increase throughout the developing world. At this rate 1.9 billion people are estimated to populate the urban areas of developing countries by the year 2000, in addition to the already heavy urbanization level in the developed countries. [6]

One of the most important environmental problems of urbanization is the amount of solid waste that is generated at a rate that outstrips the ability of the natural environment to assimilate it and municipal authorities to manage it. The resulting contamination affects all environmental media and has a direct negative effect on human health and the quality of urban life. Current approaches to solid waste management are by and large, unsustainable.

Despite such apparent neglect of solid waste issues, it currently consumes a large proportion of most municipal budgets; in some cases, as much as 50%. Efforts to reduce this expenditure would (i) free some municipal funds for other services, such as primary health care, and (ii) encourage further development of re-use and recycling techniques that highlight solid waste as a valuable resource. [7]

The primary responsibility for solid waste management rests with city authorities who are the single most important actors to implement the activities successful outcomes will require the delegation of special responsibilities and financial resources to the local authorities by central governments. This, in many cases, will involve policy changes, legal reform, institutional capacity-building, the use of modern management approaches and appropriate technologies to improve the efficiency and effectiveness of current solid-waste management practices.

In many cities of the developed world, solid and liquid waste management is undertaken by the private sector under contract to the local authorities. The trend of similar private sector involvement also appears to be increasingly the case in developing countries as well. There are, however, risks related to the infrastructure preceding such privatization. For example, an inefficiently run public service, often the case in waste collection, is susceptible to being replaced by a private monopoly over which the municipal council would have little control. In this context, use of competitive tendering, retaining several different companies for the service needed and monitoring of contractor's performance ensure acceptable and effective services. [8]

There is much scope for improving the real value of current and future investments already made in the formal and informal waste management sector. For example, studies carried out by UNCHS (Habitat) as well as by UNDP and World Bank have shown that highly developed and active informal waste management networks exist, particularly in the developing countries. Similarly, many local authorities and their organizations are taking initiatives to share techniques through partnerships and twinning, to deal with the growing solid waste issue. Encouraging and supportive policies from central governments would assist the efforts of both the formal and the informal solid waste management sectors. In the case of the latter, further support could not only drastically reduce waste collection costs but could also improve income-generation and employment opportunities of the urban poor. [9]

Technologies for Solid Waste Management

Environmentally sound management of increasing amounts of difficult-to-treat or organic wastes is among the topics of major concern today in most cities. The logical starting point for solid waste management is to reduce the amounts of waste that must be managed that is, collected and disposed of as nuisances and hazards. Reducing wastes and maximizing environmentally sound waste reuse and recycling should be the first steps in waste management. The environmental, social, and economic benefits of integrating practices of

waste reduction into SWM are the bases for an emerging worldwide agenda for solid waste management. Following are some methods, which are widely used throughout the world for the proper treatment and disposal of solid waste. [10]

- Sanitary Landfill
- Aerobic Composting
- 3 C – Aerobic Composting Process
- Biomethanation Pyrolysis / Gasification
- Palletisation
- Incineration

Out of these methods we are only concentrating on sanitary Landfill, Aerobic Composting and 3 C – Aerobic Composting Process. Sanitary landfill is a mandatory process, which everyone has to adopt. After any process of waste degradation, whether it is Aerobic Composting or 3 C – Aerobic Composting Process, or any other process, inorganic and inert material has to be sent to sanitary landfill site.

Sanitary Landfill

Landfills are a vital component of any well-designed SWM system. They are the ultimate repository of a city's MSW after all other SWM options have been exercised. In many cases, the landfill is the only SWM option available after the MSW is collected. The safe and effective operation of landfills depends on the sound planning, administration, and management of the entire SWM system.

This begins with an institutional and policy environment that views SWM as an important component in the sustainable development plans of a city and country. It continues with SWM regulations that are designed to protect human health and the environment. It goes further with funding that is driven by the needs of the system rather than by political expediency. It ends with the coordination of SWM programs, from waste reduction and resource recovery through collection, transfer, and ultimate disposal, into an integrated system. This system must provide a vital public service without compromising human health or the environment.[11]
As per Municipal Waste Rules, discourage unscientific land filling/dumping, as these pose problems of:

1. Pollution in surface run-off during rainfall
2. Pollution of soil/groundwater/downstream aquifers
3. Unhygienic/unsanitary condition in surrounding area

Landfill will be restricted to non-biodegradable, inert waste and other waste not suitable for recycling or for biological processing.

Aerobic Composting

Composting is the single most important activity for successful gardening. Vegetation and animal manures decompose with the help of bacteria, fungi, & other microorganisms. The result is a rich earthy layer of pure organic magic. Compost attracts the mighty, sought after earthworm, which in sufficient numbers make our work much easier. It also encourages the growth of beneficial microorganisms, which greatly help the development of stronger, healthier plants. It provides needed nutrients and improves the soil ability to nourish your growing plants. It promotes better drainage in heavy clay soil allows sandy soils to retain needed moisture. Compost is actually organic slow release fertilizer. In addition composting relieves some of the pressure on overburdening the landfill

Merits of Composting [12]

- Soil Conditioning
- Improved Manure Handling
- Improved Land Application
- Reduced Waste Disposal Costs
- Lower Risk Of Pollution and Nuisance Complaints
- Pathogen Destruction

Methods of Composting

One method of composting will probably suit your circumstances better than another. The following three technologies seem to work best for composting:

- Turned Windrow
- Aerated Static Pile (Individual)
- Aerated Static Pile (Extended)

Aerobic Composting Process

This process is based on selected microorganism and on enzyme basis. The team has got practical experience and has been running the compost plan for the past seven years. From the research it has been observed that when all the parameters required for the degradation in controlled way are made available, then it can reduce the process cycle to a great extent. This process can obtain good quality organic manure cum fertilizer.

Parameter required to accelerate aerobic process are as follows: [13]

- Small size organic matters.
- Selected microorganism for degradation.
- Air, (Controlled supply)
- Moisture

- Temperature (In build during process)
- Carbon and nitrogen ratio

Process designed with all above parameters can be termed as 3C – Aerobic Process. 3C stands for you:

- **Covered** - Total process is carried on in a covered area. Emitting of foul smell is restricted. In general any composting method emits foul smell. The first step has taken care by using the process.
- **Continuous** - There is no question of leaving the garbage on the ground. The biological treatment to control foul smell at the time of unloading the garbage will take care of the foul smell. After treatment it is feed to the machine for segregation and processing. So total organic matter can be converted in to organic manure within ten days. The refuse material can be for recycling to add better value to the environment.
- **Controlled** - Controlling of all six parameters required for the process helps to produce good quality organic manure cum bio fertilizer within shortest period. [14]

Health Impacts of Solid Waste

- Exposure to hazardous waste can affect human health, children being more vulnerable to these pollutants. Many studies have been carried out in various parts of the world to establish a connection between health and hazardous waste.
- Waste from agriculture and industries can also cause serious health risks. Waste dumped near a water source also causes contamination of the water body or the ground water source.
- Disposal of hospital and other medical waste requires special attention since this can create major health hazards.
- Waste treatment and disposal sites can also create health hazards for the neighborhood. Improperly operated incineration plants cause air pollution and improperly managed and designed landfills attract all types of insects and rodents that spread disease
- Recycling too carries health risks if proper precautions are not taken.
- Direct handling of solid waste can result in various types of infectious and chronic diseases with the waste workers and the rag pickers being the most vulnerable [15]

Preventive Measures

At the household-level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting, which is undoubtedly the best method for the correct disposal of this segment of the waste.

What you can do to Reduce Solid Waste

- Carry your own cloth or jute bag when you go shopping.
- Say no to all plastic bags as far as possible.
- Reduce the use of paper bags also.

- Reuse the soft drinks plastic bottles for storing water.
- Segregate the waste in the house -keep two garbage bins and see to it that the biodegradable and the non biodegradable is put into separate bins and dispose them separately.
- Dig a compost pit in your garden and put all the biodegradables into it.
- See to it that all garbage is thrown into the municipal bin as the collection is generally done from there.
- When you go out do not throw paper and other wrappings or even leftover food here and there, make sure that it is put in the correct place, that is into a dustbin
- As far as possible try to sell all the recyclable items that are not required to the kabariwala (person who trades in waste)

Legal Aspects in India (The Municipal Solid Waste (Management and Handling) Rules, 2000)

The Municipal Solid Waste (Management and Handling) Rules, 2000 consists of nine rules and four schedules. Section 2 defines 'Municipal solid waste' (MSW) as to 'include commercial and residential wastes generated in a municipal or notified areas in either slid or semi-solid from excluding industrial hazardous wastes, but includes treated bio-medical waste.'

Rule 4 makes every 'municipal authority' responsible to implement those rules and 'for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid waste.' It also requires that the municipal authority or an operator will have to seek permission for setting up waste processing and disposal facility including landfills from the State Pollution Board or the committee constituted for the purpose.

The over-all responsibility for the enforcement of the provisions of these rules in metropolitan cities have been given to the Secretary incharge of the Department of Urban Development of the State / Union Territory. Further, the District Magistrate / Deputy Commissioner of the concerned district shall have the overall responsibility for the enforcement of these rules within their area of jurisdiction. (Rule 5)

Monitoring of the compliance of the standards regarding ground water, ambient air quality and compost the rules by above mentioned authorities quality including incineration standards as per Schedule II, III and IV shall be done by the State Pollution Boards/Committee. The State Boards, before granting permission for setting up waste processing and disposal facility, must also consider the view of other agencies like the State Urban Development Board, Town and Council Planning Department, Airport or Airbase Authority and Ground Water Board, etc.

The municipal solid waste shall be managed and handled in accordance with the compliance criteria and procedure laid down in Schedule II of the Rules. Schedule II has provided the compliance criteria's for the management and handling as follows —

1. Collection on municipal solid waste - The littering of MSW shall be prohibited in cities, towns etc. and organise house-to-house collection on regular and pre-informed timing by using bell, singing, devise collection of waste from slums, squatter areas, slaughter house, fish markets, fruits and vegetable, industrial waste, horticultural and construction or demolition waste etc.

2. Bio-medical waste and industrial waste will be collected separately and will not be mixed with municipal waste. Further, bio-degradable waste shall be made use of. Such wastes have to be disposed of as per the procedure by the Bio-Medical (Management and Handling) Rules, 1998. It is the responsibility of the generator of waste to avoid littering and delivery of waste in accordance with collection and segregation system.

3. Segregation of municipal solid wastes - In order to ensure community participation in segregation of waste, the municipal authority shall organise awareness programmes through regular meetings of representatives of local residents, welfare associations and non-governmental organization.

4. Storage of municipal solid wastes - Municipal authorities are bound to establish and maintain storage facilities as they do not create unhygienic and insanitary conditions. For this storage facilities shall be created keeping in view the quantity of waste generation and accessibility to users. It should not be open, aesthetically acceptable and user friendly.

   Storage facilities or 'bins' shall be 'easy to handle' design for handling, transfer and transportation. Bins for storage of bio-degradable waste shall of green colour, for recyclable waste with white, for other waste shall be painted with black. Manual Handling of waste shall be prohibited, but if is unavoidable, it shall be carried out under proper precaution and with due care for the safety of workers.

5. Transportation of municipal solid wastes - Vehicles for the use of waste shall be covered not visible to public. It shall be prevented their scattering. Storage facilities bins shall be cleaned on daily basis and should not be overflowed.

6. Processing of municipal solid waste (Biodegradable) - 'Suitable Technology or combination' shall be used by municipal authority to minimize burden or landfill.

Bio-degradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. Separate procedure has also been provided by Schedule IV of the Rules.

Recoverable waste should follow the rule of recycling. Incineration, including pelletisation can also be used. Disposal of municipal solid wastes (Non-biodegradable) - Only non-biodegradable and other wastes which are not suitable either for recycling or for biological processing shall be used for land filling.

Schedule III of the Rules has also provided 'specifications for landfill sites'. It includes detailed rules for (i) site selection, (ii) facilities at the site, (iii) specifications for landfill, (iv) pollution prevention, (v) water quality monitoring, (vi) ambient air quality monitoring, (vii) plantation at landfill site, (viii) closure of landfill site and post-care, (ix) special provisions for hilly areas.

Recommendations

1. Promote increased synergy between the formal and informal sectors. Despite the significant role of the informal sector in solid waste management, there are few attempts to capitalise on this potential. United Nations organizations should assist municipal authorities to recognize and integrate the potentials of the informal sector. [16]

2. Promote greater awareness of environmental and health risks from poor solid waste management. Applied research shows that the methods of waste disposal that have been undertaken for the past decades have caused death and disability to many. Greater is the awareness of solid waste issues is likely to influence consumption patterns and improve the application of sustainable policies. The increasing content of hazardous components of domestic waste should also be given a higher profile in this respect.

3. Promote the development and use of indigenous technologies. Many developing countries are dependent on imported technologies for infrastructure improvements, including in waste management. This requires high initial capital investment which in turn reduces private investment potentials. At the same time, many of the most appropriate technologies are available locally in forms that can be easily and cheaply adapted to the needs. This issue points to greater potential for technical cooperation between developing countries, including on a regional and international basis. [17]

4. Focus on strategic programme areas. Programme areas B and D, on promotion of waste recycling and reuse and increasing the service coverage, appear to offer the most promise for the short- term implementation of Agenda 21. This is, in part, due to these areas offering good opportunities for community-based initiatives. The promotion of waste recycling and reuse provides a unique opportunity in waste management; it solves the problem of environmental degradation and has the potential to alleviate urban poverty and generate income amongst the urban poor. This will, however, require supply-side policies aimed at promoting and supporting resource recovery, and demand-side policies aimed at stimulating markets for recovered materials and products.

5. Promote information systems that can accelerate the implementation of Agenda 21. The implementation of Agenda 21 in sustainable development can be improved by a major commitment to improve inter-agency cooperation. One of the main reasons for this uncoordinated approach is the lack of information systems that are responsive and non-restrictive unlike the cases of NGOs the private sector, the academia and research institutions.[18]

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CONCLUSIONS

Waste reduction needs further research on new and indigenous technologies that decrease waste and waste products. A particular area of needed research is in treatment of medical waste, involving the collaboration of UNCHS and WHO.

Recycling of liquid wastes presents various alternatives of 'waste to resource' processes. For example, in water-scarce countries, domestic wastewater provides an excellent irrigation potential with extended possibilities for urban poverty alleviation in urban agricultural environment. Expertise from the United Nations Centre for Human Settlements (Habitat) on technical methods for wastewater treatment could combine effectively with FAO's and WHO's expertise on wastewater reuse in agriculture and health aspects respectively.

Good interactive data is an essential management tool in dealing with solid waste problems. In this context, the information that exists in the UN system and elsewhere needs to be tapped particularly with the aim of developing indicators that can assist waste producers and handlers to optimize their management systems. Action plans for waste management need to be considered in an integrated manner. For example, the possibilities of implementing separate industrial and domestic wastewater treatment facilities could free more water for irrigation and enable water authorities to keep a tighter control over highly polluting industries. Cooperation with FAO, UNEP and UNIDO in this respect is most important.

Legislative updating is also an urgent need given that in many countries waste treatment/disposal standards and practices for waste treatment and disposal tend to be outdated. Cooperation between UNCHS (Habitat) and other UN agencies with programs in environmental law could help reduce restrictive legal practices and modernize the related environmental standards. Such inter-agency collaboration will require greater exchange of information between the agencies, including through the electronic media. The use of modern information systems is likely to improve project development and strengthen inter-agency projects. Further collaboration is also needed in coordinating activities at the national level to avoid unnecessary duplication.

ANNEXURE [19]

Categories of Solid Waste

Organic waste	kitchen waste, vegetables, flowers, leaves, fruits.
Toxic waste	old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.
Recyclable	paper, glass, metals, plastics.
Soiled	hospital waste such as cloth soiled with blood and other body fluids

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The type of litter we generate and the approximate time it takes to degenerate

Type of litter	Approximate time it takes to degenerate the litter
Organic waste such as vegetable and fruit peels, leftover foodstuff, etc.	A week or two.
Paper	10-30 days
Cotton cloth	2-5 months
Wood	10-15 years
Woolen items	1 year
Tin, aluminium, and other metal items such as cans	100-500 years
Plastic bags	One million years?
Glass bottles	Undetermined

REFERENCES

[1] http://www.iisc.ernet.in/cgibin/htsearch?restrict=&exclude=&config=htdig&method=and&format=builtin%2Dlong&sort=score&words=%22solid%20waste%20management%22&page=2
[2] http://www.isec.ac.in/proj12.pdf
[3] http://www.isec.ac.in/proj13.pdf
[4] http://envfor.nic.in/soer/2001/ind_waste.pdf
[5] http://medind.nic.in/jab/t01/i4/jabt01i4p276.pdf
[6] http://www.neeri.nic.in/NEERIpub.html
[7] Ibid
[8] http://www.teri.res.in/teriin/camps/newslt/issue4.pdf
[9] http://www.un.org/documents/ecosoc/cn17/1994/background/ecn171994-bpch21.htm
[10] http://www.solidwastemag.com/
[11] http://www.sciencedirect.com/science?_ob=IssueURL&_tockey=%23TOC%2313013%231988%23999919995%23451089%23FLP%23Volume_8,_Issue_4,_Pages_247327_(1988)&_auth=y&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=23e61b119bd3efa57982fa0f468a9590
[12] http://www.natcomindia.org/natcomreport.htm
[13] http://envis.maharashtra.gov.in/municipalCorp/data/20040415192807001/20040415192807001.pdf
[14] http://www.lgean.org/documents/Solid_Waste.pdf
[15] http://medind.nic.in/jab/t01/i4/jabt01i4p276.pdf
[16] http://dnr.wi.gov/org/aw/wm/publications
[17] http://www.undp.org.in/programme/GEF/sep02/SEPT2002/reader-response.htm
[18] http://www.undp.org.in/programme/GEF/sep02/SEPT2002/reader-response.htm
[19] http://coe.mse.ac.in/kidssolid.asp