Problems of Solid Waste Management in Indian Cities

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I. INTRODUCTION

"Solid waste" refers to the refuse , the solid and semi solid waste matters of a community except the night soil . Solid waste contains organic as well as inorganic matters . Solid waste management includes the entire process of dealing with solid waste ,starting from the collection from the primary source to ultimately disposing off it hygienically, so that it may not be a nuisance or create any harmful effect on near by community .The solid waste management involves , management at waste generation level , storage at the source of generation , primary collection , street cleansing , temporary storage at locality level , regular and periodic transportation of this temporarily collected waste to disposing sites and treatment plants.

As per **Municipal solid waste Management and Handling rules -2000** , solid waste management is in the obligatory function of urban local bodies , but in actual practice the solid waste management is given the last priority and the duties are either not performed or poorly performed consequently the city has to face numerable problems related to environment and sanitation .

As per the reports of the committee constituted by the Hon'ble Supreme Court of India in March 99 , the lack of financial resources , inefficient institutional arrangement , inappropriate technology , weak legislative measures and unawareness in public towards solid waste management has made the service most unsatisfactory and inefficient .

The solid waste management approach in India is extremely inefficient , using old and obsolete system , technology for storage collection processing ,treatment and disposal . There is no formal organized system of segregation of biodegradable and non biodegradable solid waste . The recovery and recycling of waste is only done by scavengers and scrap dealers which is highly hazardous to those which are involved in this job .

II. THE ENTIRE SOLID WASTE MANAGEMENT CAN BE DIVIDED IN FOLLOWING ACTIONS

1. Generation of Solid waste
2. Collection of solid waste at primary source
3. Street Cleansing
3. Transportation of solid waste to the secondary/ locality storage/community bins
4. Storage of solid waste at locality level
5. Transport of solid waste to dumping sites and treatment plants
6. Treatment and Dumping of Solid Waste
7.Traditional approaches of dealing with solid waste

III. GENERATION OF SOLID WASTE

Following are **the major sources of generation of waste** at **urban level**

1- Solid waste from **Residential Areas , Institutional/ Community areas**
2- Solid waste from **vegetables markets (retail $ wholesale)**
3- Solid waste from **Hotels , and restaurants**
4- Solid waste from **commercial areas**
5- Biomedical waste from **hospitals and dispensaries**
6- Waste from **domestic / stray animals /dairies**
7- Solid waste from **Industries**
8- Waste from street cleanising
9- Miscellaneous

IV. QUANTITY OF GENERATION OF WASTES IN INDIAN CITIES

- The **per capita solid waste** generation in few Indian cities
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City Waste Generation Rates:

- **Delhi** .60 Kg Per Capita Per Day
- **Banglore** .53 Kg Per Capita Per Day
- **Calcutta** .51 Kg Per Capita Per Day
- **Hyderabad** .35 Kg Per Capita Per Day
- **Sonepat** .343 Kg Per Capita Per Day
- **Hardwar** .40 Kg Per Capita Per Day
- **Meerut** .45 Kg Per Capita Per Day

Source: Reports concerned Municipal Corporations/Committees

- The **waste generation** in **small cities is lesser** than **larger cities** .
- The amount of **solid waste generation** is also directly related to the **economic status of families .**
- As per studies conducted by Tata Energy Research Institute , **higher income group generate more solid waste than middle and lower income groups** .
- The **lower income groups in New Delhi generate less than 1/3rd of solid waste than their higher income counter parts** .
- As per studies conducted , in smaller cities of population about 3 lakhs

the **generation of biodegradable waste (50 – 65%) is more than non biodegradable waste (35 – 50 %)** . The

biodegradable waste can be easily reduced to manures by compositing plant

V. COMPOSITION OF SOLID WASTE IN INDIA

The comparative study of the solid wastes composition for cities in industrialized countries and Indian cities reveals that the **organic matter in India solid waste is higher ,** due to the presence of a **large percentage of vegetative** matter . This is attributed to the fact that Indians eat fresh vegetables and fruits in contrast to the consumption of tinned / pre – cooked food in developed countries .

VI. COMPOSITION OF WASTES OF LARGE CITIES IN INDIA

Component % by Wet weight	**Ahmedabad**	**Bangalore**	**Bombay**	**Calcutta**	**Delhi**	**Kanpur**
1. Paper and card	5.15	1.5	3.20	0.14	5.88	1.35
2. Metals	0.80	0.1	0.13	0.66	0.59	0.18
3. Glass	0.93	0.2	0.52	0 .24	0.31	0.38
4. Textile	4.08	3.1	3.26	0.28	3.56	1.57
5. Plastic , leather	0.69	0.9	-	1.54	1.46	0.66
6. And Rubber						
7. Wooden matter	1.5	0.2	17.57	-	0.42	1.0
8. Husk and straw						
9. Bones etc	0.12	0.1	0.5	0.42	1.14	0.21
10. Stones etc	8.77	6.9	-	16.56	5.98	18.38
11. Fine earth, ash etc	29.01	12.0	15.45	33.58	22.95	22.93
12. Fermentable	48.95	75.0	59.37	46.58	57.71	53.34
Density of Refuse (kg /cu.m)	**-**	**578**	**-**	**600**	**-**	**500**

Source: Reports concerned Municipal Corporations/Committees,Nath,K.J.1984

VII. COMPOSITION OF WASTES OF SMALL CITIES IN INDIA

Ash and fine earth	30-50
Total organic fractions	30-50

Source: Reports Municipal Committee, Sonipat

Case Study of ingredients of Waste Generated at Sonepat

Component	**Percentage**
Paper	3.0-10
Plastic	1.0-5.0
Metals	0.4-1.0
Glass	0.3-10

Case study of Waste Generated at Hardwar

Components	**Percentage**	**Quantity Produced per day (Metric Tonnes)**	**Recyclable@10%**
Paper	10	14.2	1.42
Plastics	5.0	7.125	0.7125
Metals	1.0	1.42	0.142
Glass	1.0	1.42	0.142

Source: Reports Municipal Committee, Hardwar

Case study of Waste Generated at Hardwar: Cost /ValueOf Recyclable Items

Component	Recyclable Quantity /day (in kgs)	Rate Per kg (in Rs)	Total value (in Rs)
Paper	1,420	2.00	2840.00
Plastic	712.5	8.00	5700.00
Metal	142	5.00	710.00
Glass	142	0.75	71.00
Total			9321.00

Source: Reports Municipal Committee, Hardwar (2004)

VIII. SOURCES OF WASTE GENERATION IN THE CITY OF SONEPAT

S. No.	Sources of waste generation	Waste generation Per day (MP)	Percentage to the Total
A	Local Inhabitation		
1	House holds	59.04	74.96
2	Shops and commercial Establishment	1.04	2.08
3	Grain and vegetable Markets	6.50	7.61
4	Construction and Demolition Waste	3.00	3.80
5	Institutional and Medical	3.50	4.57
6	Industrial	4.00	5.07
	Sub Total (A)	77.08	98.10
B	Floating Population	1.30	1.90
	Sub – Total (B)	1.30	1.90
	Grand Total	78.38	100.00

Source: Reports Municipal Committee, Sonipat

Quantity of waste generation in Indian Cities

Population Range	Average per Capita Value (Grams/Capita/Day)
Less than one lakh	210
One lakh to five lakhs	210
Five lakhs to ten lakhs	250
Ten lakhs to twenty lakhs	270
Twenty lakhs to fifty lakhs	350
More than fifty lakhs	500

IX. PROBLEMS OF STORAGE OF SOLID WASTE AT THE SOURCE OF GENERATION

- In most of the cities in India , **the scientific and systematic storage of waste at source is not in practice .**
- The waste is normally **thrown** in **nearby vacant areas** ,**government vacant land ,drains, streets** etc .
- Because of waste thrown on the street **the environment becomes ugly** and unhygienic , so even in case of regular cleaning be Municipal Workers also, the city can not be kept clean for more than 2-3 hours .
- At sources people generally **don't arrange to provide proper dustbins** , in residential , institutional and commercial areas .
- In case of open drains and large drains passing across the city , people throw waste and these **drains are clogged** , width of **large drains are reduced** because of continuous **dumping**
- People generally use following items to collect waste at source : buckets ,polythene packets, plastic bins , metal bins with and without lids .

- People generally **don't take the waste to the designated points** they carry it to nearby roads , railway tracks , open plots etc and generally people avoid walking to the designated disposal points .
- So when **wind blows** the **heap of solid waste get carried away by wind** and **spread** in large areas and when there are rain the problem get aggravated.
- There is **no system of keeping the Bio degradable and non Bio degradable waste separately**
    - **No processing** of the waste is done in most cities . Very few cities have the organizational and administrative set – up to subject the waste to treatment process like composting and that too on a very limited scale . Most of the wastes are disposed by the concerned agency at an open dump without going in to the details of either site or wastes. **There is no adherence to any standards or norms for disposal and the sites is not scientifically managed** .
    - **The land filling practice in most Indian cities is one of the most unscientific and unhygienic practices with serious environmental implications** . The wastes are brought to the site and dumped . There are no consideration for leach ate , gases and cove. The land fill sites are mostly accessible to scavengers , animals and vectors .

STREET CLEANISING

The **major sources of street waste** in the city are –

1- Natural waste comprising of dust , decaying vegetation , fallen trees leaves , blossoms , seeds , plants and animals .
2- Road traffic waste like oil , rubber , accidental spillage of load of vehicles , animals dropping construction waste etc .
3- Waste from near by areas / population from residential area , commercial areas , industrial areas etc .
4- Litter thrown by pedestrians waste from houses , hotels , establishments , excreta of animals , pets like pigs ,cattle , dogs etc .
5- Waste produced by street hawkers , road side vegetables vendors , slum dwellers .

PROBLEMS OF DEALING WITH THE SOLID WASTE NEAR THE SOURCE OF GENERATION AND TEMPORARY COLLECTION POINTS

- **Sweepers** generally restrict themselves **only to the sweeping of the streets** and **cleaning of drains** .
- Sweepers **avoid door stop collection** of wastes in some areas , private sweepers collect the waste and deposit it to the collection points .
- As per the provision of **state Municipal acts the sweepers are required to collect waste from the door step during street sweeping on daily basis** .
- **No initiative** are generally **taken in monitoring the community** and citizen to cooperate with the municipal sweepers by bringing the waste produced in the households and commercial establishments to the sweepers or up to the community bins.
- **Municipal rules** engage workers for **eight hours in a day** with a provision of cleaning in morning as well as in the evening where as in actual practice only cleaning happens in one time ie. Morning and **work is generally done from 2-3 hours .**
- **Municipal manpower** and **financial resources are very less contextual to the gravity of problem,** and available resources **are not properly used**.

TRANSPORTATION OF WASTE TO THE COMMUNITY BINS

Transportation of waste from the source to the community bin is the responsibility of scavengers deployed for the purpose and door to door collection is required to be done but in actual situation this work is either **done by people themselves or by privately employed workers, scavengers.** Generally the vehicles used for the purpose are bin hand carts, simple hand carts, tricycles,etc

COMMUNITY BINS: TEMPORARY STORAGE OF WASTE AT LOCALITY LEVEL -

- For approximately an area of about 5-10 acre there is 1-2 temporary storage of waste .
- these storage boxes are Dalao (50' x 6' x 3') mild steel containers (6'x 4'x 3'), mild steel containers (3'x 3' x3')

X. TRANSPORTATION OF WASTES

The main objective of transportation is to **clear waste** from the city and dispose it off at the disposal site . It is the responsibility of the local body to ensure the city to be clean by transporting the waste **from various temporary storage** points to the **dumping grounds** with the help of transportation fleet maintained by the local body . The movement of waste from the households ,street sweeping , etc . to the temporary storage collection points is the collective responsibility of the sweepers and the citizens of the city .

Transportation of waste involves the following activities :

- **Movement** of vehicles to various **temporary storage points** .
- **Manual loading** of waste using baskets and other lifting tools .

- Lifting of waste from the open yards on the way to the disposal site and
- **Transportation to the disposal site** .

It is very essential to synchronize the whole operation of collection of waste with the transportation for effective management of the waste and for achieving economy in the process .

Process of Transportation of Waste :- In India generally the smaller cities have adopted open transport system for transporting the waste from the temporary storage points to the disposal site . Wastes are collected from various temporary storage points and open collection points and are loaded to the transport vehicles manually . Manual loading is found to be time consuming and reducing the productivity of the vehicles and man power deployed for the purpose . Further , manual loading and handling of wastes are posing threat to the health of sanitary workers , as the wastes were found highly contaminated . As a result ,the waste is generally seen lying in heaps or scattered at the unscientifically designed temporary waste storage points giving unsightly appearance besides causing nuisance and unhygienic conditions .

Ideally for the **manual loading** , the man power requirement is about **3 sanitary workers including Driver** . One sanitary worker shall fill the basket with the waste and another to dump into the cargo of the vehicle . For lifting operation, the sweeper who is in operation near the storage site may be used . However in case of **Sonipat** , it was observed that 4 sanitary workers including driver accompany each vehicle . It was also observed that one sanitary worker would fill the basket, another to help him to lift the waste to the vehicles and third person to unload the waste into the vehicle and level the waste inside the vehicle . There is no Driver available with Municipal Council Sonipat . The posts are vacant and have not been filled from last years . Presently the sanitary workers themselves drive the tractors .

TREATMENT AND DUMPING OF SOLID WASTE

- The main objective of treatment and disposal is to clear waste from the disposal site in an environment friendly manner with little/ non serious implication on the health and hygiene of the micro and macro environment. It is responsibility of the local body to ensure safe disposal of the waste generated with in the its jurisdiction. The urban local bodies have generally adopted **dumping as method of the disposal** of the waste as on today. Currently the waste is not treated in systematic and scientific manner. As a result the whole area in and around the disposal site has become un hygienic and posing serious threat to the public health
- In case of Sonepat city municipal council has **not specified any solid waste dumping yard**, the area where the waste is dumped are near vegetable markets and along the railway line ,again causing threat to nearby areas
- In city **of Hardwar** all the solid waste collected is **dumped in low lying areas adjacent** to the **Eastern Ganga Canal** on the banks of river Ganges on land belonging to irrigation department. The **hazardous waste of Hardwar** are also **dumped along** with all other wastes by the bank of river Ganges and adjacent to the canal,. This low lying area is approximately 1.5 kms long and varies in width from 75 to 100. Meters.
- There is **no monitoring facility** at the disposal sites, neither there is any provision of fencing/ boundary wall, there is no arrangement for protective measures like impervious lining materials cover material etc to protect. the canal/ river from contamination
- **No** consideration has been given to **pollution control**

PROBLEMS OBSERVED IN THE PROCESSING AND RECOVERY OF SOLD WASTE

1 Generally in Indian cities the **formal processing** and **recovery units** are **not established**

2. Recovery and **recyclable activities restricted** to small and medium kabadiwallas

3. Involvement of **small children** and **old people** employed for sorting and segregating waste.

5. **No protective clothing** /consideration for rag pickers / scavengers

6. Generally in Indian cities **financial implications of recovery and recycling has not been studied** or considered to use solid waste for the purpose of finance generation

STRUCTURES OF MIUNICIPAL TEAM WORKING FOR SANITARY CLEANING

In Indian towns the entire municipal area of town is divided in to sanitary divisions having 100-1000 acres of land depending on size of cities, population densities,locations,available facilities and manpower. In each of the sanitary divisions one Safai Daroga is posted under whom 5-10 scavengers / workers perform the cleaning work .Over these safai darogas there are sanitary inspectors and chief sanitary inspector responsible for the cleanliness and total hygienic environment of city.

SIGNIFICANT FEATURES OF SOLID WASTE DISPOSAL SYSTEM : A CASE OF MEERUT

Meerut is a city with population of about **12 lakhs**

- Presently the amount of **solid waste produced** by city is **600 M.ton per day.**
- Responsibility of collecting and disposing off **solid waste** is of **Municipal corporation .**
- Present capacity **of Municipal Corporation** is deal with **only 450 M ton** , and the entire **waste is dumped in out skirts of city** .
- **No proper study** has been conducted to actually examine the **nature** of **& ingredient of the waste** .

- The waste contains mainly from **industrial waste , waste from hospital / medical institution , commercial waste and residential waste.** .
- City has great potential for involving **private parties** and the **solid waste can be used commercially and for public use** , though some attempt are being made to **increase the capacity of collection and disposing off by 150 M ton .**
- **By year 2021 , there will be 1150 M ton solid waste** where as presently Municipal Corporation has **capacity** of dealing with **450 M ton.**

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The **facilities available** with **Municipal Corporation** are-

1- JCB –3 no.
2- Leader – 3 no.
3- Truck – 3 no.
4- Small truck –6 no.
5- Truck - 9 no.
6- Inspectors –6 no.
7- Safai karamchari –1923 no.

Source: Report Municipal Corporation Meerut

Status of Availability of Staff

	Post available	**actual strength**
Health officer	1	nill
Mukhya safai nirikshak	12	3
Safai nirikshak	40	7
Safai karam chari	7440	1905
Bhisti	163	nill
Malaria karam chari	27	7
Dog squad	35	5
Doctors	2	1
Compounder	12	5
Midwife	6	3

Source: Report Municipal Corporation Meerut

- Out of **70 Municipal wards** of city , **15 wards have no system for solid waste** disposal , **27 have partial system and 28 wards are fully attended.**
- **Detailed policy / activity frame work** is required for collection , of waste , segregating of harmful Industrial waste , Bio degradable waste and non degradable waste .
- At least **four locations are required to collect the waste** and with **private- public joint venture** waste should be used commercially .
- Few efforts have been made to address the problem of solid waste by allocating **three location at village Ghosipur , Rali Chauhan and Itehra** ,Also there is a mention of installation of a **modern plant for treating harmful medical waste.**
- All dumping grounds are located in south and south eastern side of city , more dumping grounds are **required towards N, NE, NW sides .**
- Location of one of the yard in village **Ghosipur** having residential density of **450 ppa which are not compatible. .**
- **Special provision in zonal development plan** are also required to develop these spaces in a way so that they do not create any problem to near by land uses.

XI. CASES OF MEGA CITIES

- In **Bangalore** again the most common method of disposal is open dumping of the wastes in the land fill sites . Bangalore has 14 such sites where the solid wastes are dumped in open heaps without any processing or treatment . There are two composting plants which can process 200 metric tones of SW per day and 300 metric tones of SW per day , however both the plants are operating much below capacity and process only one – third of their capacity .

- In **Calcutta** solid wastes are disposed by both land filling and open dumping – there are more than 40 such disposal grounds in additions to small private land filling sites . These sites receive from 500 to 10 metric tones of solid wastes per day , depending on there size .

- The situation in **other Indian cities** too is not drastically different from that in the cities discussed above and thus the need for urgent intervention , in terms of suitable long and short term plan proposals by planners for addressing the issue , and a pragmatic approach by policy and decision makers to facilitate sustainable solid waste management programmes , to prevent any further misshape like Surat . Our cities can sustain their environment and the vagaries of development only if an all – encompassing holistic approach to town and country planning is adopted and implemented .

- **In Delhi** around 5339 **Community Bins** have been placed at community level in two colors blue and red for biodegradable and non biodegradable wastes but since people are not serious in putting waste in correct bins and rather the waste is thrown in out of the bin, so the problem of solid waste is increasing day by day.

SOLID WASTE MANAGEMENT OF CITIES THROUGH PRIVATISATION
EXISTING MODELS

- In city of **Baroda** , resident welfare association are playing magnificent role regarding solid waste management of the city .

- RWA arranged door to door campaign to generate public interest , it appointed volunteers to manage the program and appointed sweepers .

- Rs 3- Rs 5per household from slum areas and Rs 30 per month per house hold is collected from other residential area , more money was paid by commercial establishments in order to transport regularly the solid waste from generation point to primary collection point

- They generated an orderly system of door to door collection of waste and transporting it to the community bins .

- In **Kochi** in 1994 the work of collecting waste from the community bins , and transporting it to the disposal sites was awarded to a private agency called PEMS (Popular Environment Management Services) through a contact for five years .

- The corporation installed 350 metal bins as community waste collection points and provided 6-7 waste collection vehicles to PEMS on rent .

- Operation and maintenance of the vehicles is the responsibility of PEMS .which ensures maintenance and efficiency of the vehicles .

All personals were employed by PEMS and collection carried out in 12 hours .shift per day .pems changed the co operation Rs 100 per cubic metre of the waste disposed at site designated and monitered by the corporation . PEMS was responsible for collecting and dumping 130 tonnes out of the total 400 tonnes of solid waste generated in Kochi in 1994 .

- PEMS collected the waste from fix points the routs were predestinated .The vehicles collect the waste from the community collection bins by hydraulic lifting and dispose the waste at the disposal sites .All secondary collection , transportation and disposal are carried out at night .

- However , the **high percentage of organic portion** in the Indian waste makes it suitable to biological processes like composting .

- In some of the large Indian cities **composting of Municipal solid wastes** (MSW) has been taken up on a commercial scale .

- In Faridabad (Haryana) and Chennai the respective **Municipalities have given contracts to private companies for producing marketable compost from the solid waste being generated in there area .**

- The **incentives to the private companies** includes allotment of **land of lease , assurance of a fixed quantity of waste every day , subsidy on the purchase of equipment and tax holidays for specified periods on the income from sale of the produce from the plant .**

- In **Delhi** the work of providing **community bins and maintaining** them has been privatized in few areas/ zones but still no significant result has been observed in comparisons to other areas

TRADITIONAL APPROACHES IN DEALING WITH THE SOLID WASTE IN INDIA

- **The solid waste in Indian cities makes it unsuitable for processing operations like incineration , pyrolysis , etc . due to the high percentage of non combustibles and moisture in the waste .**
- There are number of indeginious methods developed in India which are very suitable in our situations and are profit generating, one such method is very famous in which the solid waste is first sieved to remove larger particles, constituents, further the waste is dried and screened to remove the sand plastic and metallic etc and converted in to small pellets
- A binder could be used for pelletisation or the lignin in the vegetables matter in the garbage it self can also serve as a binder . The pellets are dried in a rotary hot air drier to around 8 to 10 percent moisture level and are then ready for use , the **pellets have a heating value of 4000 kcal / kg and a bulk density of 500 kg / cum** due to the high amount of biomass present in the Indian refuse .
- The **fuel pellets** are an **excellent domestic fuel** , since they burn without a smoke in contrast to charcoal and fire wood . Due to high heating value lesser quantity of the fuel can produce better heating in lesser time , this process will not only reduce the nuisance of ill disposed garbage but also be economical in terms of saving precious fossil fuels and fire wood . The **pellets** can also be used in **small thermal power plants** .

- Another **indigenous treatment method** developed from traditional Indian treatment processes for wastes is the **Vermicomposting** process developed and systematized by Bhawalker Earthworm Research Institute in Pune . This cost effective method needs no complex equipment and negligible energy inputs . This process utilizes the ability of the earthworms to disintegrated the biodegradable portion of the municipal solid waste . The earthworm's gut provides ideal temperature, ph and oxygen concentration for the speedy growth of useful aerobic bacteria and actinomycetes and thus has a very high microbial density about 1000 times greater than in the surrounding soil . The worm also produces enzymes which break complex biodegradable matter present in the garbage into simpler compounds which are used by the microorganism.
- **T**he **earthworm** is capable of feeding on the waste and reducing its size to 2 microns size thus providing a greater surface area for microbial action . The blood hemoglobin in worms has a very high oxygen affinity and is thus available for the micro – organism in high concentrations . The oxygen rich micro – environment accelerates the aerobic decomposition and eliminates the anaerobic micro – organism .
- The micro – organism in the earthworm's gut produce useful compounds like antibiotics , vitamins , plant – growth hormones etc . which are all present in its vermicastings . They also destroy all the pathogens in the ingested waste thus rendering the vermin casting safe .These **vermicastings** make good bio-fertilizers . This is one of the cheapest and easiest methods of processing organic fraction of the solid waste. **Vermicomposting** can be effectively used to process wastes even at the community level in both urban and rural areas due to the simplicity and low cost of the process . But segregation of the biodegradable / organic fraction of the waste is a pre – requisite .

LEGISLATIVE ASPECTS OF SOLID WASTE MANAGEMENT : CASE OF HARYANA

Most of the Municipal Acts, in Indian cities have some provisions for the management of solid wastes .

The **Haryana Municipal Act , 1973** , deals with the issue of solid waste management under **'Scavenging and House Scavenging ' . Sections 152 through 168 of the Act are dedicated to the subject** .

The provisions of the act makes the removal of offensive matter mandatory for residents, they can be served notice for this purpose by the Municipality . The act also bans the dumping of earth and solid wastes on to the streets , into drains , sewers and irrigation channels . Such offences are punished with a fine under the act . The act also abolishes the practice of scavenging and carrying of night soil by persons on their head .

XII. RECOMMENDATIONS

- There is a dire need to **educate and make aware the people** to change their habits , so as to store waste at source, and dispose off the waste as per the direction of Municipal council and effectively participate in the activities of Municipal council.
- **Clear guidelines** relating to the kind of storage receptacles , segregation of waste etc. should be issued , offenders should be penalized .
- There should be **segregation of non biodegradable /recyclable waste** at sources or at secondary collection point and methods like compositing should be used for biodegradable waste.
- There should be segregation of waste at the city level also for disposing the recyclable waste and hazardous waste properly .
- The food waste , vegetable and **organic waste** produced at source which are biodegradable should be stored in **non corrosive container** preferably with cover / lid .
- Dry and **recyclable waste** should be stored in bag / sacks made of plastic / paper / cloth etc .
- All the domestic **hazardous waste** , electronic equipment waste should be stored in bags / sacks and should be disposed in **notified safe areas** .
- **Separate community bins** should be provided for **dry and wet** waste .
- For commercial areas and hotels the dustbins should be **containers** not more than **100 lts** in size with handles on top or on sides with rim at base .
- In case of **vegetable markets large containers** complementing the transportation system should be provided .
- For waste in meat and fish markets the containers should be **non corrosive** and not more than 100lts .
- **Biomedical waste** from hospitals and nursing homes should be treated as per the provisions contained in Government of India , Ministry of Environment and Forest Biomedical wastes (Management and Handling) Rules -1998 .
- Wastes from construction sites , **Demolition waste** should be **with in** the **premises** and not at all abstructing the road .
- **Door step** collection of waste by municipal workers and commercial areas should be ensured .
- All waste should be **segregated in bio degradable , non biodegradable waste** before primary collection **.**
- **Transportation** to **temporary source** should be by handcarts / trycles with detachable containers of 20 to 40lts capacity .
- For **street cleanising** sweeping operation should be broadly clarified as per the cleansing requirements .
- The time of **sweeping** operation should be **synchronized** with that of **generation** by dividing the city in to sweeper beats .

- Shovels should be used to pick the **heaped waste** and transfer to the containers .
- For temporary storage and in case of **community bins** , containers should be **metal mobile containers** in place of cylindrical cement . bins , masonary tanks and space should be provided to accommodate 3-10 cubic meter size .
- In order to **reduce waste at dumping site** , Incinerators , composting methods can be used .
- There is a dire need for community participation and design and development of appropriate system of primary collection of waste so as to synchronize with the storage at source as well as temporary storage collection point
- The **dumping** should be done generally in **low lying areas** of city , open land available in out skirt of city .
- Every dumping site should be **away from residential area** or habitation .
- Dumping sites should preferably be **barren land**
- Sites should have **proper access** .
- Sites should have **provision for workers** shelter stay , tools , equipment , electronic weigh bridge etc
- **Private initiative** is required in treatment and disposal solid waste .
- There are requirement of **state legislation** , rules or controls governing the solid waste management .

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