MUNICIPAL SOLID WASTE MANAGEMENT BEST PRACTICES

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ABSTRACT

Solid waste management is a systematic process minimizing solid waste in an area. By this method to control of solid waste as well as alternative useful for solid waste as resources utilization. Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Various studies reveal that about 80% of MSW is disposed of unsafely at open areas, creating problems to public health and the environmental pollution. An approach made to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW. Various treatment methods with their advantages and limitations. The study gives some suggestion which may be benefit to local people and researchers to work further.

General goals:

1) Waste reductions as the most preferred management technique followed by reuse/reduce, recycle then ingeneration with energy recovery and least preferred landfill.
2) Must undertake all the waste reduction measures to an extent, practical, feasible.
3) Recycling measures are practical with available technology, market effectiveness
4) 3 R (R,R,R) waste to energy recovery
5) Landfill option become unavailable / legislatively prohibited , integrated solid waste
6) Reducing and recycling of solid waste to max feasible extent. Third option is combustion of remaining solid waste after deduction.

OBJECTIVE AND VISION:

1. Collection of generated MSW from Door-to-Door.
2. Segregated Garbage Collection.
3. To reduce the quantity of solid waste disposed off on land.
4. Waste collection and transportation methods and measures.
5. Ensure better human health and safety measures.
6. Environmental and economical sustainable and feasible.
7. Recovery through sorting recycling (recovery, material paper, glass, metal)
8. 100% MSW Collection Efficiency.
9. Efficient Transportation to Processing/ Landfill Site.

Introduction

1.1 About the municipal solid waste:

The quantity of MSW generated in Karimnagar has been consistently rising over the years. This can be attributed to the rapid population growth, mass migration of population from rural to urban areas, increase in economic activities in general in the city and the change in lifestyle of the people. According to the Population Census 2010, the 3 rd highest percentage of urban population in Telangana is in Karimnagar (93%).

There has been a decennial population growth of 46.31% between 2001 and 2010 as against the corresponding All-district level, which is 21.34%. Along with intrinsic population growth the rural to urban mass migration account for additional population pressure on the city. Change in lifestyle of the people has resulted in increased wasteful consumption, leading to a change in the composition and increase in the quantum of solid waste generated. Urban solid waste is normally a complex mixture of household, construction, commercial, toxic industrial elements and hospital wastes. On an average, city generates 400 tonnes1 of municipal solid waste per day. A physical analysis reveals that it consists of about 32% compostable matter.

The recyclable components include paper 6.6%, plastics 1.5% and metals 2.5%. Primarily the responsibility of solid waste management is vested upon several public sector agencies. However, various other stakeholder groups, such as waste pickers, waste dealers, recyclers and recycling unit workers play significant roles in the overall scheme of things.

Literature review

In the overall sequence of activities, starting from collection of recyclable materials to the final disposal and recycling of waste, significant contributions are made by a range of private stakeholder groups outside the municipal authorities. These stakeholder groups wheel the informal sector recycling trade activities namely segregation, collection, sale and purchase of recyclable materials, and the actual process of recycling at recycling units. Residents and shopkeepers sell recyclable items, such as newspaper, glass containers, tin cans etc. to waste collectors. The waste pickers retrieve recyclable materials from what is discarded by households, commercial establishments and industries from municipal wastes. Larger commercial establishments and industries sell the recyclable waste (in segregated form or otherwise) to waste dealers in bulk, who then sell it to recyclers.

Waste pickers pass on the retrieved materials to waste dealers. Then there are agents who facilitate transactions between medium / large waste dealers and recycling unit owners. A typical structure of waste trade is presented in Fig 1.

Recycling and movement of waste through the various people involved in the waste trade

Waste picker		
Small waste dealer	Medium waste dealer	Large waste dealer

Socio Economic Profile of waste pickers Most Vulnerable:

Waste pickers, scavengers, or rag pickers as they are commonly called, constitute that segment of the people involved in the waste trade who make a living by collecting and selling recyclable materials out of municipal solid waste. Though they play a pivotal role in the larger waste management systems they remain most vulnerable in the urban society.

In the absence of a formal census, it is also not possible to ascertain the precise age or the sex profile of this population. The survey found 24% female and 76% male Street waste/Dump yards recycler consumer waste pickers. Overall 45% were above the age group of 25 and 24% below 16 years of age. 31% were between the age group of 16 to 25. Females in the occupation might be because most women return to their household chores before noon and there exists an area wise variation. On the whole it is found that either both men and women within the household are engaged in waste picking or only the women are involved. Often the children assist their parents during waste picking. A study conducted by National Labour Institute (NLI) in 1997-1988 found waste picking to be the fourth largest occupation for street children. The present study found only 24% of the waste pickers to be children. A possible reason could be that most child waste pickers take up waste picking as a family occupation and collect waste with their parents.

Waste pickers as migrants:

Most waste pickers are migrants from rural. Unemployment and poverty are two prime reasons for their migration into urban setups. 97.5 percent of the migrants surveyed revealed that they came to city looking for employment and ended up waste picking as a means to survive. They include both Hindu and Muslim. Once in the city most of them took up waste picking as a means to survive. Moreover, the very nature of the activity, which requires no skill, no investment and no contacts or references, might be other reasons for migrants to become waste pickers.

Income of waste pickers:

Adult waste pickers earn Rs 45 to 80 per day. A child waste picker earns Rs 10-15 when he is assisting his parents. If he is working independently he earns Rs 20 and Rs 30 as he can then devote more time to his activity. A waste picker with a cycle earns Rs 50- 80/day and one with a tri cycle earns Rs 150-200/day. They usually sell the collected waste to the local waste dealer on a daily basis, as they have no place to store the waste. Since they have little savings they depend on the waste dealer for loans and advances. About 75% of them are illiterate. Even after several years at waste picking they do not acquire any special skills and are hence unable to move into any other occupation.

Health Hazards:

The occupational health hazards of waste pickers arise from two aspects – poverty and their occupation itself. Since they belong to the poorest and most deprived section of the urban population, under nutrition, growth retardation, anaemia, tuberculosis and other bacterial and parasitic diseases are very common amongst waste pickers. These make them all the more susceptible to occupational health hazards.

In the hope of discovering some saleable item the waste pickers rummage through putrefying waste heaps including toxic medical waste using their bare hands and feet and hence come in direct contact with waste material. Infections and infestations results due to such contact with human and animal excreta, sputum, dead animals and potentially infectious hospital waste dumped in refuse dumps this makes them highly susceptible to a number of health hazards.

Injuries in form of cuts and bruises:

Hazardous working conditions lead to frequent injury in the form of cuts and bruises from glass, metal sharps, broken bottles etc. 28% waste pickers reported experiencing such injuries often while 61% said that they got injured once in a while. 27% of the waste pickers who collect medical waste sustain injuries from syringes, sharps and broken bottles and ampules.

Air borne diseases:

During long dry periods the surface of landfills and open dumping grounds becomes dry and very dusty. The waste pickers are exposed to air borne dust which makes their working conditions all the more unpleasant. Under these conditions infections and allergic disorders, especially of the respiratory tract, are common.

Chemical Poisoning:

Chemical poisoning includes pesticide poisoning. Waste pickers often come across empty containers of chemicals, which they sometimes use for storing food or water or burning such containers as source of heat in winter. Several anecdotal pesticide poisoning pesticide cases have been documented in children who have used discarded pesticide tins as glass for drinking water5, lead poisoning in families where discarded lead battery containers were used as fuel have been documented.

Government Initiatives and Policies:

Employment requirements of increasing numbers of urban poor and management of vast quantum of solid waste generated are the key factors that have combined to create the increasingly growing occupation of waste picking.

Though the waste pickers play a significant role in the entire process of waste management yet their services go unnoticed and issues concerning their livelihood go unaddressed. Government approaches to the needs of the waste pickers are too compartmentalized and fails to have a holistic view of their problems and requirements. It is imperative that policies be so designed that they are more responsive to the needs of the waste pickers. In the present section an analysis has been done of the government policies and programs on the main factors that have contributed towards the growing occupation of waste picking. Employment integrated into overall planning process and Employment Oriented Urban Poverty Alleviation Programmes. Urban poverty as a priority area occupied the attention of the planners only in the Seventh Five Year Plan when urbanization was realized as an integral part of economic development.

In the seventh plan emphasis was given to urban employment generation as a means to tackle urban poverty. Self-employment programmes, namely, Self-Employment Programme for the Urban Poor (SEPUP) was introduced in

1986 and Nehru rozgar yojana (NRY) was introduced in 1989. SEPUP was the first urban poverty reduction programme with emphasis on employment. It was a stand alone, one-dose small credit intervention programme. NRY was a more comprehensive employment programme with increased number of interventions like widening the employment base for the skilled as well as unskilled workers including women, through promotion of micro-enterprises. Thereafter, other poverty alleviation programmes were also introduced.

Government Policies towards management of the huge quantum of waste generated:

At the national policy level, the Ministry of Environment and Forests has legislated the Municipal Waste Management and Handling Rules, 2000. It gives details of the practices that are to be followed by the municipalities for managing urban waste. Though the rules recommend recycling they do not say how to follow it or give any direction towards promoting recycling. Indirectly waste to energy technologies are encouraged through the formulation of technology standards.

Municipal solid waste (MSW) includes waste from households, non-hazardous solid waste from industrial, commercial and institutional establishments (excluding bio-medical waste) market waste, yard waste, agricultural wastes and street sweepings. Industrial and community hazardous waste and infectious waste, is not considered as MSW and should be collected and processed separately. MSW (Management and Handling) Rules 2000 defines MSW as "commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes".

1. Understanding the current waste management practices
2. Identifying waste management needs
3. Setting priorities for actions required
4. Identifying budget needs
5. Coordinating with different stakeholders
6. Measuring progress in terms of targets achieved
7. Modifying priorities as the plan develops
8. Communicating and coordinating with the external agencies/local agencies to achieve the targets

MSW a growing challenge

Over the next two decades, growing urbanization in India will result in a massive increase of waste. By the year 2021, the urban population is expected to represent 41% of the overall population. A study conducted by the CPCB on management of MSW in the country estimates that waste generation from the present 20 million tonnes per year is expected to increase to 40 MT per year. The estimated requirement of land for disposal would be 100 square kilometres.

- India produces 48.0 MT of MSW annually at present.
- Urban population increasing between 3 – 3.5 % per annum.
- Per capita waste generation in India is increasing by 1.3 % per annum.
- Yearly increase of waste generation in India is around 5%.

To tackle the waste generated in urban areas, the urban local bodies are investing around 35 -50 % of its available funds, spending about Rs. 500-1500 per ton on solid waste management. Hence there is an urgent need to increase efficiency for better service delivery and optimization.

Land disposal of solid wastes has been practiced for centuries. Municipal, industrial, agricultural and urban activities produce huge amounts of wastes, which require safe and permanent secured disposal. In view of growing challenge of solid waste management in the country, the Central Government has incorporated solid waste management as one of the components in the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) programme, initiated by the Central Government for extending financial resources. Many cities are getting benefit from this massive programme.

waste material	price for dealers / kg
I-PLASTIC	
1) Pet bottles (coke, mineral water bottles etc.)	2
2) plastic thread, fibres, rope, chair cane	6-7
3) milk packets	3
4) hard plastic like shampoo bottles, caps, plastic box, 5) etc.	7
6) plastic cups and glasses,	8-10
II-PAPER	
1) white paper used in 2) offices/press cutting	3
3) mixed shredded paper 4) mixed paper	5
5) cartons and brown packing 6) papers	4
7) fresh news paper 8) carton sheets	10
9) aluminium	50
10) beer and cold drink cans	5
11) deodorants, perfume bottles	20
1) aluminium foil	50
2) electrical wires	20
III-OTHER METALS	
1) steel utensils	40
2) copper wires	60
IV-GLASS	
1) broken glass	2
2) bottles (beer)	5

Suggestions for Requirements for common MSW management facilities

In order to regulate the waste from different sources of waste generation in the municipality, CPCB has notified Municipal Solid Waste Management & Handling Rules, 2000 which are applicable to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid. Corresponding schedules in the rules.

The Rule contains 3 Schedules:

1. Schedule-I: Specifications relating to collection, segregation, storage, transportation, processing and disposal of MSW.

2. Schedule-II: Specifications for land filling indicating; site selection, facilities at the site, specifications for land filling, Pollution prevention, water quality monitoring, ambient air quality monitoring, Plantation at landfill site, closure of landfill site and post care.

3. Schedule-III: Waste processing options including; standards for composting, treated leachates and incinerations.

Physical and Chemical Properties of High Quality Compost Property Values

Physical Properties

1. Density 500-800 g/L
2. Water content 30-45%
3. Granulation size fine grained 4-12m, coarse grained 12-40 mm
4. Low content of foreign substances and stones
5. Foreign substances < 0.5% stones < 5%

Chemical Properties Content should be within the following values in percentage wise

1. N: 0.5 to 1.8
2. P2O5: 0.4 to 1.0
3. K2O: 0.6 to 1.8
4. MgO: 0.7 to 3.0
5. CaO: 3.0 to 12.0
6. Salinity 1.0-8.0 g kCl/L
7. pH 7 – 8
8. Matured compost - 20% organic matter
9. Raw compost - >40% organic matter
10. Low content of heavy metals Lead: 50 to 100
11. Cadmium: 0.1 to 1.0
12. Chrome: 26 to 60
13. Copper: 30 to 50
14. Nickel: 10 to 30

The alternative treatment and disposal technologies are:

1. Recycle/Reuse
2. Landfills(sanitary Landfill / Bioreactor landfill / Secured landfill)
3. Composting
4. Anaerobic digestion / Bio-methanation
5. Community health impacts
6. Incineration

Other policy documents include:

- Manual on Municipal Solid Waste Management, prepared by an expert committee constituted by Ministry of Urban Development, GOI, January 2000.
- Recycled Plastics Manufacture and Usage Rules, Ministry of Environment and Forests (MOEF), GOI, September 1999.
- Solid Waste Management in Class I Cities in India. Committee constituted by Honourable Supreme Court of India and headed by Mr. Asim Burman, Municipal Commissioner, Calcutta Municipal Corporation, March 1999.
- National Plastic waste Management Task Force. Committee constituted by MOEF, GOI, August 1997.

Chemical Characteristics:

Knowledge of chemical characteristics of waste is essential in understanding the behaviour of waste all through the waste management system and also in selecting and determining the efficiency of any treatment process. Further, the characteristics of leachate that could potentially contaminate the surrounding water resources depend on the waste characteristics. Chemical characteristics include (i) chemical; (ii) toxic characteristics.

1) Chemical characteristics include pH, Nitrogen, Phosphorus and Potassium (N-P-K), total Carbon, C/N ratio, etc.
2) Toxicity characteristics include heavy metals, pesticides, insecticides, Toxicity test for leachates etc. Knowledge of chemical characteristics is essential in waste processing and disposal facilities.

Processing waste:

Waste handling, sorting, and processing at the source

The second functional element in the solid waste management system is waste handling, sorting, storage, and processing at the source. Waste handling and sorting involves the activities associated with management of wastes until they are placed in storage containers for collection. Handling also encompasses the movement of loaded containers to the point of collection. Sorting of waste components is an important step in the handling and storage of solid waste at the source. For example, the best place to separate waste materials for reuse and recycling is at the source of generation. Households are becoming more aware of the importance of separating newspaper and cardboard, bottles/glass, kitchen wastes and ferrous and non-ferrous materials. On-site storage is of primary importance because of public health concerns and aesthetic consideration.

The sorting, processing and transformation of solid waste materials is the fourth functional element. The recovery of sorted materials, processing of solid waste and transformation of solid waste that occurs primarily in locations away from the source of waste generation are encompassed by this functional element. At present, sorting of mixed wastes usually occur at a materials recovery facility, transfer stations, combustion facilities, and disposal sites. Sorting often includes the separation of bulky items, separation of waste components by size using screens, manual separation of waste components, and separation of ferrous & non-ferrous metals. Waste transformation is undertaken to reduce the volume, weight, size or toxicity of waste without resource recovery.

3.7 Disposal:

The final functional element in the solid waste management system is disposal. The disposal of wastes by land filling or uncontrolled dumping of mixed wastes is the ultimate activity of solid waste management, whether they are residential wastes collected and transported directly to a landfill site, residual materials from materials recovery facilities, rejects of composting, or other substances from various solid waste-processing facilities. Currently in a large number in areas of cities do not have any processing facilities and the municipalities tend to haphazard dumping of wastes all over the dumpsites.

Landfill

Landfills are vital components of any well-designed MSW management system. They are ultimate repositories of a city's MSW after all other MSW management options have been exercised. In many cases, landfill is the only MSW management option available after the MSW is collected. The safe and effective operation of landfills depends on sound planning, administration, and management of the entire MSW management system as per the Municipal Solid Waste (Management & Handling) Rules, strict measures have been imposed to discourage unscientific land filling/dumping, as these pose problems of

a. Pollution in surface run-off during rainfall and leachate discharges to surface water Channels
b. Pollution of soil/groundwater/downstream aquifers
c. Unhygienic/unsanitary condition in surrounding area.

Major Constituents

1. Methane 30 to 60 %
2. Carbon Dioxide 34 to 60 %
3. Nitrogen 1 to 21 %
4. Oxygen 0.1 to 2 %
5. Hydrogen Sulphide 0 to 1 %

Composting

In vermi-composting, the aerobic decomposition of organic matter is by using microorganisms. It is the use of selected species of earthworms to help decompose and transform organic wastes into useful compost. In this method, earthworms play important role in fragmenting, mixing and aerating the waste. There are various methods of vermin composting, making it impossible to present a definitive guide to best practice. Vermi-composting is carried out at relatively low temperatures under 25°C, compared with composting, where pile temperatures can exceed 70°C. With vermi-composting it is vitally important to keep low temperature; otherwise the earthworms will be killed. It is the joint action between earthworms and the aerobic microorganisms that thrive in these lower temperatures that breaks down the waste. Hence it is common with vermi-composting systems to apply waste frequently in thin layers, a few centimetres thick, to beds or boxes containing earthworms in order to prevent overheating and to help keep the waste aerobic. It is difficult to directly compare composting with vermin-composting in terms of the time taken to produce stable and mature compost products.

Breeding of flies, insets and rodents:

Birds are attracted to landfill sites in large numbers, particularly where sites receive appreciable amounts of food wastes. Usually only large birds such as eagles, gulls, etc. are regarded as a nuisance. Bird control techniques should be carefully planned taking into account the species likely to be affected. Measures which can be used to mitigate bird nuisance include the employment of good landfill practice, working in small active areas and progressive prompt covering of waste, together with the use of bird scaring techniques. Measures involving explosions or distress calls have inherent adverse environmental impacts in terms of noise. These birds also create problems to aircraft travel.

Leachate

Leachate and runoff from waste storage and processing areas may contain organic material, phenols, nitrates, phosphorous, dissolved metals and other contaminants. Therefore, leachate if not collected and treated can contaminate soil, ground and surface water because of the following reasons:

a) Impact on underground soil
b) Ground water pollution through lechate migration from unlined landfill
c) Presence of heavy metals in leachate
d) Presence of toxic substances in ground water
e) Leachate effect in underground water at surrounding area and becomes unpotable
f) Harmful substances in near ground water
g) Ammonia and nitrogen fluctuation in soil.

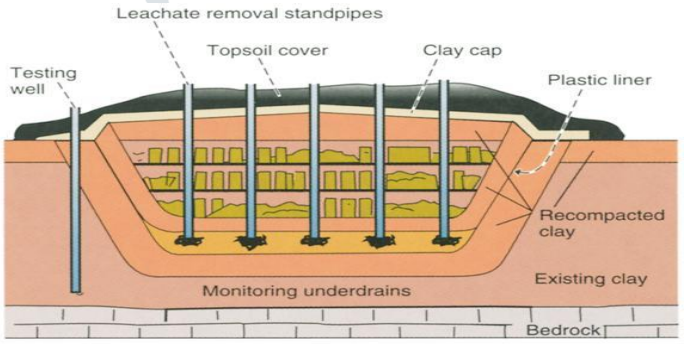

Figure 3.35. A secure landfill for toxic waste. Contents are enclosed by a thick plastic liner and two or more layers of impervious compacted clay. A gravel bed between the clay layers collects any leachate, which can then be pumped out and treated.

Methane and carbon-dioxide gas emissions

MSW contains significant portions of organic materials that produce a variety of gaseous products when dumped, compacted, and covered in landfills. Anaerobic bacteria thrive in the oxygen-free environment, resulting in the decomposition of the organic materials and the production of primarily carbon dioxide and methane. Methane is likely to release out of the landfill. Landfill gas facilities capture the methane and combust it for energy. Source separation and recycling drastically reduces the generation of these gases. CO2 & CH4 are the two major green house gasses causing global warming. CO2 and methane together are 81% of GHGs. Methane is 21 times more potent than CO2 and therefore reduction of both gases is required.

Community health impacts

1. Occupational and health hazards amongst MSW workers
2. Potential to create health hazards through disposal facilities
3. Impact on human health because of biogas, leachate, contaminated runoff or hazardous waste decomposition product
4. Impact of odour and mosquito on human health through uncontrolled dumping
5. Acute and genetic toxicity of landfill leachate
6. Impact on biological entities such as animals, birds and pathogens
7. Health impacts due to burning of solid waste which may result in breathing problems, burning of eyes, etc
8. Uncollected garbage and litter spread beyond the waste management facility

Waste transportation Study area Karimnagar

As per Overview and Challenges of Improving the Management of Solid Waste in Karimnagar the transportation costs of wastes range from Rs. 300 to 400 per ton and may vary from place to place depending on the following factors. Measures, which could be followed for collection of segregated waste include:

- Collection of segregated waste Bells or horns by the tricycle staff with public participation by time
- Improving the quality of life of rag pickers from segregating waste at source
- Proper use of community bins
- Waste collection through tricycles, motorized vehicles
- Collection of recyclable waste by rag pickers from shops and establishments soon as they open
- Collection of vegetable, fruit, meat, fish wastes from the markets on a daily basis
- Collection of hotel and restaurant waste on a full cost recovery basis by local bodies if desired.
- Collection of garden waste on weekly basis.
- Collection of waste from marriage halls, community halls & commercial centers oncost recovery basis.
- Collection of construction and demolition waste on rate per ton basis as prescribed by the local bodies.
- Dairy and cattle shed waste is collected daily and sent to specified municipal storage containers nearby

The Environment (Protection) Rules, 1986 - SCHEDULE VI
General Standards for discharge of environment pollutants
(Part - A : Effluents)

S.N.	Parameter	Inland Surface Water	Public Sewers	Land for Irrigation	Marine Coastal Areas
1.	Colour and Odour	Nil	Nil	Nil	Nil
2.	Suspended Solids mg/L, Max.	100	600	200	100
3.	Particle size of suspended solids	< 850 micron	-	-	-
4.	pH value	5.5-9.0	5.5-9.0	5.5 - 9.0	5.5-9.0
5.	Temperature	< 5 °C increase	-	-	< 5 °C increase
6.	Oil and Grease mg/L	10	20	10	20
7.	Total residual Chloroine mg/L	1.0	-	-	1.0
8.	Ammonical N (as N), mg/L	50	50	-	50
9.	Total Kjeldahl Nitrogen (as NH_3) mg/L	100	-	-	100

Conclusion and Recommendations:

Management of municipal solid waste in the city is far from satisfactory. There are problems in the solid waste management practices prevailing in the city at every level, i.e., collection, transportation, processing and disposal. Mismanagement of solid waste is a matter of serious concern for public health and environment. In MCK zones there is no clear cut standard for the placement of waste receptacles. Present design and location of waste receptacles is not accepted by the people. The distribution of safai walas and transportation vehicles in MCK zones is uneven. Presently, all three landfill sites are fully packed and overflowing. Government must encourage composting, vermin - composting, incineration, refused derived fuel etc. processing and treatment methods for reducing the solid waste disposal problems because the processing of the waste is only the answer of municipal solid waste.

- Open waste storage sites and other unhygienic street bins should not be allowed
- The placement of waste receptacles should be correct.
- Segregation of household waste at the source would reduce the burden of solid waste significantly while at the same time improve the supply of composite serving the nutrient poor farmer.
- Government should adopt 4R's (Reduce, Reuse, Recycle and Resource Recovery) principle.
- Government should increase the number of composting and energy generation plant.
- Public awareness programmes should be arranged by the government regularly.

Dual role of collection of both recyclable and biodegradable waste:

A possibility of the services provided by the waste pickers may be explored by engaging them in the collection of the biodegradable component of municipal waste as well. They can then play an active role in facilitating decentralized composting in specific urban pockets. Such an approach will not only ease the burden of municipalities but also legitimize their work providing them with social and economic security.

Encouraging recycling:

Recently, waste to energy technology propagated by private industries is slowly gaining a foothold as a method to manage increasing urban waste. This will replace traditional systems of waste management based on reuse and recycle and threaten the livelihood of waste pickers. The waste to energy policy with the objective of promoting waste solely as an energy source, supported by the Ministry of Non Conventional Energy Sources (MNES) needs to be reviewed. There is a need to encourage recycling as a viable option of waste management through subsidies on recycled products. This will in turn safeguard the livelihood of the various stakeholders involved in the waste trade, most importantly the waste pickers.

Setting up of co-operatives:

Presently though waste pickers contribute substantially towards recovery of recyclable materials they work and live under extremely unhygienic conditions. It is essential to improve their living and working conditions. The waste pickers could be organized to set up cooperatives with the help of NGOs. The waste pickers could then collect waste directly from households instead of foraging in garbage dumps. This will reduce the occupational health hazards.

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