

SYSTEMS APPROACHES TO INTEGRATED SOLID WASTE MANAGEMENT IN MYSURU CITY

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Abstract : *Integrated solid waste management (ISWM) in its simplest sense incorporates the waste management hierarchy by considering direct impacts (transportation, collection, treatment and disposal of waste) and indirect impacts (use of waste materials and energy outside the waste management system).*

The solid waste management in Mysuru city appears to be inadequate and needs up gradation. Solid waste has to be disposed off scientifically through sanitary landfill and recyclable portion of the waste should be salvaged. More emphasis needs to be laid on segregation and collection of waste at door step. Segregation of recyclable material from mixed waste not only is tedious but also wasteful, therefore the residents should be sensitized towards the importance of segregation of wastes at source.

IndexTerms - *Integrated solid waste management, GIS/GPS, Sanitary landfill.*

I. INTRODUCTION

MSWM is a challenging problem for the developing countries like India where the trend of urbanization is very high. In India, the municipal bodies render the solid waste management services. Though it is an essential service, it is not attaining proper priority, which it deserves and services are poor. This has caused many problems in urban environment as well as to the public health in most of the Indian cities and towns. Increasing population levels, booming economy, rapid urbanization and the rise in community living standards have greatly accelerated the municipal solid waste generation rate in developing countries. Municipalities, usually responsible for waste management in the cities, have the challenge to provide an effective and efficient system to the inhabitants.

Municipal solid waste (MSW) is one of the major areas of concern all over the world. In developing country like India, there is rapid increase in municipal solid waste due to urbanization and population growth. Composition of waste varies with different factors like living standard, climatic condition, socio-economic factor etc. Solid waste management is a challenge for the cities' authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning.

II. Solid Waste Management in Mysuru city

Mysuru is the third-largest city in the state of Karnataka, India. Located at the base of the Chamundi Hills about 146 km south west of the state capital Bangalore, it is spread across an area of 128.42 km². According to the provisional results of the 2011 national census of India, the population of Mysuru is 887,446. The total population of Urban Agglomeration(U/A) is 9, 83, 893. It is the Second biggest U/A in terms of Population. Mysuru City Corporation (MCC) is responsible for the civic administration of the city, which is also the headquarters of the Mysuru district and the Mysuru division. The city profile of Mysuru is given in Table 1

Table1: The city profile of Mysuru city

FEATURES	STATUS
Population(2011 census)	915212
Households	195472
No. of slums	81 Nos. (both notified and identified)
No. of municipal corporation wards	65
Area within corporation limits	128.42 Sq.Km
Height above MSL	770 m
Annual rainfall	798.2mm
Total waste generated (existing)	402 MT/day
Length of all roads and streets	1773 Km
Length of open drains	2989.36 m

Waste is collected from houses daily. However, nothing is done specifically for the plastic waste management in Mysuru. Mixed waste is collected and is simply dumped in the landfills. Thus it is realized that there is a need to take up a sustainable municipal solid waste management plan in Mysuru city. Efforts should be made for the segregation and suitable processing and disposal and the possibilities of energy recovery from waste should also be explored. Recognizing the potential of greenhouse gas generation from sanitary landfills, it may be worthwhile to segregate the inert materials for dumping and plastic waste for recycling while planning energy recovery from biodegradable waste through the application of anaerobic treatment systems. It is observed that, now few organisations, schools, and colleges

are trying to spread the awareness about waste segregation by keeping dustbin of two colours one for dry waste and another one for wet waste.

MCC is responsible for the management of solid waste generated in the city. The city administration has been decentralized in 8 zones. There are in all 65 wards in the city. The chief Health Officer is the overall in charge of solid waste management in the city. According to MCC, around 259.14 TPD solid waste is generated every day.

Current MSW management structure in Mysuru city

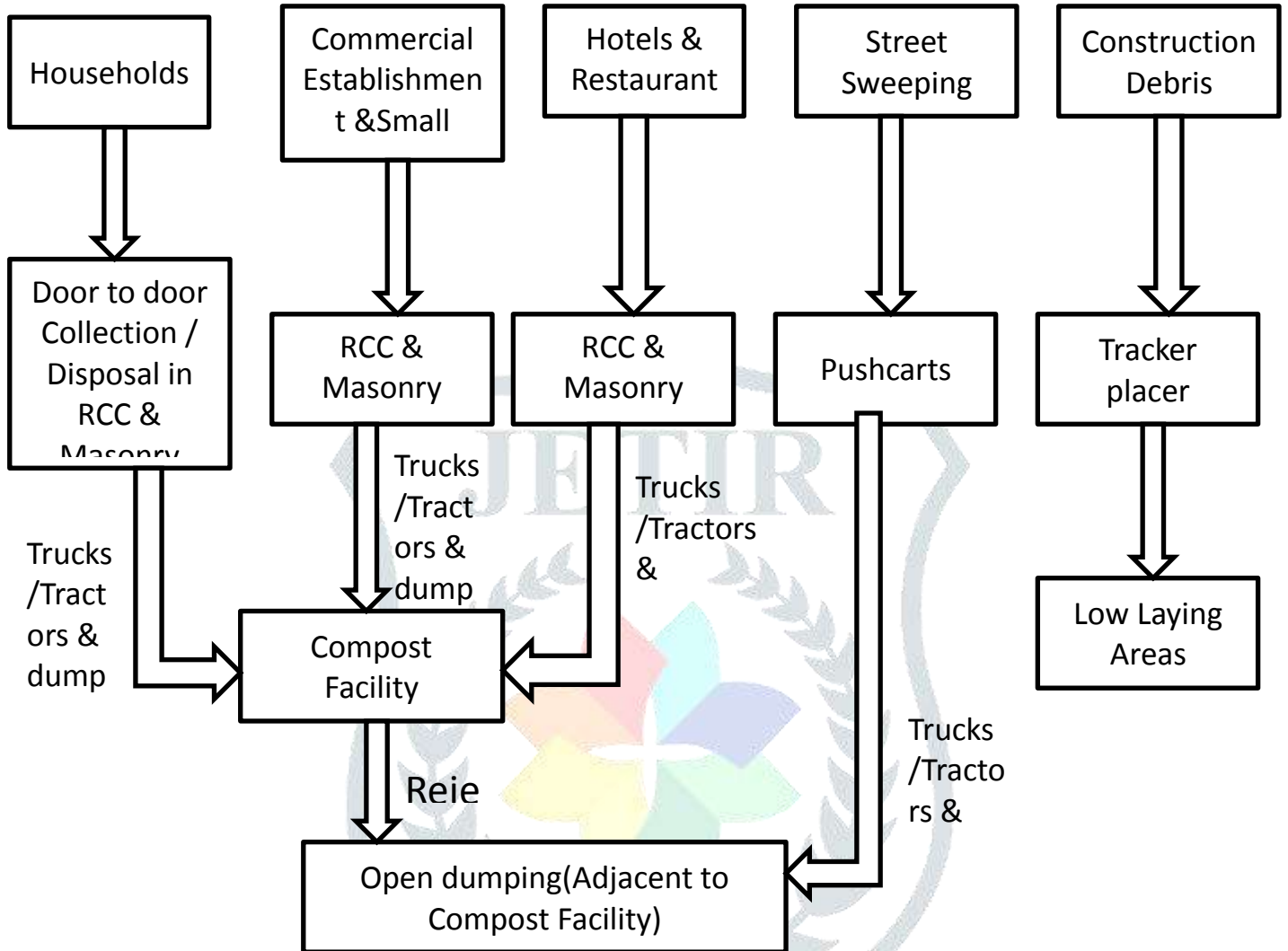


Table 2: Solid Waste categories based on sources

Sources	Typical facilities, activities, or locations where wastes are generated	Types of Solid waste
Agricultural	Filed and row crops, orchards, vineyards, diaries, feedlots, farms, etc.,	Spoiled food wastes, agricultural wastes, rubbish and hazardous wastes
Industrial	Construction, fabrication, light and heavy manufacturing refineries, chemical plants, power plants, demolition, etc	Industrial process wastes, scrap materials, etc; nonindustrial waste including food waste, rubbish, ashes, demolition and construction wastes, special wastes, and hazardous waste
Commercial and Institutional	Stores, restaurants, markets, office buildings, hotels, auto repair shops	Paper, cardboard, plastics, wood, food wastes, glass, metal wastes, ashes, special wastes, etc.
Municipal solid waste	Includes residential, commercial and institutions	Special waste, rubbish, general waste paper, plastic metals, food wastes.

Table 3: Quantity of MSW Generated in Mysuru city

SN	Generator	Number	Unit generation per day	Estimated quantity (MT)
1	Population*	9,38,386	360 g/capita/day	338
2	Commercial Establishments	20,329	1.0 kg/unit	20
3	Hotels and Restaurants	413	50 kg/unit	21
4	Marriage and Function halls	124	50 kg/unit	6
5	Street Sweeping			17
Total MSW generated per day in MT (*includes areas covered beyond MCC limits)				402

In Mysuru, 402 tonnes of waste is generated per day, which is managed by sending it to five different places which are as follows:

- a. 200 tonnes of waste per day is sent to centralised compost plant by mechanical methods. Here, the waste is decomposed aerobically by windrows compost.
- b. 25 tonnes of waste is sent to 5 Zero Waste Management (ZWM) plants manually. These ZWM plants are located in five different zones (zone 1, 2, 3, 5, 6) each having a capacity of 5 tonnes. Here also, aerobic composting takes place.
- c. About 5 tonnes of waste, which is fresh market waste is sent to Pinjrapole Society where the waste is handled to feed the stray cattle's.
- d. Nearly 2 tonnes of animal waste is collected from butcher shops and slaughter houses. This kind of waste is buried deep in the ground.
- e. The rest of the waste is simply stored in containers and is lately sent to the capping areas.

Street sweeping activity in the city is carried out by the PKs. The street sweepings and the silt collected from the road side drains are temporarily stored in small heaps on the road sides or are collected in the bins and transferred to tractor placers for disposal. The estimated road length in

Mysuru is 1764.53 km, which has been classified into three categories depending upon the frequency of sweeping. The same is set out in the table below.

Table 4: Road classification

SN	Classification of Roads	Road length(Km)
1	Type A(sweeping on a daily basis)	684.68
2	Type B(sweeping twice a week)	610.95
3	Type C(sweeping once a week)	468.90
	Total Road length	1764.53

2.1 Waste Collection Scheme in the City

The municipal solid waste collection in the city includes door to door collection, street sweeping activity and secondary collection and transportation.

2.1.1 Primary Collection (Door to Door Collection of Solid Waste)

This scheme is implemented in all 65 wards of the city. Out of all the 65 wards, 62 wards are handled by contract labourers, while the other 3 wards are handled by federation of Mysuru City Wards Parliament. There are 240 auto tippers and 396 pushcarts deployed for the collection of waste. Chicken and mutton market waste are being collected separately by 5 auto tippers and 1 canter.

2.1.2 Street Sweeping Activity

In Mysuru city, 17 wards are handled by MCC permanent Pourakarmikas, 1 ward by federation of Mysuru City Wards Parliament (W-28), and 47 wards are handled by contract labourers. The cleaning of streets and drains takes place during day time while the truck mounted street sweeping machine is used for night sweeping of main roads.

2.1.3 Secondary Collection and Transportation

For the collection of waste from 65 municipal corporation wards, 255 numbers of single compartment containers and 130 numbers of 4 compartments 4.5 cum containers are placed in all the wards. For the collection of bulk waste from markets/choultry/hotels etc., 66 numbers of 4.5 cum Skip Containers are placed in all 65 wards. For the transportation of secondary collected wastes, 20 numbers of Dumper Placers and 2 numbers of Compactors are used. For the transportation of street sweeping waste and silt, 55 numbers of Tipper Lorries are used by MCC. All SWM vehicles in MCC are monitored through GPS system.

2.2 Treatment and Disposal of Solid Waste

A 200-250 tonnes capacity compost plant is located near Vidyaranyaapuram. This was established in 2001 under ADB project and is out-sourced to M/s IL and FS Company for Operation and Management on PPP basis. Lease rent and royalty of Rs.61 lakh/annum to MCC was paid. 30-35 metric tonnes of manure is produced per day from this compost plant, out of which 5% of manure and 20% of carbon is credited to MCC. Deploying auto tippers collects 5 tons per day (TPD) of Non vegetarian and slaughter waste separately which is disposed by deep burial in Kesare. This is a chain link process, which is monitored through GPS. 5 TPD of Market fresh vegetables, fruits waste is generated in the city, which is transported to Pinjrapole. Society for feeding stray cattles. Bulk waste generators such as hotels, hostels, choultries etc. generate 2 TPD of kitchen waste. This waste is being used to feed the biogas plant which is located in Mysuru zoo. About 20 TPD of waste is being handled in 4 Zero waste management plants, which are located in 4 zones of MCC. The remaining waste is dumped in the capping area where bio-culture is sprayed on day to day basis.

III. INTEGRATED SOLID WASTE MANAGEMENT

Integrated solid waste management refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency. The SWM initiative was carried out in an integrated manner combining all the important aspects coherently viz., banning of the use of polyethene bags, door to door collection covering all the areas, effective transportation, processing of solid wastes, composting, bio-gas production and clean and green program.

3.1 ISWM Plan

An ISWM Plan consisting of a Management System including: Policies (regulatory, fiscal, etc.), Technologies (basic equipment and operational aspects) Voluntary measures (awareness raising, self regulations)

- A Management System covers all aspects of waste management; from waste generation through collection, transfer, transportation, sorting, treatment and disposal.
- Data and information on waste characterization and quantification (including future trends), and assessment of current solid waste management system for operational stages provide the basis for developing a concrete and locality-specific management system.

3.2 Focus of the ISWM Scheme

1. Segregation of wastes at source especially the household wastes through active participation of community and in separate containers and regular collection of wastes by using separate fuel efficient vehicles according to nature of the wastes. Use of compactor makes the collection drive more efficient and cost effective.

2. Improve community bins, storage containers for the storage of biodegradable and wet wastes and containers should be placed scientifically using GIS and GPS.
3. Adequate training to all the levels of staff engaged in solid waste management to handle respective functional aspects like collection, generation, storage, segregation of waste etc. and medical check-ups for municipal workers and rag pickers should be mandatory at regular interval.
4. Establishment of some transfer station for smooth operation of the SWM system at some suitable locations.
5. Composting should be done with the help of technological experts and to handle the bulk of waste generated every day sanitary landfill site have to be set up to dispose off the rejects after composting.
6. Promotion of public participation in the SWM scheme and constitution of citizen forum in each municipal ward involving local people.
7. Developing public –private partnerships leading to privatization of some aspects of garbage collection, recovery and disposal.
8. To tackle various issues such as road sweeping, open dump, open burning, garbage collection, disposal etc. Regular monitoring is necessary.

3.4 Focus of the ISWM program includes the following:

- Assessment of present condition and organizational set up.
- Reduce, reuse and recycle solid waste to the greatest extent possible.
- Co-operate to the extent practicable in recycling programs conducted by the civilian community (on installations that do not have recycling programs).
- Pursue the use of joint or regional solid waste management programs and facilities with the government and non-government agencies.
- Financial support towards infrastructure and maintenance.
- Facilitating community participation in solid waste management activities intellectual input – research on design, materials, concept.
- Privatize solid waste management facilities or contract for waste disposal services, including recycling.
- Divert 40% of non-hazardous solid waste from incineration and landfills. By the end of next five years, greater than 40% diversion rate for non-hazardous solid waste, and integrated non-hazardous solid waste management programs that demonstrate an economic benefit (when compared with only landfill and incineration disposal).
- Complying with applicable regulations regarding solid waste management and recycling.
- Overall monitoring and co-ordination.

IV. CONCLUSION

Rapid population growth and unplanned urbanization led to the tremendous increase in the amounts of municipal solid waste in many cities and towns of the developing countries like India. Mismanagement of wastes not only causes serious environmental problems but also risks to public health. Therefore, there is a shift from the traditional solid waste management options to more integrated solid waste management approaches. However, the lack of planning, adequate resources, administrative inefficiency is posing a serious obstacle to implement the ISWM approach.

Waste management system in Mysuru is traditional and needs up gradation in the areas of storage, collection, transfer, processing and disposal. Financial hurdles and lack of co-ordination and co-operation between the concerned authority and the public has created bottlenecks in improving its efficiency. The potentiality of the community participation in the waste management system has to be given more and more emphasis for smooth management of the system along with the adoption of latest spatial analytical technologies such as GPS-GIS system. Major challenge with plastic waste management is that different types of plastic wastes are mixed, which is very difficult to separate. So, an environment friendly plastic waste management plan must also be implemented forth with. However, government initiative is always necessary to make the system successful.

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