"SOLID WASTE MANAGEMENT OF VADODARA CITY- FEASIBILITY STUDY"

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ABSTRACT

Increase in population levels, booming economy, rapid urbanization are major issues now a days. For most of the urban local bodies in India, solid waste is a major concern that has reached alarming proportion requiring management initiatives. Rise in living standards of people has also acerbated MSW in Vadodara. Improper treatment of solid waste affects the environment and threat of unhygienic condition in city. At some places lake of control systems and evaluation and improper management have created problems in city. It causes pollution of Land and pollutes ground water too. Moreover, there is need of transportation facilities for conveying in from source to the site of disposal. Besides this, there is non-availability of land for dumping and its breath taking cost. These studies introduce an efficient solid waste management system complying with MSW rules and create the necessary infrastructure for same. Thus, these arises a need to reduced, recycle, reuse MSW with composting, safe sanitary land filling and other effective methods is needed and treating bio-medical waste with incineration and should be treated and disposal safely and making system management, technology and financing for better tomorrow.

Keyword: - *Urbanization, Solid waste, Environment, Pollution, Recycle, Reuse*

1. INTRODUCTION

Solid waste (refuse) - anything solid which is rejected or left out as worthless, unwanted or useless solid material generated from combined residential & commercial activities. E.g.:-garbage, rubbish, ashes, tins etc. it may be organic (putrescible) or non –putrescible.

The global pollution due to solid waste is increasing and the changes made in environment are irrecoverable so three is necessity for proper disposal of solid waste with a minimum risk to mankind and environment. This is fundamental to solid waste management. Future projection estimates that the world's waste production could reach up to 27 billion tonnes by 2050, a third of which may be generated in Asia.

Waste management is defined as the collecting, transporting managing, processing and Disposing of all waste streams. Recycling & reuse of solid waste production electrical energy and it can also protect environment.

Increase in population levels, booming economy, repaid urbanization are major issues now a days. For most of the urban local bodies in India, solid waste is a major concern that has reached alarming proportion requiring management initiatives. Rise in living standards of people has also acierated MSW in Vadodara.

Improper treatment of solid waste affects the environment and threat of unhygienic conditions in city. At some places lake of control system and evaluation and improper management have created problem in city. It causes pollution of land and pollutes ground water too. Moreover, there is need of transportation facilities for conveying solid waste from source to the site of disposal. Besides this, there is non-availability of land for dumping and its breath taking cost. This study introduces an efficient solid waste management system complying with MSW rules and creates the necessary infrastructure for same. Thus, there arises a need to reduced, recycle, reuse MSW with composting, secured sanitary land filling and other effective method if needed and treating bio- medical waste with incineration and should be disposed safety and making system better from waste generation to waste disposal with effective management, technology and financing for better tomorrow.

The survey reveals that there is lack of adequate number of sanitary landfills in Indian cities out of the 22 surveyed cities only (27.27%) 6 have sanitary landfills (Ahmedabad, Chandīgarh, Jamshedpur, Mangalore, Surat and

Vadodara). 10 out of 22 cities (45.45%) do not have sanitary landfills and the fact that large cities like greater Mumbai, Delhi and Kanpur are included in the list.

Health of urban inhabitants is threatened by hazardous chemical components in solid waste, particularly in illegally dumped waste. 20% of household wastes goes down the drain. Solid waste leads waste leads to many problems including contamination of surface and ground water. Thus, mitigation of these risky circumstances necessitates comprehensive actions. Hence to achieve improvements the capacity of solid waste management organization should be enhanced technically, financially, legally and institutionally.

1.1 PRINCIPLES

Municipal solid waste management involves the application of principle of integrated solid waste management (ISWM) to municipal waste. ISWM is the application of suitable techniques, technologies and management programs covering all types of solid wastes from all sources to achieve the twin objectives of waste reduction and effective management of waste still produced after waste reduction.

1. WASTE REDUCTION
2. EFFECTIVE MANAGEMENT OF SOLID WASTE

1.2 OBJECTIVES

1. To minimize the rate of waste generation through education and source reduction;
2. To encourage and facilitate the recovery, reuse and recycling of material within the waste stream;
3. To maintain, at a minimum, the MRA recycling mandate of 20%;
4. To provide for adequate facilities and programs to achieve these goals, for a ten-year planning period and beyond;
5. To operate a transfer capability in a optimizes the delivery of Carroll's MSW to other final disposal sites; and
6. To implement a county policy that considers land filling a "last resort" in the waste management hierarchy.

1.3 PROBLEMS

Solid waste management is a civic problem and it has to evolve optimally and continuously to serve the future generation solid waste if unchecked can not only be a health hazard but will in part multidimensional threats, which include serious detrimental, environmental, social, and economic impacts, SWM is developing countries is a complex issue as the types of wastes generated very widely became of varying localities with diverse population. The boundaries of the analysis of the "waste problem" are difficult to define. A complete and environmentally sound SWM requires effective contribution from all those who are involved in this problem. Everyone is part of the waste generation problem and everyone shall also be part of solution of proper management .i.e. solution depend upon collecting human action and efforts.

1.4 GOAL

A comprehensive, integrated system of solid waste management in Vadodara city Waste management authority service area that achieves the specify service, health and safety, financial, environmental and institution objectives for each member, yet balances these public values in a member that bring maximum benefit public service to the citizens of the service area as a whole.

1.5 SCOPE

The objectives of our review were to determine what progress the province has made towards a province-wide waste management system and whether the province has systems in place to monitor and regulate waste management activities.

1.6 LITERATURE SURVEY

(A). M.A ASHRAH ALI 2005

This study has analyzed the generation and characteristic of solid waste in Dhaka city, along with the associated environmental impacts and existing solid waste management practise. Special focus was given on the effect of composting on final disposal of solid waste and effect of landfill site location on transportation cost. An estimate of the future generation rate indicates that the present generation rate of 3500 tons/day may exceed 30 thousand ton/day by the year 2020. The mixed waste dumped at dumping sites is characterized with high organic content and high moisture content (about 80% by weight, respectively).according to required land filling areas, projected assuming 50% collection efficiency, on the year 2020, land requirement with composting of 40-80% of the organic waste

range from 167.11 acres/yr. to 96.975 acres/yr., while that without any composting stand at 206.31 acres/yr. with composting, the peak rate of greenhouse gas methane generation would be as low as half of that for without any composting. Result from study shows that the imminent selection of dumping sites away from the city centre due to unavailability of land and/or higher land price will induce three times as high daily waste transportation cost as compared to that at present.

(B). SHRUTHI BACHAMANDA 2007

The management of municipal solid waste has become an acute problem due to enhanced economic activities and rapid urbanization. Increased attention has given by the government in recent years to handle this problem in a safe and hygienic manner. In this regard, municipal solid waste management (MSWM) environmental audit has been carried out for Bangalore city through the collection of secondary data from government agencies, and interviews with stakeholders and field surveys. Field surveys were carried out in seven wards (representative sample of the city) to understand the practice and identify the lacunae.

2. FUNCTIONS & OVERVIEW

2.1 FUNCTIONS

The activities associated with the management of municipal solid wastes from the point of generation to final disposal can be grouped into the six function element:

(a)Waste generation
(b)Waste handling and sorting, storage, and processing at the source;
(c)Collection;
(d)Sorting, processing and transformation;
(e)Transfer and transport; and
(f)Disposal

2.2 DIFFERENT METHODS OF SMW AND OVERVIEW

1. COMPOSTING

This is the method where in refuse is mixed with sludge & night soil & allowed to undergo decomposition & stabilization by the action of bacteria. The organic matter gets decomposed into stable, non-injurious substances which are of economic value to the soil. The final product will be good manure.

2. VERMICOMPOSTING

Vermicomposting is a bio oxidation and stabilization process of organic matter that involves the joint action of earthworms and bio organic. The residual material can be uses as soil conditioner.

3. ANAROBIC DIGESTION/BIOMETHANNATION

Solid waste with a large content of organic matter is decomposed anaerobically under favorable condition to produce biogas consisting of mixture of methane and CO2.

4. INCINERATION

- Organic plastic waste and biomedical waste

Incineration is a process of controlled combustion for burning of waste and residue combustible material, CO2, waste vapors, ash and it is aerobic process.

5. PYROLYSIS/GASIFICATION

- Organic waste
- Solid waste is heated indirectly from external heat source and absence of oxygen to bring about an irreversible chemical change converting the waste into gas, liquid and inert chart that is aerobic process.

6. LANDFILLING

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 option has 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:

Pollution in surface run-off during rainfall and leachate discharges to surface water channels Pollution of soil/ground water/downstream aquifer.

- Unhygienic/unsanitary condition in surrounding area landfill can be of the following types:
- Sanitary landfill/bioreactor landfill/engineered sanitary landfill – mixed waste with landfill gas recovery, leachate collection system and storm water management system
- Secured MSW landfill-inert waste without landfill gas recovery
- Mon fills-only one kind of waste

Fig: 1 INSERT WASTE DUMPED AT LANDFILLING SITE

ISECURED LANDFILL

Secured landfill are designed to greatly reduce or eliminate the risks that waste disposal may pose to the public health and environmental quality. They are usually paced in areas where land features act as natural buffers between the landfill and the environmental. For example the area may be comprised of clay soil which is fairly impermeable due to its tightly packed particles, or the area may be characterized by a low water table and an absence of surface.

Fig: 2 LEACHATE COLLECTION PIPE & TANK

Fig: 3 EQUIPMENT FOR HANDLING

COMPOSTING PROCESS

By controlling some of the composting influencing factors, natural composting process could be accelerated. These influencing factors also have impact on quality of compost produced. Some of the important factors in the composting process are temperature, C/N ratio, phosphorous, sulphur, moisture, particle size, oxygen flow, etc.

Fig: 4 SOLID WASTE AT COMPOSTING SITE

PROCESS ADOPTED FOR TREATMENT OF MSW IN VADODA

The bundled project activity mechanically treats MSW generated in Vadodara in addition to producing RDF from the treated waste. In the base line scenario all the MSW generated in these cities were being dumped in open landfills unscientifically leading to GHG emissions.

The city of Vadodara generates approximately 650TDP of MSW daily. Prior to the project activity implementation by HBPEL, MSW was routinely dumped at the dumping ground in the area of Vadsar.

TECHNOLOGY EMPLOYED

Pre-processing of MSW is primarily intended to remove large debris and large objects of inert that are typical of littering culture in India. Processing of MSW into RDF involves a series of processes. The quantity of waste generated is approximately between 150 to 180 TDF and none of the cities have any facilities for processing the MSW into RDF other than at the project activity site. All five project activity sites are located near the landfill sites of the cities

Fig: 5 SOLID WASTE COLLECTION SYSTEM - PRIMARY AND SECONDARY

The solid waste lying on the MSW tipping will then be picked up by front end loaders or a fixed knuckles boom grab cranes and will be fed to automatic conveyer feeder which carries the waste to the metal and plastic separator for the removal of metals and plastic. After passing through the separator the waste will be fed to the primary segregation trammel where the waste movement occurs through rotary drums and the waste gets segregated into wet, dry, recyclables and inert. The inert material will be sent to landfill for safe disposal.

3. ACTUAL IMPLEMENTATION

3.1 PRESENT STATUS IN VADODARA

Present status:

- Quantity of M.S.W. generation: 750.00 M.T. per day.
- Collection and transportation : 730.00 M.T. per day

(a) Primary collection & its transportation:-

- Sweeping during day and night time.
- Container lifting.
- Door to door garbage collection vehicles with GPS system.
- Night scraping & brushing activity

(b) Secondary transportation:-

Waste transportation is being carried out with the help of dumper trucks, container lifting vehicles, refuse compactors and transportation vehicles. The collected waste is transported from the storage receptacles to the landfill site in dumper placer and closed dumper trucks. A dumper truck is fully covered with plastic/tarpaulin sheets during transportation. In view of the present city population and area, the total number of containers required for collection city waste should be around 650. Since VMC has commenced door-to-door waste collection, the collected waste is being transported directly to the compost pant/disposal site. The existing 261 containers are/would be sufficient for city waste storage.

(c) Disposal of M.S.W.:-

Vadodara Mahanagar sevasadan has also developed its second processing plant adjoining to the landfill cell phase I site of 300 MT/day (expandable up to 700 TPD) capacity based on integrated processing technology with the intention to minimize waste load on the landfill site and to increase the life span of the landfill site thereby. The work is allotted to M/S. Hanjer biotech energies Pvt. Ltd. on PPP basis. The integrated processing facility is consisting of composting of biodegradable matter, palletisation, recovery of recyclables such as metals, rubber, plastics etc. RDF and manufacturing of sand and eco bricks. Only 20% of the total incoming waste is going for the land filling by this technology. The processing plant is operationalized from febuary-2010. The tenure of the agreement is of 10 years which will expire in 2018. The capacity of plant is now expanded to 500 TDP.

3.2 METHODOLOGY

1. PRE-STUDY SCENARIO

In the pre-study scenario, municipal solid waste is collected from the municipal area/settlement and disposal in the existing solid waste disposal site (SWDS). While compaction and leveling is common to increase the life of SWDS, there are no measures for landfill gas capture/destruction. The open disposal of waste causes a number of environment and health hazards, in addition to unabated release of methane in to the atmosphere, which is one of the prominent greenhouse gases.

Thus, the business as usual practice in the absence of the project is disposal of waste without any measures to avoid methane emissions (also the baseline scenario).

2. CHARATERISTICS OF MUNCIPAL SOLID WASTES

It is estimated that solid waste generated in small, medium and large cities and towns is about 0.1 kg 0.3-0.4 kg and 0.5 kg per capita per day respectively.

Table-1 PHYSICAL CHARACTERISTIC OF SOLID WASTE

Sr. No	Types of water	Present by weight	Sr. No	Types of water	Present by weight
1	Vegetable leaves	40.15	5	Glass/ceramic	0.44
2	Grass	3.80	6	Metal	0.64
3	Paper	0.81	7	Stones/ashes	41.81
4	Plastic	0.62	8	Miscellaneous	11.73

The composition of municipal solid waste in India shows lower organic matter and high ash or dust content. It has been estimated that recyclable content in solid wastes varies from 13-25% and compostable material is about 80-85%. A typical composition of municipal solid waste is given in table-1.In order to assess the status of municipal solid waste in the Vadodara city. A detailed questionnaire was prepared and issued to Vadodara Municipal Corporation. Besides this, a visit has been made to various parts of the city and inspected the dustbins, dumping sites, parks and bank of the Vishwamitri River. The information on the questionnaire received on 18th February 2002 from the Vadodara municipal corporation with the following details. For collection system route optimization is on trial basis. Quantity will be updated in next report by VMC; rest data is more or less same. VMC is managing solid waste based on JNURM project guidelines.

3. LOCATION OF THE CITY

Vadodara city of the Gujarat having a total area of 108 sq.km is located at a latitude and longitude of 22°-17'-59 and 73o-15'-18 respectively. The total administrative wards under Municipal Corporation are 10 in numbers with total areas of 98.22 sq. k. meters. The total population of the city and municipal population is 13.23 laces. The minimum, maximum temperature of the city throughout the year varies from 10°C to 44.5°C with a minimum temperature of 27oC. Relative humidity of the city ranges from 45 to 90% and average relative humidity of the city ranges from 45 to 90% and average relative humility is 65%. The wind speed of the city throughout the year ranges from 6 m/sec to 40 m/sec.

4. MUNCIPAL SOLID WASTE

Total quantity of solid waste generated is approximately 750 MTP while the quantity of solid waste collected by Municipal Corporation is 400 MTP per capacity per day generation of municipal solid waste collected based on the total population from various sources viz. commercial markets, vegetable markets, slaughterhouse, residential area and miscellaneous are 20, 50, 10, 410 and 10 MT/day respectively.

5. CHARACERISTIC OF MUNCIPAL SOLID WASTE

The municipal solid waste contains 50% biodegradable organic matter, 10.25% recyclable solid waste, 8% inert solid waste, 12% unclassified foil derbies and 20% moisture content. In recyclable solid waste, paper and plastic are the main component.

6. COLLECTION SYSTEM FOR MUNICIPAL SOLID WASTE

Vadodara Municipal Corporation has 3380 numbers of dustbins/collection devices out of these only 3273 are under operation and rests are as standby within all the 10 wards.These include 150 cement RCC rings, 2500 wheelbarrows, 592 containers of 3.5 m3, 9 skipper and 22- dumper placer. The details installation of of dustbins/collection system ward wise is given in table-5.

7. MANPOWER ENGAGED IN THE COLLECTION OF MUNICIPAL SOLID WASTE

There are 3200 manpower engaged in the collected of municipal solid waste including 578 supervisory staff and 1108 stand by manpower in all the 10 wards. Ward wise number of trips taken for the collection of municipal solid waste from various wards is 198 while the total number of trips undertaken per day is approximately 225.

8. QUANTITY OF S.W TRANSPORTED FROM COLLECTION POINT TO THE DUMPING SITE (S)

Total quality of the solid waste transported from the collection point to the nearest dumping site is 500 MTP through container, 100 MTP through trucks and 100 MTP through FC (tempo) respectively. Quantity of the solid waste collected and disposal by the municipality is contradictory in itself.

9. STATUS OF DUMPING SITE

There are three dumping sites viz. vadsar dumping site having area of 7 areas and other two sites i.e. nileshnager and Gorwa-Laxmipura having area of 8 and 5 acres respectively. The Vadsar dumping site is under operation rest two are not under operation. The existing dumping site is not developed scientifically. Vadodara Corporation will develop new landfill site as per the provision of municipal solid waste management rules- 2000.

10. STATUS OF THE EQUPMENT AVAILABLE WITH MUNCIPAL CORPORATION

Municipal Corporation have 37 total equipment's available which include bulldozer, loaders, small loaders, skip container, excavators only 10 are under operation which rest may be out of order.

11. FREQUENCY OF LIFTING OF GARBAGE FROM DUSTBINS WASTE RECIPTANTS:

Municipal corporation use to lift garbage from dustbins on daily, alternate day and weekly depending on the quantity of solid waste generated from various wards.

12. STATUS OF TRANSPORTATION VEHICLES UNDER MUNCIPAL CORPORATION

They have 30 numbers of total vehicles available with the municipal corporation including 10-dumper tripper trucks 10 containers and 10 numbers of pickup vans. Which are under operation. The capacity of container, truck and FC (tempo) are 3 MT respectively.

TABLE-2 NUMBER OF TRIPS OF VEHICLES IN EACH WARD

Ward	No's of lifting Containers	No's of Small Depart Mental Dumper Trips	Tractor	Nos. of Big Depart Mental Dumper Trips	Total m.t lifting by VMSS (a)	Door to door & open spot m.t (contractors) (b)			Total (a+b) m.t
						D TO D	Open Spot	Total	
1	0	0	1	3	31.000	8.860	0.000	8.860	39.860
2	9	1	0	2	38.250	22.535	0.000	22.535	60.785
9	6	0	0	2	27.500	27.135	0.000	27.135	54.635
Total	**15**	**1**	**1**	**7**	**96.750**	**96.750**	**0.000**	**58.530**	**155.280**
3	6	0	1	2	28.500	25.900	0.000	25.900	54.400
4	8	0	2	1	22.000	34.815	0.000	34.815	56.815
12	3	1	2	0	12.750	36.230	0.000	36.230	48.980
Total	**17**	**1**	**5**	**3**	**63.250**	**96.945**	**0.000**	**96.945**	**160.195**
5	8	0	0	2	30.000	20.805	86.985	107.790	137.790
7	24	0	0	0	30.000	60.435	101.909	162.394	192.394
8	13	1	0	0	23.250	27.655	32.865	60.520	83.770
Total	**45**	**1**	**0**	**2**	**74.250**	**108.895**	**221.809**	**330.704**	**413.954**
6	6	0	0	0	7.500	62.390	71.700	134.090	141.590
10	13	0	0	0	16.250	51.515	49.335	100.850	117.100
11	3	0	0	0	3.750	58.820	66.535	125.355	129.105
Total	22	0	0	0	27.500	172.725	187.570	360.295	387.795
Grand Total	**99**	**3**	**6**	**12**	**261.750**	**437.095**	**409.379**	**846.474**	**1117.224**

13. RECYCLING OF WASTE

Methodology for safe recycling of solid waste segregated from the municipal solid waste has not been standardized. The main steps involved in process prior to recycling include collection of waste at doorsteps, commercial and from other placements, collection of solid waste from the community dumping or picking up of waste from final disposal sites. It has been seen that 7-15%of the waste can be recycled.

14. WEALTH FROM SOLID WASTE

Since municipal solid waste contains 45 to 50 % biodegradable organic matter keeping in view of private sector has taken initiative to use the garbage as profitable venture. Bio machination and sanitary landfill gas are two methods for the energy recovery .garbage has a potential to guarantee about 150-250 cubic meter biogas per tones waste depending upon the quality. Other options for the treatment of municipal solid waste are pellet ration paralysis/gasification, incineration and biological weather, which vermin composting. The municipal corporation works with mainly two objectives:

To strengthen effective & timely collection of garbage directly from the door step.
To improve the system of transportation of waste by ensuring "handling waste only once".

15. TREATMENT OF SOLID WASTE

The municipal solid waste should be segregated at source. This is very essential requirement for its treatment. After segregation, waste can be treated accordingly. A systematic flow diagram for the treatment of municipal solid waste is given below:

4. ANALYSIS OF CHEMICAL CHARACTERISTICS

4.1 LEACHATE ANALYSIS

Table-3 RESULT OF LEACHATE ANALYSIS

SrNo	Parameter	Typical Range	Upper Value
1	PH	6.5-8.5	-
2	Colour	-	-
3	Odour	Bad	Bad
4	TDS (ppm)	1000-2000	55000
5	Chloride (ppm)	47-2440	11375
6	Alkanet (mg/l)	730-15050	20850
7	Acidity(mg/l)	-	-

4.2 DAILY ANALYSIS MSW INERT WASTE PARAMERTER AND LIMITS

Table-4 WASTE PARAMENTER AND LIMITS

Sr. No	Parameter	MIN	MAX
1	PH	6.5	8.5
2	Calorific value	1400	2000
3	Specific gravity	0.60	0.85
4	% loss on ignition	15	40
5	% moisture	15	30

4.3 GROUND WATER ANALYSIS

Table-5 GROUND WATER PARAMENTER AND STANDARD VALUE

Sr. No	Parameter	Standard value
1	PH	6.5-8.5
2	Total suspended (mg/l)	2000
3	TDS(mg/l)	500-2000
4	Chloride (mg/l)	250-1000
5	Sulphate (mg/l)	200-400
6	Alkanity (mg/l)	200-600
7	Total hardness(caco3) (mg/l)	300-600

4.4 WEEKLY ANALYSIS REPORT ON INERT WASTE RECELVED AT VMC SITE

Sample source: inert waste from m/s hanjer bio &atladra comm.
Colour: black

Table-6 ANALYSIS REPORT ON INERT WASTE RECEIVED AT VMC SITE

Sr. No	Date	pH	Specific gravity	C.V (Cal/l)	LOL %	Moisture Content
1	1/3/2016	7.52	0.73	1641.58	16.88	15.49
2	2/3/2016	6.40	0.82	1478.91	15.21	19.74
3	3/3/2016	6.34	0.59	1466.95	15.08	20.18

4	4/3/2016	6.60	0.63	1807.11	16.58	14.77
5	5/3/2016	6.78	0.68	1377.13	18.50	18.75
6	6/3/2016	7.23	0.93	1264.08	14.71	16.65
7	7/3/2016	8.06	0.85	1734.33	13.47	23.51
8	8/3/2016	6.84	0.66	1668.29	18.46	15.46
9	9/3/2016	7.67	0.72	1620.38	16.87	14.75
10	10/3/2016	6.74	0.88	1440.64	15.96	19.68
11	11/3/2016	6.93	0.74	1565.39	15.91	20.60
12	12/3/2016	7.61	0.72	1864.87	16.64	18.63
13	13/3/2016	6.37	0.88	1791.60	17.66	17.57
14	14/3/2016	6.15	0.64	1672.68	17.20	16.51
15	15/3/2016	7.09	0.82	1238.38	18.51	15.14
16	16/3/2016	7.88	0.74	1761.76	16.68	14.79
17	17/3/2016	7.49	0.72	1882.73	12.19	24.08
18	18/3/2016	7.25	0.59	1439.48	13.69	21.10
19	19/3/2016	6.85	0.60	1587.68	18.36	13.35
20	20/3/2016	7.33	0.45	1235.95	19.54	11.41
21	21/3/2016	7.94	0.91	1680.54	16.99	15.10
22	22/3/2016	7.69	0.57	1693.02	15.75	15.82
23	23/3/2016	6.22	0.55	1544.42	12.10	24.14
24	24/3/2016	6.63	0.80	1672.01	17.52	14.33
25	25/3/2016	6.95	0.78	1410.94	14.86	15.36
26	26/3/2016	6.63	0.64	1227.08	17.18	14.26
27	27/3/2016	8.02	0.66	169.01	14.47	23.49
28	28/3/2016	7.15	0.70	224.93	20.01	13.17
29	29/3/2016	7.20	0.87	184.08	19.92	18.36
30	30/3/2016	7.38	0.72	361.43	19.00	15.51

4.5 OBSERVATIONS

During visit to various parts of the city and dumping site, some observations have been derived as under: there are three dumping sites, out of them only one dumping site located at Vadsar is under operation for dumping of municipal solid waste as open land fill site while other two dumping sites located at L&T circle nileshnager and Gorwa - laxmipura road are not being used for dumping of solid waste.

There is no segregation of the municipal solid waste at source

There are number of parks, un-cemented drains and roadsides in the city where unauthorized dumping has been noticed. Burning waste in the solid waste in the solid waste in and around the dust bins by the rag pickers leading to the deterioration of surrounding air environment with the highly toxic fumes coming out from burnt municipal solid waste particularly on account of plastic waste burning.

At Vadsar dumping sites located on the bank of Vishwamitri River, burning of mixed municipal solid waste has been observed. The fauna and flora near on the bank of Vishwamitri River has been detoriated to a great extent. The stretch of the river at Vadsar dumping site has approaching to ward chocking by the burnt and unburnt municipal solid waste in near future if the ate of dumping of garbage not stopped. The process of leachate percolation through land may also contaminate the quality of ground water at Vadsar near the dumping site.

Fig: 6 LANDFILLING SITE AT JAMBUA VADODARA

- Number of road has been visited where dumping of domestic waste along with municipal solid waste seen.
- During visit to jambua site operated by Hanjer biotech ltd. Is closed since l year and waste is not processed and directly dumped at landfill site. During monsoon the weight of MSW is increased due to presence of moisture content in it. The land filling site is closed prior to I month of monsoon due to inconvenience caused to dozers to dozers and dump trucks while dumping and leveling of waste on earth covers. One more financial issue is that, recycled products are not sale and no funds are raised.

5. CONCLUSIONS / SOLUTION

There arises a need to reduce, recycle and reuse MSW with different methods of solid waste management & disposal from waste generation point to waste disposal for safety and better tomorrow.

SOLUTION

1. Provide two major and one minor transfer stations for four zones
2. Respective wards have to dispose their solid waste at corresponding transfer stations& not approach directly to the final disposal site
3. Compactor type trucks (8-12mt) should be used to transfer solid waste from transfer station to land fill site.
4. The transfer of solid waste from transfer station should be preferably performed in the night shift to avoid traffic congestion in day time.
5. Proper vehicles must be allotted to that ward/zone to take away that solid waste
6. Door to door collection system should be effectively applied within wards only & not for direct disposal.

6. REFERENCES

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