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Current Status of Solid Waste Management of Shimla

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Abstract—*This paper here talks about the stringent enforcement of the Municipal Solid Waste Managementand Handling Rules, 2000 through systematic planning process and emphasizes the need to take holistic view of state toward municipal solid waste management. Shimla "Queen of Hills" is the capital of Himachal Pradesh which has been a big tourist attraction for a long time. The total waste generation being 93 MT/day of which 70-75 MT being the collection figure. The 27% of the actual population is the floating population which is big a issue for proper management. The collection process includes both primary and secondary methods for which minimal charges have been levied. The process of collection and transportation is managed by Municipal Corporation, Shimla. The part of processing and treatment is being handled by private operator. The fraction of biodegradable component is 80% which is used for composting and rest can be used as RDF and is sold to private players to generate revenue. To make the system more environment friendly the location of treatment plant was changed with increased capacity and efficiency.*

1. INTRODUCTION

Since the time unknown all the living beings (human beings, animals, birds etc.) are generating solid waste to make their lives easy. Since then till now municipal solid waste has grown as a major problem all over the world. Different countries have found different methods, mechanism and ways to dispose it or to reuse it so that any kind of hazards can be avoided and the pollution which can be cased by these wastes can be minimised. The best possible alternatives found so far have been to generate energy by different methods and utilize it in different ways or to recycle it for different purposes. In India also MSW is growing as a big problem which can become hazardous if proper steps are not taken in time. In the metropolitan cities and other major cities some steps have been taken for the collection of it and efforts have been made to put it through recycling and reuse. But the results are not very enthusiastic. Even now the disposal and the land filling are supposed to be the best possible alternatives to get rid of the solid waste. In smaller cities the situation is worse and the same thing holds truth for the hill stations. In the last few decades the problem of solid waste has grown many folds in these areas because of these places being tourist spots and migration population. According to a study done in the past it was found that the solid waste generation in India reached the level of 960 million tons annually in the year 2006 as by products during industrial, mining, municipal, agricultural and other processes. Of this quantity 350 million tons are organic waste from agricultural sources, 290 million tons are inorganic waste from industrial and mining sectors and 4.5 million tons are hazardous in nature. By the year 2047, MSW only will reach 300 million tons and the land requirement for its disposal 169.6 square kms as against 20.2 square kms which was occupied in 1997 for the management of 48 million tons. (Akolkar, 2005) Unfortunately open dumping areas are still observed in developing countries- where the waste is dumped in an uncontrolled manner, which can be detrimental to the environment. Large communities can afford to use a combustor for the volume reduction, but the smaller towns cannot afford the capital investment of such scale. This has to the use of sanitary landfills. The basic principal of land filling operation is to prepare a site with liners to deter the pollution of ground water, deposit the refuse in the pit, compact it with especially built heavy machinery with huge steel wheels, and cover the material with earth at the conclusion of each day's operation. The buried organic material decomposes anaerobically, producing various gases, such as methane, carbon dioxide and the liquids which have very high pollutional capacity when they enter the ground water. Modern landfill also requires the gases generated by the decomposition of the organic materials to be collected and either burned or vented to the atmosphere. Methane is said to be 21 times more potent than carbon dioxide in aggravating the problems related to global warming. It is estimated by TERI that in 1997 India released about 7 million tons of methane into the atmosphere. This quantity will rise to 39 million tons by 2047 if no efforts are made to either control it or recycle it to reduce the emission through various methods. (Asnani, 2000) The first system for collecting and using landfill gases placed into operation in California after a number of gas-extraction wells were driven around a deep land fill to prevent lateral migration of gas. These wells burned off 44 cubic meter/ min. of gas without need for auxiliary fuel. (Aarne Vesilind, 2002) In most environments, it is the final step in the decomposition of biomass. Biogas can be used to run a gas engine to produce electrical power, some or all of which can be used to run the sewage works. Some

waste heat from the engine is then used to heat the digester. The waste heat is, in general, enough to heat the digester to the required temperatures. The power potential from sewage works is limited in the UK, there are about 80 MW total of such generation, with the potential to increase to 150 MW, which is insignificant compared to the average power demand in the UK of about 35,000 MW. The scope for biogas generation from non sewage waste biological matter energy crops, food waste, abattoir waste, etc. is much higher, estimated to be capable of about 3,000 MW. Farm biogas plants using animal waste and energy crops are expected to contribute to reducing CO2 emissions.

The options and facts discussed above were kept in mind for the studies in the concerned area. Shimla district lies in the North-Western ranges of the Himalyas. It is located 31.6 degree N 77.10 degree E with an average altitude of 2397.59 meters (7866.10 ft) above mean sea level. The city is spread on a ridge and its seven spurs. The city stretches nearly 9.2km. from east to west. The highest point in Shimla at 2454 meters is the Jakhoo hill. Shimla is a Zone 4 (High Damage Risk Zone) per the Earthquake hazard zoning of India. Weak construction techniques and increasing population pose a serious threat to the already earthquake prone region. There are no bodies of water near the main city and the closest river Sutlej, is about 21 km. away. Other rivers that flow through the Shimla district, although further from the city are Giri,Pabbar(both are tributaries of Yamuna). The green belt in Shimla district planning area is spread over 414 hectares (1023 acres). The main forest in and around the district are that of Pine, Deodar,Oak and Rhododendron. The main aim of the study was to find the realistic idea of the waste being generated depending upon its physical characterization and to find the mechanisms and techniques by which its energy potential can be utilised efficiently and the area which was being used for the landfilling and dumping can be minimised. So the surveying and sampling was done from all over the place and the detailed analysis was carried out.

2. EXPERIMENTAL METHODOLOGY

2.1 Site Survey

A thorough survey was conducted to collect the information about the city and its waste management practices. The distribution of population, main sources of waste generation, main areas of waste generation were observed.

2.2 Data Collection and Sampling

2.2.1 Collection of primary data

- The data regarding waste produced per day was noted from the disposal site on daily basis over a period of 7 days.
- The sampling of the waste was done by collecting waste from the bins in the different wards and disposal site by using quartering technique.

2.2.2 Collection of secondary data

- The data regarding demographic features, population density, ward wise detailed information was collected in detail.

2.3 Testing and Analysis

2.3.1 Characterization

This process was done to segregate the samples in different physical components like plastic, polythene, foils, vegetables etc. in dry state and wet state.

2.3.2 Moisture Content

Moisture content was determined by weight loss of the sub-sample (105 degrees for 24 hours) using the gravimetric method (BIS, 1982).

2.3.3 Carbon Content

Carbon content was measured by the ignition method (550 degrees for 2 hours in muffle furnace). (BIS 1982)

2.3.4 pH and Electrical Conductivity

5 grams of sub-sample was mixed well in 50 ml distilled water and pH was measured using a pH meter with a glass electrode, previously calibrated and corrected for temperature (BIS, 1982). The above mixture was filtered by Whatman filter paper No.42 and EC was measured using a conductivity meter.

3. RESULTS AND DISCUSSION

The table below shows the variation of population in the city in coming years. (Table 1)

Table 1: Variation in Population in Shimla

Years	2011	2021	2031	2041
Resident Population (nos)	1,69, 758	2,56,883	3,49,361	4,18,296
Floating Population	76,000	1,00,000	1,25,000	1,50,000
Solid Waste Generation (MT)	86.01	124.91	166.03	198.90

The Table below shows the physical characteristics of the waste samples from the city. (Table 2)

Table 2: Physical Characteristics of MSW

S. No.	Component	Residential Zone		Commercial Zone		Mixed Zone	
		Weight	Percent	Weight	Percent	Weight	Percent
1	Metal	3	0.3	0.5	0.1	11	0.9
2	Glass	15	1.5	3.5	0.7	19	1.7
3	Food	435	42.6	96	18.8	295	26
4	Paper	162	15.9	167	32.8	205	18.1
5	Textile	56	5.5	16	3.1	78	6.8

6	Plastic	84	8.2	87	17.1	164	14.5
7	Rubber	9	0.9	14	2.7	55	4.8
8	Inert	84	8.2	31	6.1	129	11.4
9	Misc. Combustible	75	7.4	22	4.3	54	4.8
10	Misc. incombustible	97	9.5	73	14.3	125	11.0

The Table below shows the chemical characteristics of the waste samples from the city. (Table 3)

Table 3: Chemical Characteristics of MSW

S. No.	Component	Residential Zone	Commercial Zone	Mixed Zone
1	pH	6.48	6.84	6.23
2	Moisture (%)	58.2	40.7	52.5
3	Nitrogen(%)	.87	.68	.71
4	Phosphorus(%)	0.39	0.17	0.25
5	Potassium(%)	0.32	0.28	0.63
6	Total carbon(%)	35.48	25.04	36.96
7	C/N ratio	40.84	36.78	52.06
8	Calorific value (kcal/kg)	2840	2480	2950
9	Temperature	13.5	10.5	12.5
10	Organic matter(%)	41.7	30.03	47.5

The above tables clearly show the exact nature of the waste generated in the city of Shimla where food waste is the largest component with good calorific value.

4. CONCLUSIONS

Shimla city has witnessed large scale urban expansion in the last one decade. The municipal limits have expanded tremendously putting extra load on the existing infrastructure. The city has gradually improved SWM infrastructure through various programmes. In the last few years technical expertise has been brought in by private sector, development organizations and capacity building measures of MoUD. MSW (M&H) Rules, 2000 enforcement is ensured through High Court interventions, stringent byelaws and public participation results in improved aesthetic value and environmental health of the city. The waste has high recycling and biodecomposition potential which can be utilized. It is experienced that realistic data on the population and waste generation are prerequisite for planning waste management system. These data management and SLB reporting capacities of within the city need to be strengthened. The routing and loading plan has to be reworked for optimal use of the huge potential. Stringent monitoring can be deployed by using technological options like global positioning system for vehicular movement, radio frequency based system for effective door to door garbage collection and use of geographical information system (GIS) remote sensing for future proposals. Management of the PPP contractual obligation is still a challenge. Sanitation being a state subject, it is pertinent that the state government needs to take a holistic view towards solid waste management. A state level solid waste management strategy is recommended to strengthen and empower ULBs for proving sustainable solid waste management services in efficient way. Information exchange workshops and communication plan targeting behavioral change should be steered at state and ULB level in coordination.

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