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Research Article

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Assessment of Solid Waste Management Practices in Ibadan Metropolis

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Abstract The adverse effect of poor waste management practices in Nigeria metropolitan cities cannot be underestimated due to their negative influence on health, environment and the residence of such areas. It is therefore necessary to investigate the existing solid waste management structure in Ibadan metropolis, Nigeria with a view to design, predict and recommend effective strategies that would produce efficient solid waste management techniques, systems and culture. This paper focused on investigating the solid waste management practices in the study area to ascertain why solid waste remains the feature on the streets in certain part of Ibadan. Data for the study was gathered through consultation, interview and field work at various dump sites in the metropolis. Improvement was recorded in collection of solid waste compared to the previous years, but expected pragmatic approach had not been effectively adopted in its transportation, disposal and conversion. Efficient solid waste management requires recycling, even when disposal is not a problem. The required technocracy in upgrading the existing system for proper handling is purely engineering and inevitable. It is therefore recommended that the capacity of the agency in waste management should be improved; Research and development (R&D) must be adequately funded for possibility of good result and there should be education and awareness among the residence of such area. This will ensure effective waste management control in the metropolis.

Keywords Solid waste, Management, Collection, Transportation, Treatment, R&D

Introduction

Anything that is inevitable should be accommodated, treated accordingly and effectively managed. Generation of solid waste is inevitable within human and animal environment. Ibadan, the largest city in West Africa and the country heart of politics had not being without her challenges of solid waste management. It had been so formidable that it appears to defile all financial, administrative and technical resources of the various authorities concerned. Despite the regular publicity in the mass media and the constant political statement and action of highly placed personalities in authority, solid waste remains the features along the main roads and water ways in Ibadan. In some cases, roadways are completely littered by solid waste. However, with improved level of publicity awareness, indiscriminate deposit of solid waste had reduced at major centers of the city.

The failure of the numerous efforts to address the problem of environmental health hazard in the metropolis has been attributed to various factors like; unhealthy socio-cultural practices, poor environmental sanitation education and awareness, low literacy level, bad governance, disregard to the rule of law and other forms of indiscipline [1].

Ibadan as one of the south western metropolitan city in Nigeria is located at the junction of the savannah and the forest vegetation, 128km inland north east of Lagos and 530km southwest of Abuja. It is also in the south eastern part of Oyo state about 120km east of the border with the Republic of Benin in the forest zone close to the boundary between the forest and the savannah. The city ranges in elevation from 150m in the valley area to 275m above sea level on the major north-south ridge which crosses the central part of the city. The city's total area is 1,190 Sqm (3,080 km^2) with Population of 2,338,659 according to 2006 national census, Density of 2,140/Sqm (828km^2) and Metro Density of 600/Sqm (250/km^2).

Due to increase in population, urbanization and industrialization including globalization, the challenge of solid waste management (SWM) in the Ibadan, the second largest city in Africa, has increased and even now

complex. Contributory factors to the challenge include inadequate regulatory framework that has manifested in lack of interest of private sector investment in service delivery (infrastructure); uncoordinated institutional functions; low political will, low capacity to discharges duties, poor data information for planning, wrong attitude of waste generator amongst others. Yet on the increase is the demand for good waste management service for public health and environmental protection.

SWM entails the collection, storage, transportation, treatment and disposal of waste in such a way as to render them innocuous to human and animal life, ecology and the environment generally [1]. In the same view, it is the process of collecting, transporting, processing, recycling or disposing, managing and monitoring of waste materials [2] and [3]. The term usually relates to materials produced by human activity and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. Today, waste management practices include reuse, recycle, recovery and treatment. Reuse is using again items that can be disposed as waste such as glass jars, bottles, plastic bags etc. Recycle is the creation of new things from used items such as paper, broken glass, some form of plastics, bottles etc. Recovery is the regaining of items which were disposed as waste in waste dumps. Treatment is the handling of waste to minimize its negative impact on the environment which is mostly applied to liquid wastes such as industrial effluents and household sewage [3].

The quantity and rate of waste generated in the various states of Nigeria depends on the population, level of industrialization, socio-economic status of the citizens and the kind of commercial activities being predominant. The average waste generated per person in most cities is 0.58kg/person/day, [4]. The composition of solid waste within the city of Ibadan is represented in fig. 1:

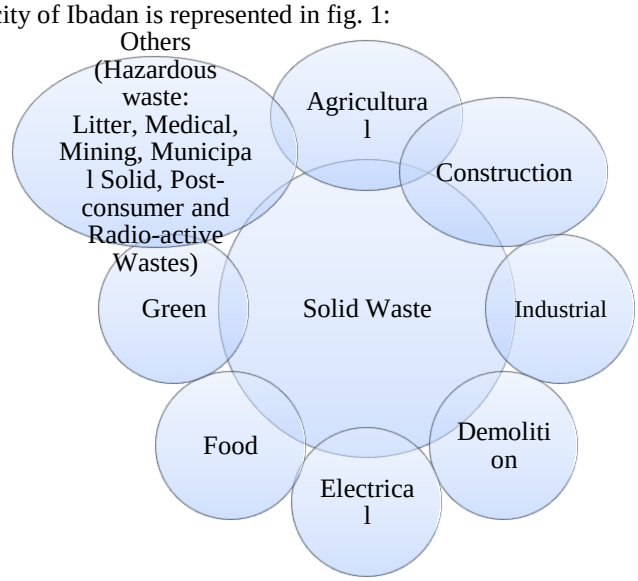

Figure 1: Solid Waste Composition within Ibadan Metropolis

Solid waste was classified based on physical, chemical and biological status as follows [5]:

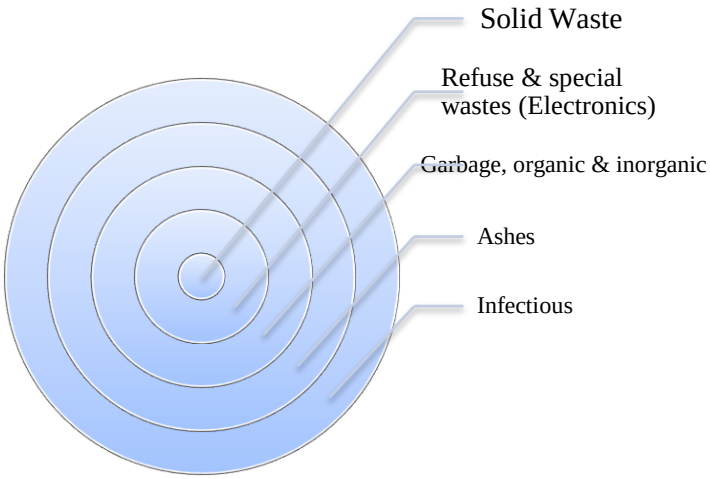

Figure 2: Solid Waste Classifications [5]

In addition, composition was described as a term used to identify individual components that make up the solid waste stream and their relative distribution, usually by percent by weight, see typical components distribution in residential municipal solid wastes for different countries (in percentage of total), Table 1. Such information is important in evaluating equipment needs, systems and management programs and plans [6].

Table 1: Distribution of components in residential municipal solid waste [7]

Components	Low-income	Middle-income	Upper-income
Organic			
Food waste	40-85	20-65	6-30
Paper	1-10	8-30	20-45
Cardboard	-	-	5-15
Plastics	1-5	2-6	2-8
Textiles	1-5	2-10	2-6
Rubber	-	-	0-2
Leather	-	-	0-2
Yard waste	1-5	1-10	10-20
Wood	-	-	1-4
Inorganic			
Glass	5	5	8
Aluminium	2	2	0
Dirt, ash etc.	20	15	5

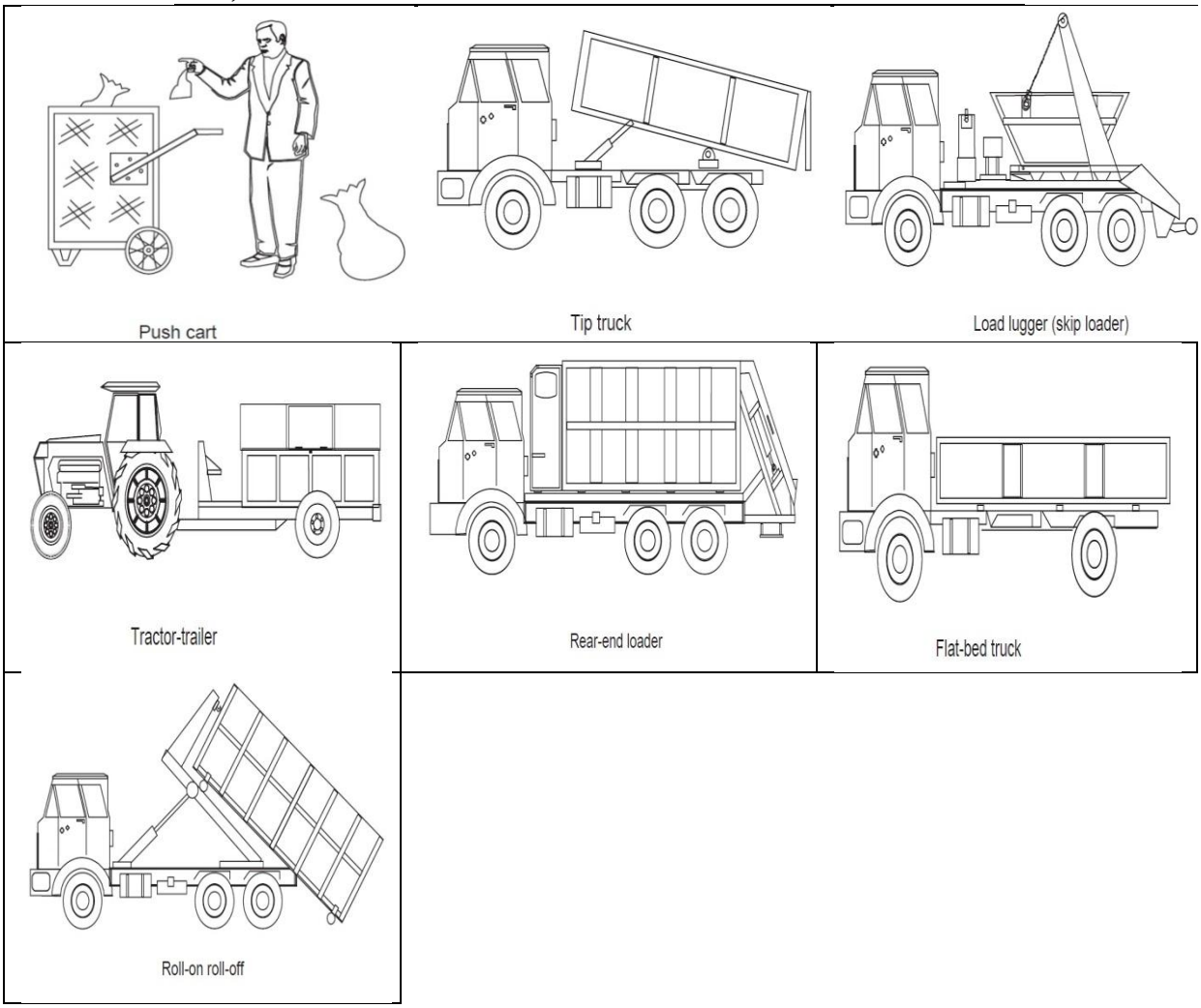

Figure 3: Waste Collection and Transportation Options

The level of waste generation in the traditional city of Oyo State was estimated to about 55200kg/day and comparing this with that in other south-west cities of Nigeria, the city was ranked third highest, Table 2 [8].

Table 2: Waste generation in some South-West cities in Nigeria per person/day [8]

Cities	Waste generated per person/day
Abeokuta in Ogun state	0.60
Ado-Ekiti in Ekiti state	0.71
Akure in Ondo state	0.54
Ile-ife in Osun state	0.46
Ibadan in Oyo state	0.58

It was also informed that the city generates 135,391 ton/month, 330kg/m^3 density and 0.51kg/capital/day of solid waste [4].

Moreover, these solid wastes are usually transported to distant locations from point of collection and the functional element of transfer and transport refers to the means, facilities, and appurtenances used for effective the transfer. Typically, the contents of relatively small collection vehicles are transferred to larger vehicles that are used to transport the waste over extended distances either to material recovery facilities or to disposal sites, Fig. 3 gives detail of some of the options.

Until relatively recently, solid waste was dumped, buried, or burned, and some of the garbage was fed to animals. The public was not aware of the links of refuse to rats, flies, roaches, mosquitoes, fleas, land pollution, and water pollution. People did not know that solid waste in open dumps and backyard incinerators support breeding of diseases vectors including typhoid fever, endemic typhus fever, yellow fever, dengue fever, malaria, cholera, and others [9]. Disposal of solid waste has to be accomplished without the creation of nuisance and health hazards in order to fill full the objectives of solid waste management program. Thus, this paper is aimed at investigating and assessing the solid waste management practices in Ibadan metropolis, Oyo state, Nigeria.

Methodology

One-to-one interviews were conducted with Oyo State Waste Management Authority (OYOWMA) at Agodi, Ibadan to gather information about the official dump sites and collect data on the engineering aspect of solid wastes in the metropolitan city. Officials at the Department of Protective and Regulatory Services (DPRS) were also contacted and interviewed.

Approved dumpsites were also visited and on the spot assessment carried out, dumpsite workers also interviewed. The conditions of the dump sites visited are presented in the Plates below. Sampled cases were analyzed in accordance with scientific procedures of assessing engineering effectiveness of facilities and processes.

Plate 1: Dump site collection attendants

Plate 2: entrance of Asunle dumpsite, Awotan

Plate 3: The condition at Aba Eku site after rainfall

Plate 4: Situation at Lapite site with burning smoke

Plate 5: Features at Asunle dumpsite with Scavengers at work

Cases of the solid wastes management practices were technically identified and sampled accordingly as applicable to storage, collection, transportation and operations at dumpsites.

Results and Discussion

Average person generates 0.58kg/person/day of waste within Ibadan locality. The waste generated by each local government was estimated, using population census data of 2006 is presented in fig. 4 and 5.

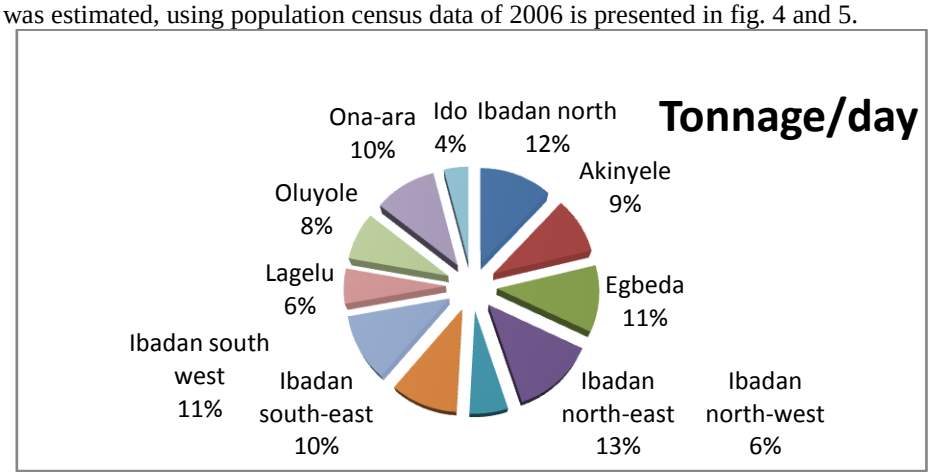

Figure 4: Waste generated by each Local Government per day in tonnage

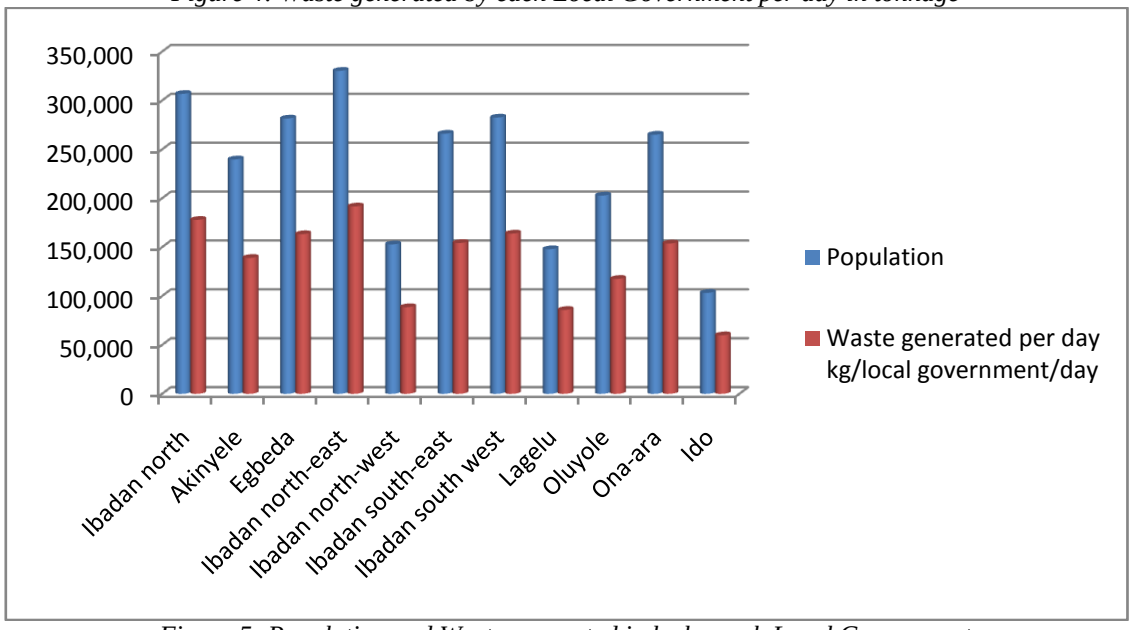

Figure 5: Population and Waste generated in kg by each Local Government

Engineering aspect of Solid Waste Collection: Waste generated are collected at spots in different ways, ranging from on-the-ground street free dumping, Plate 6 and 7 to container packages or direct dumping into the waste truck, Plates 8.

Plate 6: Street Removal of waste along Iwo road

Plate 7: Waste Management Staff at work on road median

Approximated Solid Waste Measurement: In the absence of weighing bridge to ascertain loading capacity, effort was put to play in adopting the following alternative means.

Capacity of the above facilities;

a) Plastic waste bin, PP 08, about 0.0011 tonnes
b) Ford truck, PP. 12, contains about 0.065 tonnes of waste
c) Mc Neilus goliath, PP. 11, contains about 0.1116 tonnes of waste
d) RDK goliath truck, PP. 10, contains about 0.186 tonnes of waste
e) Metal skip bin, PP. 09, about 0.0093 tonnes

(a) Plastic waste bin at The Polytechnic, Ibadan

(b) Ford disposal truck

(c) Direct loading into Mc Neilus goliath truck

(d) Direct loading into RDK goliath truck

(e) Metal skip bin along Sango- UI road, Ib.

Plate 8: (a) – (e) Solid Waste Management Collection and Transportation Facilities

Metal skip bins containing 11m^3 of solid wastes, about 0.0093 tonnes are positioned along major roads in the Ibadan metropolises to collect waste. For domestic, household, small businesses and industries were also given a plastic on-site waste collection bin which contains about 240 litres of waste. The government has also provided in most market areas, large shopping centres and other transfer stations 35m^3 closed steel container having capacity of about 0.295 tonnes of waste. The same are being loaded into waste collection trucks, trice per week.

Table 3: Daily Generation and collection of solid waste in each LGA

Local Government	Population	Tonnage/day	Tonnage Capacity of skip bin	No of trips of skip bin needed
Ibadan north	306,795	196.15	0.0093	21,091
Akinyele	239,745	153.28	0.0093	16,481
Egbeda	281,573	180.02	0.0093	19357
Ibadan north-east	330,399	211.24	0.0093	22,714
Ibadan north-west	152,834	97.71	0.0093	10,506
Ibadan south-east	266,046	170.09	0.0093	18,289
Ibadan south west	282,585	180.67	0.0093	19,426
Lagelu	147,957	94.6	0.0093	10,172
Oluyole	202,725	129.61	0.0093	13,937
Ona-ara	265,059	169.46	0.0093	18,222
Ido	103,261	66.02	0.0093	7,099

The collection crew comprises of one (1) driver to a truck with average of three (3) workers per truck running three (3) shifts every day and travels an average of eleven (11) trips per day.

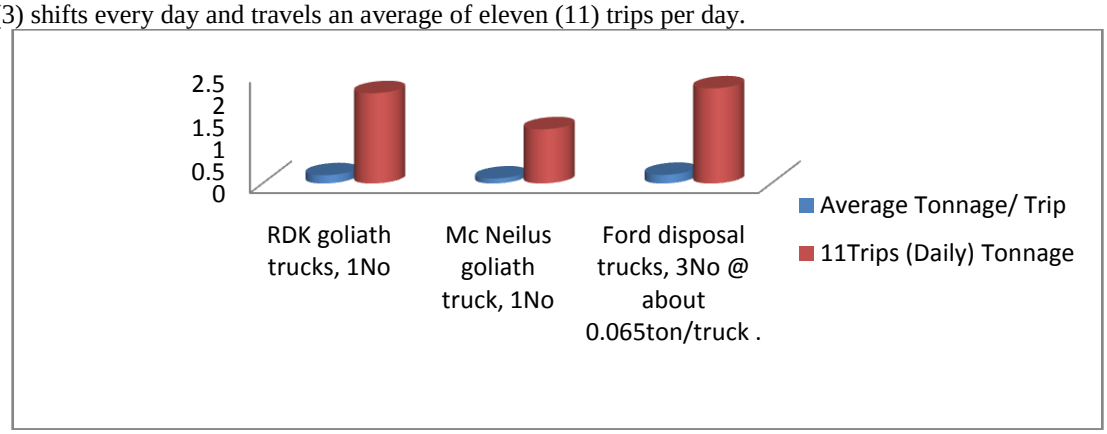

Figure 6: Daily Transportation Capacity Estimation per LGA

It is to be noted that the state also registered private contractors that majorly use tipping collection trucks of varying capacities. An average of 5.420 tonnage were recorded per day for 11 trips.

Table 4: Waste Generation and Transportation Facilities Capacity per LGA

Local government	Population	Generated Tonnage/day	Disposal Transp. Capacity Tonnage/day	BALANCE (Surplus)
Ibadan north	306,795	196.15	5.42	190.73
Akinyele	239,745	153.28	5.42	147.86
Egbeda	281,573	180.02	5.42	174.60
Ibadan north-east	330,399	211.24	5.42	205.82
Ibadan north-west	152,834	97.71	5.42	29.29
Ibadan south-east	266,046	170.09	5.42	164.67
Ibadan south west	282,585	180.67	5.42	175.25
Lagelu	147,957	94.6	5.42	89.18
Oluyole	202,725	129.61	5.42	124.19
Ona-ara	265,059	169.46	5.42	164.04
Ido	103,261	66.02	5.42	60.60

Conclusion and Recommendation

The most difficult and expensive part of solid waste management is transportation. Even in developed countries where house to house collection and transportation are practiced, more than 70% of the budget is often spent on collection and transportation. Though budgeting information could not be made available, yet it is clear by deductive reasoning that no solution oriented budget is on ground to handle the increasing solid waste in the city of Ibadan.

Technical evaluation reveals the following;

Tables 3 and 4 above showed that the collection system is not adequate. For effective management of waste generated on a daily basis, there must be required provision for collection. Otherwise our streets and roads corridors can not be free of environmental eye sore as a result of overflow of solid waste, even where container is positioned. Thus, prompt loading and transportation cannot be compromised, since generation and collection of solid waste is daily affair. Table 4 showed that the situation is far from expected. Number of truck provided must have needed capacity to evacuate wastes from spot of collection with required number and categories of workers. Provision must also be on ground for maintenance and running cost. Workers must be well remunerated. Loading record cannot be kept without "weighing bridge". Trucks must be weighed before and after loading to generate engineering data. However, nothing of such is available in the Metropolitan City of Ibadan. This is a serious challenge to engineering aspect of solid waste management**.** In addition, disposal sites in Ibadan are operated as dump sites rather than being a waste management sites that is operated from sorting to conversion/sanitary landfills as done in the developed countries. It is unethical to see almost zero site organization; no site office, no laboratory, no waste treatment technocrats and no functional machineries for weighing, spreading and turning. The sorting is left to the activities of the scavenger with indiscriminate burning without consideration to the attendance air pollution and offensive odour as in plate 4.

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