

Assessment of Municipal Solid Waste Management Practices in Bahawalpur City, Pakistan

Asad Ali Khan¹, Muhammad Mohsin², Muhammad Nasar-u-Minallah³, Tasleem Barkat⁴

¹⁻⁴Department of Geography, The Islamia University, Bahawalpur, Pakistan

²Department of Geography, Govt. Sadiq Egerton College, Bahawalpur, Pakistan

³Department of Geography, Govt. Postgraduate College, Gojra, Pakistan

*Email: nasarbhalli@yahoo.com

Received: 20 March, 2020

Accepted: 21 May, 2020

Abstract: Solid waste management is a global issue persisting in most of the developing countries like Pakistan. Current study briefly appraises the management and practices of municipal solid waste (MSW) in Bahawalpur city. Data were collected from different sources by using an in-depth interview and questionnaire tool. The findings reveal that domestic organic waste accounts for about 35.32% followed by debris, dirt and construction material waste (30.89%). About 273.69 tons solid waste is generated on daily basis whereas only 218.95 tons per day is collected and disposed. The collection rate of MSW varies from 61% to 80% in the city. The service coverage area was about 70%. The total sanitary staff was also very limited (735) as compared to the increasing population and served only 75% population of the Bahawalpur. The equipment and machinery used for MSW collection and disposal operation were also limited and out of fashion which were needed to be replaced. There is no proper landfill for disposal of solid waste which is openly thrown at five dumping sites and burned. This situation further creates many environmental and health issues. Recycling is almost absent in the city and behavior of the inhabitants also adds to an ineffective solid waste management in the city. It is necessary to create awareness among the people about bad effects of improper dumping of solid waste and the need to tackle this problem.

Keywords: Solid waste management, MSW practices, strategies, stakeholders, Bahawalpur.

Introduction

Solid Waste Management (SWM) refers to the handling, collection, generation, storage, transfer, processing and disposing of Municipal Solid Waste (MSW), in such a way, which is ruled by the top principles of public benefits health, and environmental concerns (Daskalopoulos et al., 1999). Solid waste management is a worldwide issue, particularly in developing nations due to their burgeoning populations, changing life style, increasing living standards of community, and rising waste generation (Hassan et al., 2016). The issue is much striking particularly in developing countries like Pakistan. On the other hand, developed nations have launched ordered programs for the disposition of solid waste, while developing nations usually use inefficient methods such as open dumping of solid waste (Berkun et al., 2005). In most of the developed nations, feasible rules and regulations, and working plans are now taking place; while in developing nations' municipalities are facing the deficiency of finance and skills to handle with this calamity (Abu Qdais, 2007). Solid waste management is considering a major problem in large urban areas due to vast amounts of generated waste (Haydar and Masood, 2011; Hameed et al., 2017). Municipal solid waste management forms one of the most essential environmental and health issues prevailing in many African cities (Chirisa, 2013). Likewise, numerous countries understood that their solid waste handling methods doesn't fulfill the needs of sustainable development.

In Pakistan waste handling is also a major problem. Management and disposition methods i.e. composting, sanitary land filling and incineration are relatively fresh in Pakistan (Veenstra, 1997). Raw open dumping is the leading usual exercise all over the Pakistan and dumping sites are generally set to fire to lessen the quantity of collecting waste. In Karachi, the biggest city of Pakistan the generation of solid waste is astonishing 12,000 tons per day in which most of solid waste is openly thrown in streets, roads, open spaces (Mahmood and Khan, 2019; Hameed et al., 2017). The strategies to cope up the menace of solid waste are urgently needed. Perhaps, among these, the people willingness to pay for effective solid waste disposal is considered more useful. It is found that willingness to pay for improved management of solid waste is highly related to gender, size of the household, age of the household head and level of education (Addai and Danso-Abbeam, 2014). Wide and sustainable populace willingness to pay (WTP) and willingness to participate (WTPP) are the basis of productive domestic waste management (Han et al., 2019). Another strategy is the public private partnership (PPP) that could be effective in solid waste handling and management. The study conducted in Lagos city (Nigeria), have found that people have firm positive opinion of public private partnership as a strategy of waste handling (Aliu et al., 2014). In private sector, the monitoring system is a key for better management, allocation and management and dealing with available resources to tackle solid waste issue (Ashraf et al., 2016).

Materials and Methods

Bahawalpur city is the 11th largest city of Pakistan located between 29° 22' N latitude and 71° 41' E longitude (Fig. 1). As per the last National Census of Pakistan (2017) the population of the city was 681,696 that is now estimated to 822,276 in 2020 (Govt. of Punjab, 2011). The city is divided into 21 Union Councils (UCs) comprising 18 urban and 3 rural union councils respectively. In this study, only urban union councils were surveyed for municipal solid waste management. The rapidly increasing urban population of Bahawalpur is also aggravating several environmental issues.

In current study, data were collected through a structured questionnaire and in-depth interview. Primary data were gathered through in-depth interview conducted with officials of TMA Bahawalpur and different stakeholders and by using a questionnaire tool. Secondary data were gathered through different official reports and government published reports. Study in point focused on the practices and strategies of MSW management in the study area. Data were collected about the selected variables of the solid waste i.e. composition, service coverage, brief performance indicators, solid waste handling equipment, collection and distribution of solid waste and dump points.

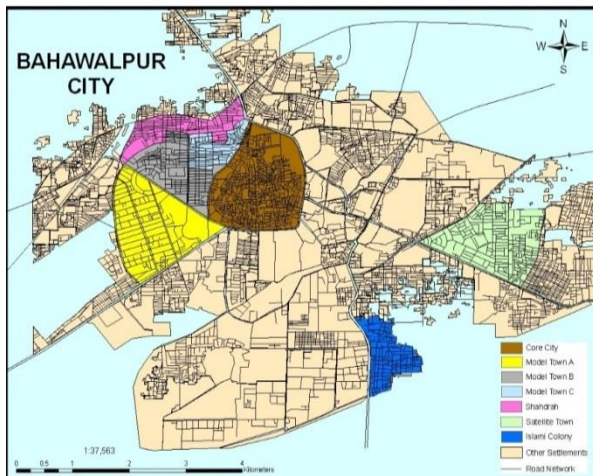


Fig. 1 Map of Bahawalpur city.

Results and Discussion

Figure 2 shows the composition of municipal solid waste of the study area. It reveals that domestic organic material (kitchen waste and vegetable /fruits remain etc.) accounts about 35.32% while 30.89% waste comes in the form of debris, dirt and construction material. It is found that in Bahawalpur city, the solid waste generated at domestic level consisted of organic waste and polythene bags. Almost 88% generated solid waste contained food remains, polythene bags, plastic scrap and cardboards (Mohsin and Chinyama, 2016). Another study also certified that about 35.3% waste comprised by organic waste, followed by textile/rags (8.4%) and plastic and rubber

(7.3%) respectively (Shafqat et al., 2014). Similarly, in Karachi, the examination of composition of waste suggests organic waste as the biggest portion of 64% followed by recyclables stuff with 27% and inert material with 9% (Majeed et al., 2018).

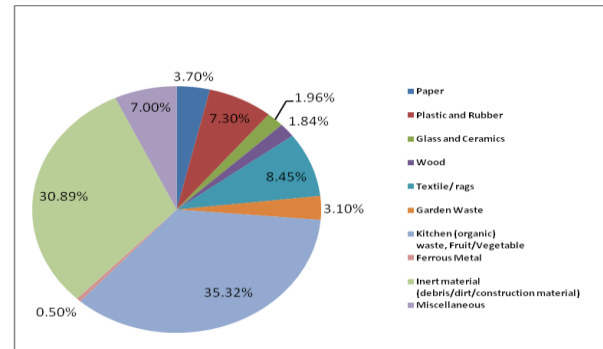


Fig. 2 Composition of municipal solid waste in Bahawalpur city.

Service Coverage of the Municipal Solid Waste

Various estimates show that 273.69 tons solid waste is generated each day while the amount of waste collection is 218.95 tons per day (Table 1). According to Mohsin and Chinyama (2016) 322 tons of solid waste is generated per day in Bahawalpur city. Generally, the generation of solid waste in many urban centers of Pakistan is higher than the documented because rest of the waste remains uncollected on the streets or plots. In Lahore, the second biggest city of Pakistan, about 5,000 tons of solid waste is generated each day. Only 70% solid waste is collected and disposed in far-away dumping sites, which creates serious environmental risks (Haydar and Masood, 2011; Kareem et al., 2016).

Table 1 Service coverage of MSW in Bahawalpur city.

Categories	Value
Percentage of Area Served	70%
Union Council	21 (18 Urban and 3 Rural)
Percentage of Population Served	75%
Waste Generation (tons/day)	273.69
Waste Collection (tons/day)	218.95
Lifted Waste (%)	80%
Un-lifted Waste (%)	20%

In Bahawalpur, up to 74% of households have thrown waste in open spaces which is a risk to surrounding environment and health as it fosters the breeding of flies, rodents, pollution of soil and water and bad odors (Khan et al., 2014). Another study also shows that about 84% generated solid waste material thrown in streets openly (Mohsin and Chinyama, 2016).

In Ahmedpur East (a Tehsil of Bahawalpur), findings reveal that almost 95% of solid waste is inappropriately thrown in the open fields and streets, creating severe environmental problems. Moreover, the generation rate of solid waste was expected to increase in coming years with expanding population (Mohsin et al., 2016).

Municipal Solid Waste Performance Indicators

About 0.4 kg solid waste is generated rate per capita each day (SW generation/c/d) in Bahawalpur city. Rate of collection of MSW ranges from 61% to 80% in 2017 census. The answer is 1.14 staff per 1,000 population (Table 2). Population per staff can be estimated by dividing the total population with total number of staff, the answer is 876 persons per staff. Total staff per 1,000 houses is 7.76, while houses per staff can be obtained (estimated by dividing the total population with average household size 6.8, the answer can be obtained by dividing the answer with the total staff) as 129 houses/staff. Total staff/ waste collected can be figure out by dividing the total staff (735) with the total per day waste collection (218.95 tons) and waste collected per staff can be obtained by converting the tons into kilograms and dividing with the total staff members.

Table 2 The performance indicators for SWM in Bahawalpur city.

Indicator	Performance
Rate of Waste Generation/person	0.4 kg/c/d
Rate of Waste Generation/house	2.72kg/h/d
Rate of Waste Collection	61% to 80%
Total Staff/Population	1.14 S/1000 P.
Population/Staff	876 persons/staff
Total Staff/House	7.76 Staff/1000 household
Houses/ Staff Members	129 Houses/ Staff
Total Staff/ Waste Collected	3.35 Staff/Ton
Waste Collected/ Staff Member	298 kg/Staff

Additionally, the machinery and equipment available to handle the solid waste were also limited and lacks and thus unable to collect a large amount of solid waste effectively. There is lack of modern equipment and machinery to cope with the generated volume of waste efficiently (Table 3). Some of the equipment and machinery was old and out of fashion and needs repairing and maintenance. These findings suggest that there is a dire need to adopt new machinery and deployment of extra sanitary staff.

Table 3 Solid waste handling machinery of TMA city Bahawalpur.

Machinery/Equipment	Quantity
Tractor Trolleys	13
Tractor Front Blade	1
Tractor Containers	3
Tractor Boozers	6
Tractor Black Blade	1
Tractor Loaders	3
Mechanical Sweeper	1
Sucker Machine	2

Machinery/Equipment	Quantity
Dust bin Containers	35
De-Watering sets	16
Mobile Sullage Pump	2
Containers Carriers	3
Fog Spray Machine	19
Hand Spray Machine	23
Hand Cart	30
Donkey Cart	6
Bull Cart	04

Distribution and Collection of Solid Waste

Distribution of collected waste illustrated the difference of waste distribution among different areas of the Bahawalpur city. There are four categories of collected waste and one can observe that Union council 5 has more waste collection than the other areas of the Bahawalpur including Model town B, Ehsan colony, Karbala Gaoshala, People colony, Khan colony, Diwaan colony and some parts of Model town C. There is less awareness among people of these highly populated areas. The rate of waste generation result high as 30% to 35% solid waste remains uncollected which causes environmental degradation and problems to the residents. The solid waste collection by the responsible authority is poor in Bahawalpur city as only 40% of the generated waste is collected (Mohsin and Chinyama, 2016).

According to TMA sources the maximum container capacity of wastes storage is 6cuM. The containers and dustbins which need repair can be seen at filth depot and a place near Milad Chowk where 10 to 12 containers are in very bad condition which shows negligence of the TMA Bahawalpur city. TMA have very less allocation of budget for purchasing the new equipment and machinery and also for repairing the existing equipment. Moreover, nearly 85% to 90% solid waste management budget spend on the salaries and pension of the workers. Various tractors and trolleys are used to transfer waste from the source to filth depot and from filth depot to the final dump sites.

Table 4 Area wise distribution and collection of solid waste.

Vehicle	Area Served	Total Solid waste collection (tons)
Trolley No.1	UC no. Filth depot, 12 and 13	1,607.58
Trolley No.2	UC no.5, 6	2,070.9
Trolley No.3	UC no.10 & Bindra Pully road	1,976.13
Trolley No.4	UC no. 1, 2	1,776.51
Trolley No.5	UC no. 7, 8	1,674.27
Trolley No.6	UC no. 5, 1and Filth depot	2,088.45
Trolley No.7	UC no.17, 18	1,698.84
Trolley No.8	UC no. 16, 17	1,674.27
Trolley No.9	UC no. 14, 15	1,667.25
Trolley No.10	UC no. 3, 4	1,667.25
Trolley No.11	Circular road to	1,674.27

Vehicle	Area Served	Total Solid waste collection (tons)
Trolley No.12	vegetable market	1,625.13
Trolley No.13	Gardens Branch	1,642.68
	UC no. 11 & Radio station road to Multan road	
Containers 35	In whole city at 35 points	7,782.95
Containers 10	-	0
Donkey carts	-	0

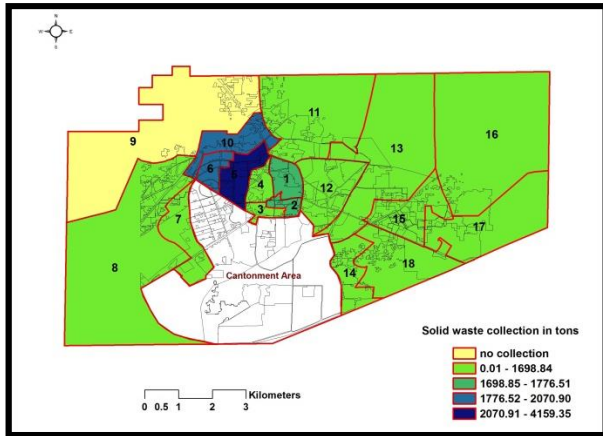


Fig. 3 Union council wise distribution of municipal solid waste in study area.

There is no landfill disposal site currently present in the city to dispose of the wastes. But TMA has fixed some open dump sites where all collected waste is thrown and burned. There are five open disposal sites located near railway station, Baghdad station near Tibba Badar Sher, Kachhi Basti waste dump site (on Yazman road), Bhinda Dakhli waste disposal site, and Chandipir near the Azam chowk at national highway (Fig. 4). There is no proper permanent landfill present in the city. Most of the wastes is dumped in two sites i.e. the most recent dump sites i.e. Tibba Badar Sher and Kachhi Basti disposal sites. Currently recycling is not being practiced in the jurisdiction of TMA Bahawalpur City.

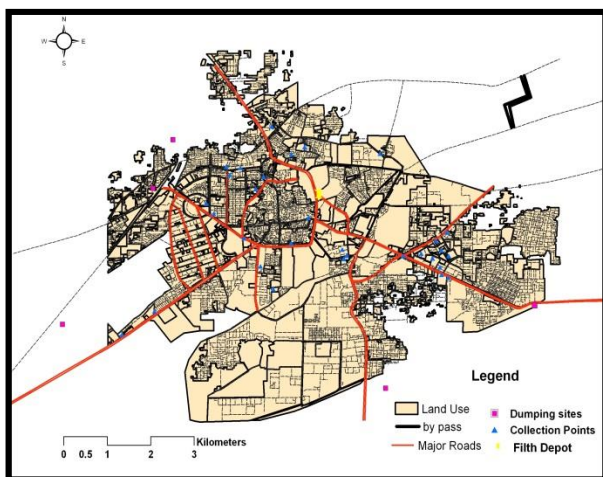


Fig. 4 Solid waste collection points and dump sites of the study area.

Conclusion

Solid waste is now one of the main issues in Bahawalpur city as found in many other cities of Pakistan. The study reveals that there is no specific rule and regulation for the management of municipal solid waste in the study area. Management of Bahawalpur union council lacks manpower and funds for purchasing new equipment. There is no specific dumping site for the safe disposition of solid waste. Behavior of the inhabitants also adds to an ineffective management of solid waste in the city. It is urgently needed to cope with municipal solid waste and the local public authorities of municipal administration need to work together. It is vital to create awareness about the effects and impact of MSW on land, air and water due to bad treatment of solid waste, so that people might become aware of the need to tackle this problem.

References

- Abu Qdais, H. A. (2007). Techno-economic assessment of municipal solid waste management in Jordan. *Waste Management*, 27 (11), 1666-1672.
- Addai, K. N., Danso-Abbeam, G. (2014). Determinants of willingness to pay for improved solid waste management in Dunkwa-on-Offin, Ghana. *Journal of Agriculture and Environmental Sciences*, 3 (1), 1-9.
- Aliu, I. R., Adeyemi, O. E., Adebayo, A. (2014). Municipal household solid waste collection strategies in an African megacity: Analysis of public private partnership performance in Lagos. *Waste Management and Research*, 32(9), 67-78 DOI: 10.1177/0734242X14544354.
- Ashraf, U., Hameed, I., Chaudhary, M. N. (2016). Solid waste management practices under public and private sector in Lahore, Pakistan. *Bulletin of Environmental Studies*, 1(4), 98-105.
- Berkun, M., Aras, E., Nemlioglu, S. (2005). Country report disposal of solid waste in Istanbul and along the Black Sea coast of Turkey. *Waste Management*, 25, 847-855.
- Chirisa, I. (2013). Solid waste, the Throw-Away culture and livelihoods: Problems and prospects in Harare, Zimbabwe. *Journal of Environmental Science and Water Resources*, 2 (1), 001-008.
- Daskalopoulos, E., Badr, O., Probert, S.D. (1999). Economic and environmental evaluations of waste treatment and disposal technologies for municipal solid waste. *Applied Ecology*, 58, 2009-255.
- Govt. of Punjab. (2011). Bahawalpur city profile. Lahore: The urban Unit, Government of the Punjab.

- Hameed, K., Riaz, O., Nasar-u-Minallah, M., Munawar, H. (2017). Types of hospital waste and waste generation rate in different hospitals of Faisalabad city, Pakistan. *J. of Basic and Applied Sci.*, **13**, 386-391.
- Han, Z., Zeng, D., Li, Q., Cheng, C., Shi, G., Mou, Z. (2019). Public willingness to pay and participate in domestic waste management in rural areas of China. *Resources, Conservation and Recycling*, **140**, 166-174.
- Hassan, T., Zahra, A., Hassan, A., Feridoun, A., Reza, D. (2016). Characterizing and quantifying solid waste of rural communities. *Journal of Material Cycles and Waste Management*, **18** (4), 790-797.
- Haydar, S., Masood, J. (2011). Evaluation of kitchen waste composting and its comparison with compost prepared from municipal solid waste. *Pakistan Journal of Engineering and Applied Sciences*, **8**, 26-33.
- Kareem, M., Nasar-u-Minallah, M., Parveen, N., Naqvi, S. A. A. (2016). Spatial analysis of ground water contamination in close vicinity of solid waste sites in Faisalabad using GIS techniques (A case study). *Science International*, **28** (2), 1051-1055.
- Khan, A. A., Fatima, M., Khan, K. (2014). Spatial analysis of environmental health risks: A case of Bahawalpur district, Pakistan. *Pakistan Journal of Commerce and Social Sciences*, **8** (1), 238-257.
- Mahmood, H., Khan, M. M. (2019). Urban solid waste management in Karachi, Pakistan. *International Journal of Economic and Environmental Geology*, **10**(1), 78-83.
- Majeed, A., Batool, S. A., Chaudhry, M. N. (2018). Environmental quantification of the existing waste management system in a developing world municipality using Ease Tech: The case of Bahawalpur, Pakistan. *Sustainability*, **10**, 2424.
- Mohsin, M., Chinyama, A. (2016). Impacts of solid waste management practices on environment and public health: A case of Bahawalpur city, Pakistan. *Journal of Environmental and Agricultural Sciences*, **9**, 69-79.
- Mohsin, M., Anwar, M. M., Iqbal, M. J. (2016). Practice and conditions of solid waste management in Ahmedpur East, Bahawalpur, Pakistan: A way forward. *Sindh University Research Journal (Science Series)*, **48**(1), 95-100.
- Shafqat, A., Noor, S., Fatima, M. (2014). Practices and challenges of municipal solid waste management in Bahawalpur city, Pakistan. *Journal of Sustainability Science and Management*, **9**, 90-98.
- Veenstra, S. (1997). Sanitation and solid waste technology.