

INVESTIGATION TO CHECK THE FEASIBILITY OF COMPOSTING FOR SMALL CITIES IN DEVELOPING WORLD: A CASE STUDY OF TAXILA CITY

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ABSTRACT

The case study presented herein investigates the composition of solid communal waste from a small city in a developing world and investigates the feasibility of using composting waste treatment. Taxila, a small city in Rawalpindi District, is selected as a focal area for this study and to start with the prevalent major environmental problems resulting from poor solid waste management were investigated. In the next stage of investigation, focal area was further subdivided into three neighbourhoods while considering the population and living standards of dwellers, with these zones named as poor, average, and rich. A total of fifty, thirty and fifteen sampling sites are selected from each of these zones respectively. Solid waste samples are collected from the selected sites for a week on daily basis, which are then analyzed to find their composition and are recorded accordingly for each zone. The analyses of collected samples indicated that almost 60-70% of generated communal waste from all three zones is organic in nature and that the composting option for such communal waste could be a more sustainable and economical solution when compared to sanitary land filling. The research findings indicated that biodegradable communal solid waste composition in small cities of developing world is suitable for composting that could help to minimize the harmful environmental impacts on life from open dumping and sanitary land filling of municipal wastes.

KEY WORDS: Taxila, biodegradable, waste, composting, organic, environmental, impacts

INTRODUCTION

The open dumping of communal waste and as well as the open burning cause significant environmental issues in developing countries. The municipal authorities in the poor countries like Pakistan are not able to collect about 30% to 60% of generated communal waste owing to resource constraints¹. The dispersion of uncollected wastes is blocking drains/sewers and creating unhygienic living conditions for occupants of these areas and for people walking on the walkways/streets. Illegal dumping and scattering of communal waste, being prevalent in unprivileged areas, is also causing the blockage of sewerage/drainage system, epidemics and environmental disorder¹.

ISSUES RELATED TO POOR HANDING OF COMMUNAL WASTES IN DEVELOPING WORLD

Financial constraints, lack of technical staff, faulty waste handling methods, low collection efficiency, insufficient transportation and illegal dumping of the communal waste are few major issues in the developing world. The developing countries, like Pa-

kistan, are seriously facing afore mentioned issues¹⁻². Habitats of small towns and major cities in Pakistan are continuously exposed to environmental hazards due to illegal dumping of communal waste while on the other hand illegal burning of dumped waste is spoiling the air quality and local environment. Annual generation of communal waste materials in the poor world is increasing as compared to available waste handling facilities, partially impeding municipal authorities in the developing world in managing communal solid waste. Improper development in urban centers, diversify nature of waste materials, extreme weather conditions in summer, outdated machineries and faulty hauling systems are making waste management even harder. To this end, the percentage of collected municipal waste and its disposal is nowhere near that required in Pakistan².

STUDY AREA

The waste samples from the city of Taxila, being representative of small cities in developing world, were collected to explore the feasibility of composting in small cities of developing world. Taxila is located

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approximately 25 km from the capital of the country and at a short distance from many famous and important industrial establishments of national and international interests. The Heavy Industries of Taxila (HIT), the Hattar Industries, the Air Weapon Complex (AWC), the Pakistan Ordnance Factories (POFs), the Heavy Mechanical Complex (HMC) are few of these. The overall climatic behavior of this zone is humid/sub-tropical and maximum rainfall occurs during the months of July and August, often associated with monsoon season. The annual average rainfall in Rawalpindi District is almost 990 mm. The existing communal waste collection systems under the supervision of Tehsil Municipal Administration (TMA) Taxila are not sufficient to resolve the waste management issues of the town.

RESEARCH AIMS

The major research objective associated to this investigation was to determine feasibility of composting method for managing communal solid waste in small cities of developing countries like Pakistan, whereas the associated minor research objective was to identify and highlight adverse environmental issues resulting from conventional poor solid waste management techniques.

MATERIAL AND METHODS

(a) Collection of background data

Basic field conditions in the study area with respect to communal waste handling, waste disposal issues, transportation and collection issues, weather conditions, composition of generated waste, demographic data was collected in the first phase of field collection.

(b) Data compilation from relevant departments

The relevant information to the research activity was also collected from the concerned authorities. TMA Taxila was consulted for the same purpose to collect the basic statistics for generation rate, composition, collection, transportation and disposal.

(c) Field sampling

Using the statistics provided by the relevant authorities study area was divided into three major

zones on mostly on the basis of their economic situation. These groups were defined as rich, middle and poor associated respectively. Fifteen, thirty and fifty samples were collected each day from rich, middle and poor zones respectively over a period of seven days. Additionally, sampling for four different seasons was carried out through out the year during the months of December, March, June and September for seven successive days from the designated groups. Household size during the sampling was also observed.

(d) Samples analysis

The different compositions of organic waste, plastic and rubber, textile materials, paper products, glass materials, metals, leather items, trimming and garden waste etc were determined by weight during physical analysis and presented as kg/Capita/day for selected groups.

(e) Results

The study findings and results were analyzed by using computer software (MS Excel). The demonstrated graphs during the result analysis are addressed in the text for further elaboration.

ENVIRONMENTAL ISSUES IN TAXILA DUE TO POOR MANAGEMENT OF COMMUNAL WASTE

Poor communal solid waste management system in the Taxila City is highlighting many environmental issues in the area. Poor management of communal waste can be seen in the Figure 1. Transportation of household waste through open-body trucks is a common practice in the Taxila city. Figure 2 and 3 are highlighting the worst practice of poor handling of communal waste in the Taxila city.

Worst negative impacts on the environment due to poor management of communal waste in the developing countries are presented in Table 1. The illegal dumping and low collection efficiency of communal waste is resulting the blockage of sewer/drainage systems in the study area as shown in the Figure 4.

RESULTS AND DISCUSSIONS

Basic requirements for the composting

Basic requirements for an efficient composting system are appropriate oxygen, reasonable Carbon to nitrogen ratios, required amount of moisture, effective



Figure 1: Transportation of communal waste through open trolleys



Figure 2: Open dumping along the road side

porosity, required size and texture of organic particle, allowable pH, recommended temperature and suitable climate. The ideal values for these parameters are shown in Table 2. The Composition of generated communal solid waste and climatology are reasonably favoring the composting systems in Pakistan and other developing countries³.



Figure 3: Dumping of communal waste on Railway line



Figure 4: Blockage of open drains

Table 2: Basic requirements for composting

S No	Parameters	Range
1	C/N ratio	10:1 to 30:1
2	Optimum moisture content	40% to 60%
3	Size and texture	Max ½ Inches
4	pH	6 -8
5	Temperature	135°F to 160°F
6	Salt conductivity	1.0 to 10.0 dS/m
7	Organic matter content	30% to 70%

Table 1: Environmental issue due to poor management of communal waste 3-9

S No.	Concerns	Related impacts on environment
1	Illegal dumping and poor collection efficiency within the local communities	Failure of sewerage/drainage systems.Overflowing of sewers and drainsPoor living environment in residential areasChances of epidemics Contamination of waster bodies through lechate
2	Illegal throwing of food items in living areas	Attracts insects and animal for food. Effects on ecology and environment Nuisance
3	Illegal/uncontrolled burning of solid waste	Producing toxic air pollutantsDamaging indoor and outdoor living environment
4	High composition of polythene bags	Land pollution; Harmful for faunas ; Failure of sewerage system
5	Unsafe/Risky environment for crews	Threats to the lives of workersChances of injuries
6	Faulty design of collection vehicles	Nasty and unhygienic

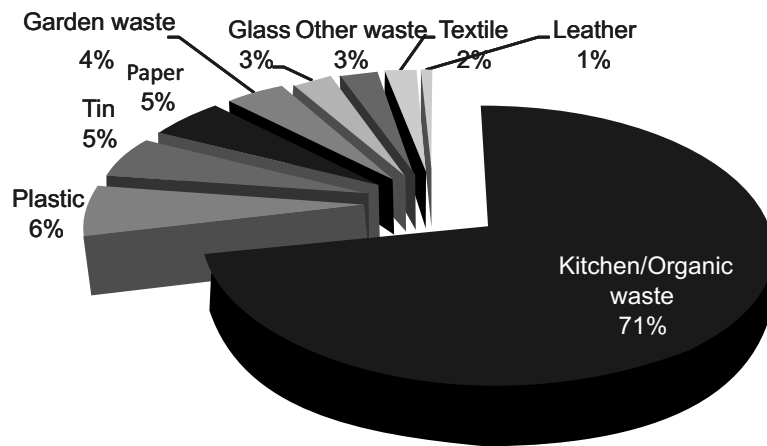


Figure 5: Composition of communal waste from Taxila city

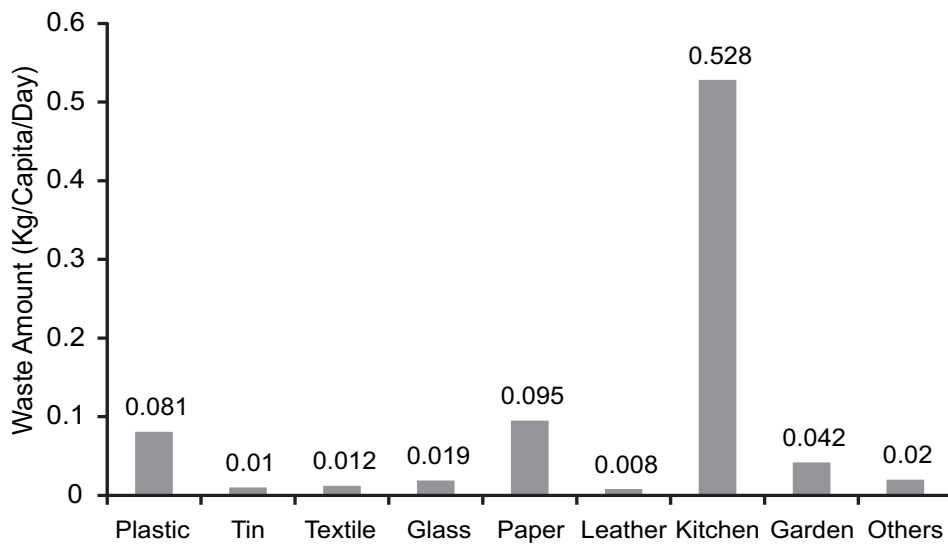


Figure 6: Communal waste composition of high income group

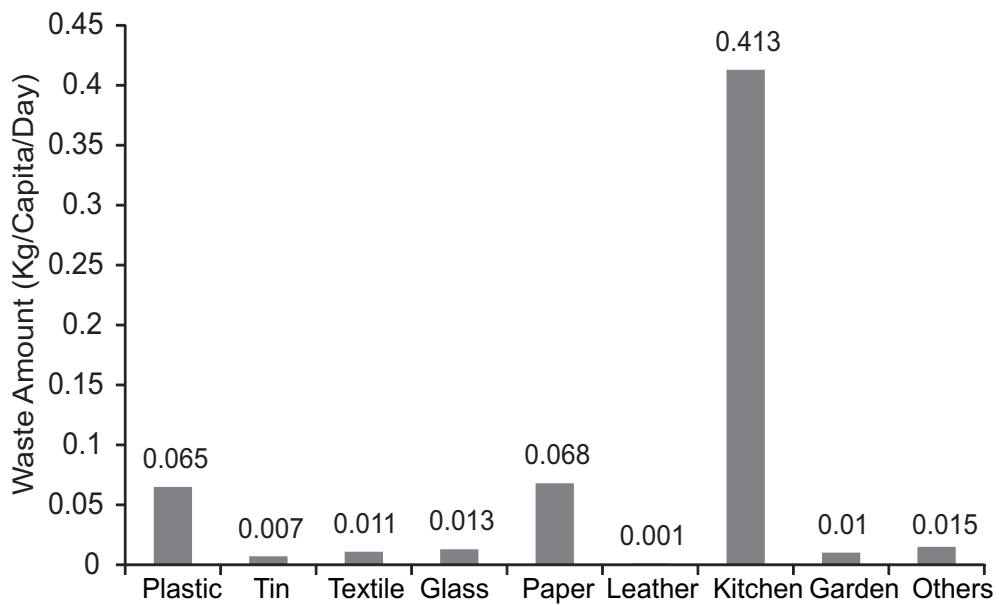


Figure 7: Communal waste composition of middle income group

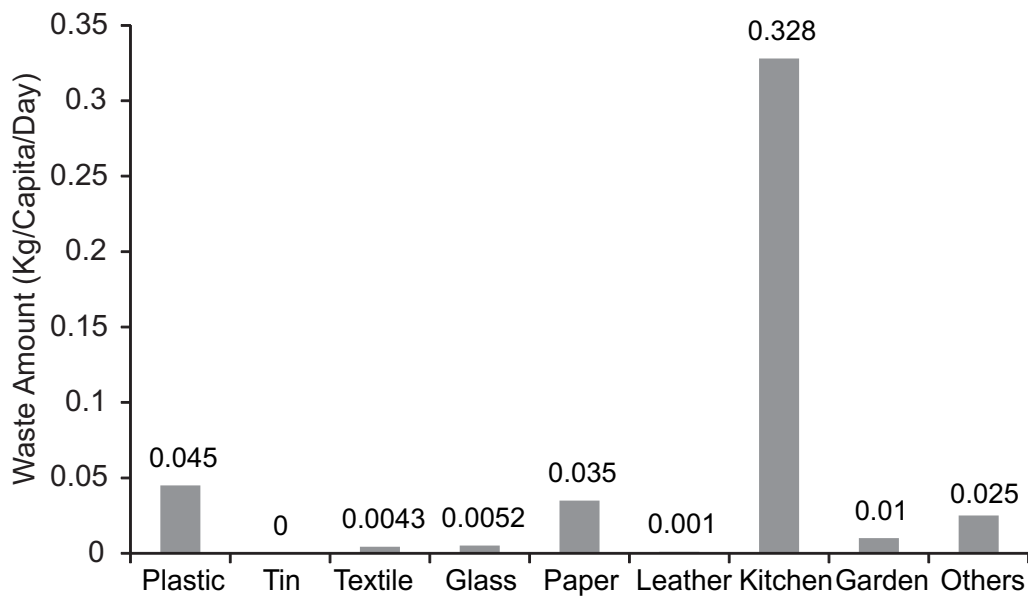


Figure 8: Communal waste composition of low income group

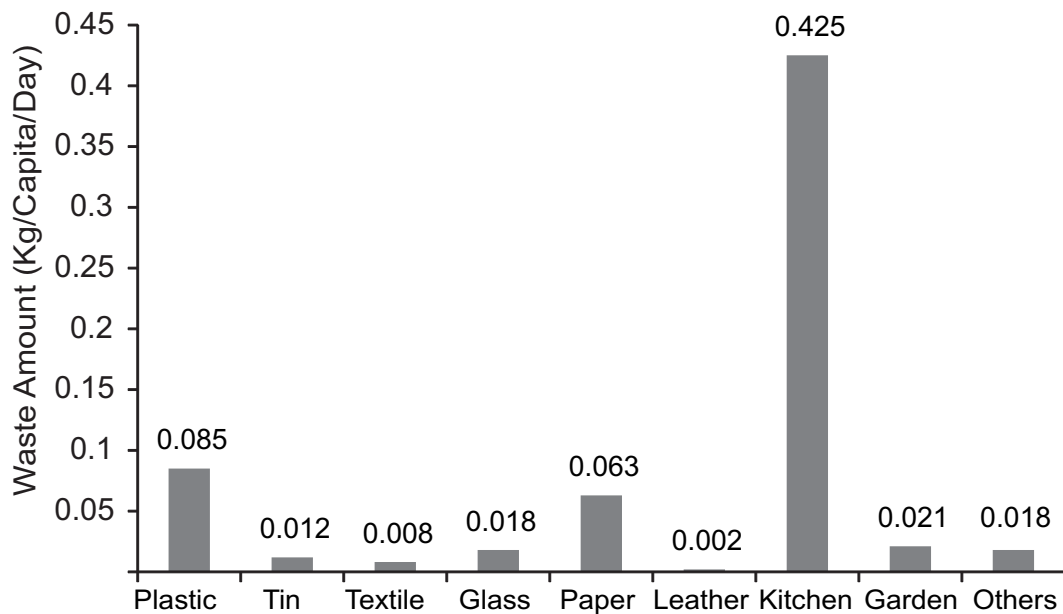


Figure 9: Average waste composition of Taxila city

COMPOSITION AND ANALYSIS OF SAMPLES

Collected samples from the study area were analyzed for organic waste, plastic and rubber, textile materials, paper products, glass materials, metals, leather items, trimming and garden waste etc figure 5. The composition analyses of these samples are presented as kg/Capita/day for selected groups as shown in Figure 6, 7 and 8. It is concluded from the field sampling that high income families in the study area are generating more amount of communal solid waste as compared to the other groups. Figure 6 is high-

lighting that high income families in the Taxila city are also generating attractive amount of plastic materials and different forms of paper, but still the biodegradable waste materials are more than 60%. The average per capita solid waste generation rates for the defined groups were determined by the sampling data. The Taxila city is presenting average per capita per day communal waste generation rate of 0.815, 0.603 and 0.453 in kg for high income group, middle income group and low income group respectively. On the other hand Fig. 9 is indicating the overall results for

average solid waste generation rate in the city. The analyzed composition trend of collected samples from the Taxila city is presented in Figure 5.

It is being concluded from the analysis and field sampling that the generated communal waste of Taxila city is producing almost 60-70% of organic materials. From the relevant literature it can be easily concluded that through out the world in the developing countries the solid waste composition is so close to the Taxila city as discussed. Due to the almost similar living trends in the poor nations, most of the developing countries are producing high percentage of biodegradable organic wastes. On the behalf of this fact composting can be adopted as a more reliable and fruitful option in terms of financial and environmental advantages in the developing world. From the present investigation it is being concluded that environmental and climatic scenario is supporting the composting technique in Taxila city. In the developing countries the generated organic waste materials are not being utilized effectively due to poor rate of collection and faulty disposal techniques.

COMPATIBILITY OF COMPOSTING OPTION WITH THE EXISTING PRACTICE IN PAKISTAN

Through out the country (Pakistan) the separation of generated solid waste at the source is not in practice. Municipal waste administrative authorities are collecting all kinds of organic and inorganic wastes accumulatively. Collection of biodegradable and non-biodegradable waste together may create issues from the composting process. But these kinds of issues can be easily eliminated by using different bin systems. The separation of collected municipal solid waste at composting plant may raise the cost of transportation and segregation machineries. Thus, considering the overall financial scenario of the developing countries, the source separation along with public awareness is being recommended.

PEOPLE UNDERSTANDING TOWARD ENVIRONMENTAL ISSUES

The public awareness is one of the main key to the success for any kind of environmental campaign. Considering the financial constraints in the poor coun-

tries like Pakistan, public pressure from the local communities can force the government to redesign and implement the best environmental friendly techniques for the proper handling and discarding of generated communal solid waste. Considering the attitude of the indigenous population, the Government of Pakistan must need to take some initiative to adopt composting option to protect the local environment.

CONCLUSION

The present case study is concluding that the implementation of composting process in a true sense may improve the hygienic conditions in the country. Faulty transportation and handling of communal waste is seriously spoiling the local environment in the developing countries. Results and findings from the study area are highlighting that generated solid waste from the developing countries is producing almost 60% to 70% of biodegradable items. During the investigation, solid waste composition of different possible income groups was analyzed. It is investigated from the filed sampling that all kinds of families from the different income groups are producing handsome amount of organic matters in different forms. Thus, the generated amounts of biodegradable organic matters from the study area are sufficient for composting. Implementation of composting technique at gross root level in the developing countries may significantly support the agriculture, environment and economy.

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