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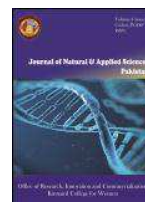
CHEMICAL AND PHYSICAL COMPOSITION OF SOLID WASTE OF A SOCIETY IN LAHORE

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Article Info	Abstract
*Corresponding Author Email Id: amber.fatima@kinnaird.edu.pk	The areas selected for study was a society in Lahore. It has 600 households in total. Sampling of solid waste were done from 60 houses and their chemical and physical composition were found outthe waste was segregated into organic (vegetable, fruit, animal food waste) and inorganic waste (cardboard, metal, plastic, glass, paper etc.) A questionnaire survey was also conducted which showed the household behavior regarding waste storage, recycling and collection from the society. It was found that about 0.34 tons of the waste is daily generated from the area. Due to poor collection services, the residents of Alpha society are more willing to pay for an improved and better collection of waste. Out of 60 households, 42 of them were willing to separate materials if a recycling program will be introduced in the society. The recycling practice of the households relies more on their understanding of recycling and level of awareness.

1. Introduction

Unwanted materials coming from industrial, commercial or agricultural activities in the solid form is considered as solid waste. A huge volume of waste is daily generated from urban areas, the collection, treatment, transport and disposal of the solid waste is a difficult problem for the authorities responsible to solve it. Problem is more critical in the countries which are developing economically (Woodson). Solid waste can be classified as rubbish, garbage, ashes, residues, construction and demolition waste on the basis of source of generation. Other types are treatment plant waste, hazardous waste, organic waste, agricultural waste and medical waste (Hayat and Hayder, 2011). Composition of solid waste varies not only from region to region but also from time to time. The steps involved for the management of the solid waste begins from generation, followed by separation, collection, transfer, transportation, and finally disposal (Iqbal, 2014). If the solid waste generated is properly managed, the risk to the environment and human health can be minimized. Inadequate solid waste collection and disposal can result in spread of various diseases like cholera, dengue fever, yellow fever etc. and can be a major cause of environmental degradation. Local governments are responsible for the solid waste management services, but due to increase in population administrations have failed to provide resources for all (Kassim and Ali, 2006). In Pakistan, one can easily observe shortage of waste collection bins, open burning, open dumping and improper sanitary landfills. According to a report by Ministry of

Environment Pakistan, more than 54,850 tons of the solid waste is generated daily in urban areas with only less than 50% collection rate (Ejaz and Janjoua, 2012). The current study is designed to study the solid waste management system of a residential area of Lahore i.e. Alpha Society.

2. Methodology
The methodology adopted for the study was as follows:

2.1 Selection Of Area
The area selected for study was Alpha Society, Lahore. There is not well defined division of economic level of people, so people of mixed economic levels live here.

2.2 Collection Of Data
Data was collected from primary and secondary sources. Primary data was collected through questionnaire survey, waste sampling and categorization whereas secondary data was collected from solid waste management departments and authorized digital libraries.

2.3 Survey Through Questionnaires
The survey was conducted in the area to get information about waste generation and its management. 60 houses were selected randomly for questionnaire survey.

2.4 Sampling Of Waste
Waste was collected from 60 households which is the 10% of the total number of houses i.e. 600 for a week. For the sampling of waste large sized empty shopping bags were used.

2.5 Analysis Of Waste
Waste was analyzed physically and chemically as well. For physical analysis, 60 houses were selected randomly and source segregation of the waste was done. The samples collected were taken to the environmental science laboratory of Kinnaird College for chemical analysis. Chemical analysis of the waste was done through proximate analysis.

2.6 Proximate Analysis
About 1 kg samples of the inorganic and organic waste were separately taken to the environmental science laboratory. Each component of the inorganic waste was separated from the samples. This process of separating the components is called segregation. The segregated components of inorganic waste were placed in the oven for 1 hour at $105^{o}C$ to calculate the moisture content. Whereas the inorganic or food waste was placed for 24 hours in the oven at $105^{o}C$.

The initial weight of each sample was noted as W1. After the waste was taken out from the oven it was cooled at the room temperature for few minutes and the final reading of the dried waste was noted as W2.

Moisture content was calculated for both the organic and inorganic waste using the formula:

Moisture Content = W1-W2 x 100 / W1

After that, the dried food waste was powdered using grinder and about 5 gram of the powdered waste was weighed separately. Then a crucible with lid was taken. Both the crucible and lid were weighed separately and their weights were noted. Then the 5 gram sample of the waste was kept in furnace at $950^{o}C$ for 30 minutes in crucible covered with lid. After 30 minutes the crucible was cooled and then weighed again for calculating the VOC.

After that, the same sample was placed again in the furnace this time without lid at $950^{o}C$ for 30 minutes to calculate fixed carbon. Ash content was measured by weighing the residue left after fixed carbon [35].

2.7 Data Analysis

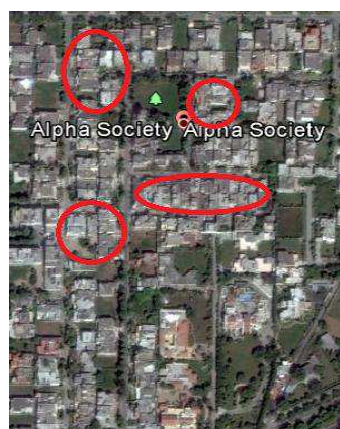Data from questionnaire survey and sampling was analyzed by excel and results were interpreted.

Figure 1: Google map of the alpha society, lahore

3. Results and Discussion

The physical analysis of waste is the percentage composition of waste which is done after segregation of each and every component collected from sampling. The chemical analysis of both the types of waste i.e. organic and inorganic waste was also done through proximate analysis. Table 1 shows the proximate analysis of the organic waste whereas table 2 shows the proximate analysis of the inorganic waste.

Table1: Proximate analysis of organic waste

Proximate Analysis (Organic Waste)	
Moisture Content	81.61%
Volatile organic compounds (VOC's)	12.1%
Fixed Carbon	6.12%
Ash	0.17%

Table 2: Proximate analysis of inorganic waste

Proximate Analysis (Inorganic Waste)	
Components	Moisture Content
Cardboard	83%
Paper	18.18%
Wrappers	0.75%
Textile	41.76%
Plastic	0.94%
Metal	1.05%

The questionnaire survey of the results was divided into three sections 1. Household identification 2. Existing situation regarding solid waste 3. Recycling practices. The results from figure 2 indicated that the minimum monthly income of the residents is less than Rs.

5000 which makes up about 1.6% of the residents. Whereas, the maximum income of the residents from the selected households was above Rs. 50000 which made up 71.6% of the residents.
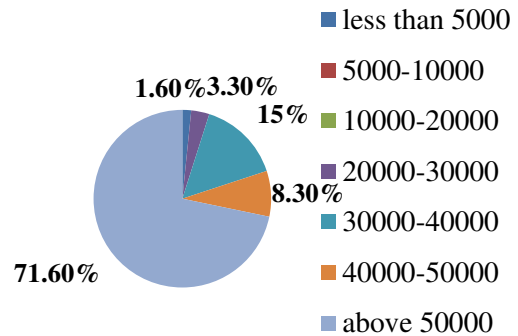

Figure 2: Level of income

Figure 3 shows that about 90% of the people use plastic or the metal container for the storage of waste. Figure 4 shows the frequency with which the waste containers are taken to be emptied. 78.3% of the residents answered that their containers are emptied daily.
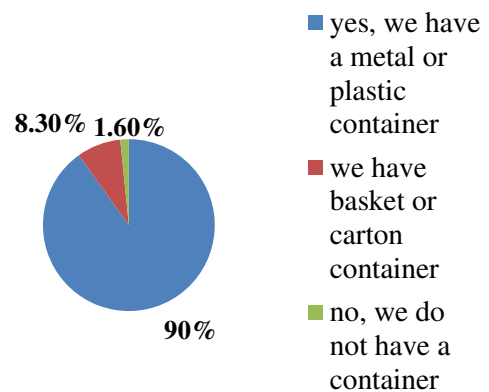

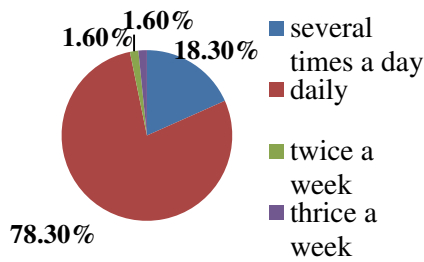**Figure 3:** Presence of container for the storage of solid waste

Figure 4: How frequently container is emptied?

Figure 5 shows the collection practice of solid waste from the area. According to 41.6% of the residents it's the local public authority that collects the waste from curbside containers. As Alpha Society is a high income area, respondents are more willing to pay if improved and better methods for the collection of waste are introduced. From the literature, in Dar es Salam, households pay for a convenient waste collection method in which when the collection vehicles reaches at the entry points of the street, one or two crewmembers walk in every street alerting the households to bring our their waste in the containers (Kaseva and Mbuligwe , 2005)
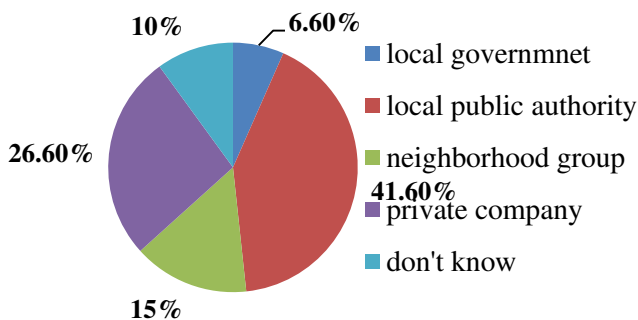

Figure 5: Collection of waste from curbside, container or pile

Figure 6 shows that 73.3% of the residents are concerned about the environmentally safe disposal of solid waste. The waste of the

Alpha society is taken to the Mehmood Booti for the final disposal and the segregation of waste is also done here by the scavengers who separate a number of recyclable materials like paper, glass, plastic, metal etc. and send them to the recycling markets helping in reducing the amount of waste. But in case of Palestine, the waste is disposed of in open dumps and is also not separated. This not only results in the production of large amount of waste but also due to the presence of dead animals and bio-hazardous materials within the waste results in considerable proportion of hazardous and unregulated waste which is unsafe for the environment and human health (Al-Khatib et al. 2010).
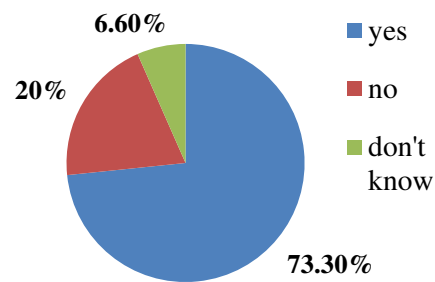

Figure 6: Concern of household about the safe disposal of waste

Figure 7 shows the willingness of the residents if a recycling program was set up for the separation of waste materials. 70% of the residents were willing to do so whereas 23.3% of the residents did not like that idea because they do not find it that much of an interesting activity.
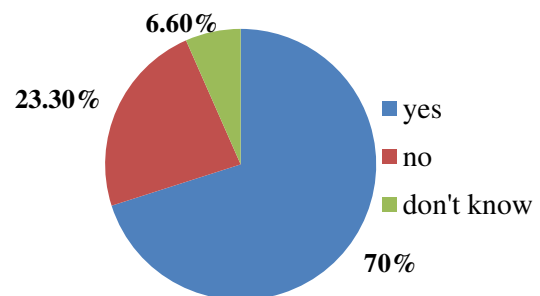

Figure 7: Willingness to separate materials if a recycling program will set up

4. Conclusion

From the detailed field study and questionnaire survey, a depiction of the solid waste management system and the recycling practices of the households of Alpha society are presented. Alpha society is a small residential area located at the canal road with the population of approximately 600. The physical analysis of the waste collected from 60 households involves the percentage composition of waste after the segregation of each and every component during sampling. In chemical analysis, proximate analysis is done which involves the moisture content, Volatile organic Compounds, fixed carbon and ash content. Due to insufficient provision of waste bins most the waste is thrown outside besides the bins. It is the responsibility of each and every individual of our society to generate less waste and use more recyclable products for a clean and pollution free environment. There is also a need to change the behavior of inhabitant towards the management of solid waste by creating a sense of awareness among them about the harmful impacts of improper solid waste management.

References

Woodson. P., "Solid waste"Hayat, S; Hayder, S, Solid Waste Management, Introduction, First edition, Empire Publishers AL- Fazal Market, Urdu Bazar, Lahore, 1 (2011).

Iqbal. S., "Solid waste disposal and collection system in Pakistan" published on Friday, April 11, 2014.

Kassim, S. M., and Ali, M., "Solid wastes collection by the private sector: Households' perspective—Findings from a study in Dar es Salaam city, Tanzania". Habitat International, 30(4) 769-780 (2006).

Ejaz.N., Janjoua. N.S., "solid waste management issues in small areas of developing world: a case study of Taxila City". International journal of environmental science and development, 3(2) (2012).

Kaseva, M. E., and Mbuligwe, S. E., "Appraisal of solid waste collection following private sector involvement in Dar es Salaam city, Tanzania". Habitat International, 29(2), 353-366 (2005).

Al-Khatib, I. A., Monou, M., Zahra, A. S. F. A., Shaheen, H. Q., and Kassinos. D., "Solid waste characterization, quantification and management practices in developing countries. A case study: Nablus district–Palestine". Journal of environmental management, 91(5), 1131-1138 (2010).