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Quantification of Solid Waste and Appraisal of Community Attitude towards Management of solid Waste in Jant Village of Haryana, India

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ABSTRACT

The study is done to investigate the attitude of the people and to inculcate awareness toward household solid waste. With the boom in the growth of population coupled with urbanization, the solid waste is predicted to increase annually. Here, the Direct sampling method is used and it involves the household survey and the quantification and the composition of the solid waste. Manual hand sorting is applied in the characterization process. The results indicate people having positive attitude towards the solid waste and the solid waste generated in the Jant village is comparatively very less. Most people have little knowledge on solid waste management, 80.67% of the household throw their waste in an open space or on the street. There is meagre information and little work on solid waste for the small villages in India. People participation is considered vital if the solid waste management is to be carried out efficiently in any place. The data thus generated in the study would help the environmental planners in their decision making on managing the solid waste and controlling the environmental pollution for the Jant village.

Key words: *Household, Quantification, Investigation, Haryana, Solid waste*

Introduction

As per the World Bank report of 2016, 2.01 billion tonnes of solid waste are generated by the world's cities that amount to 0.74 kg/capita/day. With the rapid growth of population couple with urbanization, the solid waste is predicted to increase annually by 70% from 2016 levels to 3.40 billion tonnes in 2050. In under developed and developing countries, 90 % of the waste is often disposed in the unregulated dumps or openly burnt. Comparing with the developed nations, residents from developing countries are more severely impacted by the unsustainable management of solid waste (Senzige *et al.*, 2014). These outcomes create serious health, safety, and environmental consequences. Improper management of solid waste acts as a breeding ground for disease vectors. And with the economic development unceasingly increased, the needs for efficient management of Solid Wastes are becoming crucial. The economic growth in turn drives towards increased consumption of resources, especially across the emerging nations especially, India and China. In the light of this scenario, it is vital to study and elucidate the factorsin fluencing waste generation and analyse the results bringing about best solution and practices. Looking at the present scenario and the outlook, experts predict and estimates the utmost challenges, to be faced by the emerging economic countries. Country like India, tryto combat the chal-

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lenges by legislating an Environmental Protection Act, 1986 (EPA), promoting the concept of Common Waste Treatment Facility, Public Private Partnership (PPP), Bio Medical Waste (Management and Handling) Rules, 1998, Solid Waste Managementrule, 2016, solid waste management rules 2019, etc.

Solid waste management is an important element for both the urbanisation and infrastructure development of cities. This has become more essential and critical especially for the mega cities which are rapidly growing and expanding. As Compared to those of developed countries, the management systems for residential solid waste in developing countries are not yet fully mature. So, residential solid waste is now the major problems to the suburban areas. This is not easily changeable which is difficult to undo the problems and threatens the health of people residing in and around the area. Moreover, only few studies have examined on residential solid waste in the suburban region of developing countries Sha (Cao *et al.,* 2018). Likewise, the relative lack of the investigation on the residential solid waste management, the research areas are often done in cities and very few studies are performed in residential solid waste management in suburban regions, (Hossein *et al.,* 2016). For understanding the composition of solid waste, it is necessary to characterise the composition and quantify the solid wastes. The quantification and characterisation of the household wastes are fundamental for an efficient refuse gathering and planning towards managing the waste for any household area, (Senzige *et al.,* 2014). In the process of characterisation, the data generated will help in formulating or determining the method and techniques for disposing the solid wastes. Characterisation helps to identify waste fraction which could be targeted for recycling, composting, incineration, etc. It is the various composition of waste generation and not the quantity of the solid waste that is generated which determine which type of technique and method to adequately manage the solid wasts. The foremost step in having effective design in the waste managementis the composition and not the quantity of the solid waste that need to be determined in choosing the type of method and techniques (Senzige *et al.,* 2014).

The waste so generated can be utilised as a resource for energy and other creative products. Likewise, any solid waste that cannot be appropriately reused and does not pursue the Environmental Quality Act should be restricted. The procedures in the solid Waste Management, contrast upon components, for example, family income, level of industrialisation, social advancement i.e., employment, education, and so forth and personal satisfaction of an area. Furthermore, territorial, regular, and monetary contrasts impact the solid waste management forms. So, the socio- economic dimension as well as the environmental dimension always needs to be considered.

Materials and Methods

Study Area

The research area Jant village which is in Mahendragarh District of Haryana state, India. The Jant village belongs to the Gurgaon Division. This place is in the border of the Mahendragarh district and the Rewari district. According to the Jant 2011 census, the Jant local language is Hindi. According to 2011 census, the town population is 2696 and the number of houses is 514. The female population is 47.0%. The education rate of the town is 64.8% with the female literacy rate, 25.9 % which is low. The Jant town have all out region of 491 hectares, woodland region is 54 hectares, and non-horticultural territory is 48 hectares. The total irrigated land is 443 hectares and the absolute water fall zone is 0 hectares. The village terrain is plain landform, lying near the Aravalli Mountain range. The climatic condition of the village is hot and humid.

Sampling and Data Collection

Data collection is done in two parts; firstly, through questionnaire and the second part through direct sampling from door to door. The primary source for data collection is random questionnaires. The questionnaire is done for 210 households in the Jant village. For this, a member of the family response to the questionnaire. The questionnaire covers general information of the respondent like educational attainment, family size, income, and the management of solid waste by the household. From the 2011 statistics, the education rate of the town is 64.8% which is beneath the national proficiency rate of 74.04%. So, from the information so gathered, 20 household is picked for the purposed of quantification. For the bins, we used paper cardboards with big black polythene of 50 kg capacity bag covering the cardboard. Then every evening around 4 o'clock, samples were weight by electronic digital weighing machine. The process is done consecutively for 10

days from 7th June, 2019 to 16th June, 2019. Characterization of the sample is done manually by hand sorting.

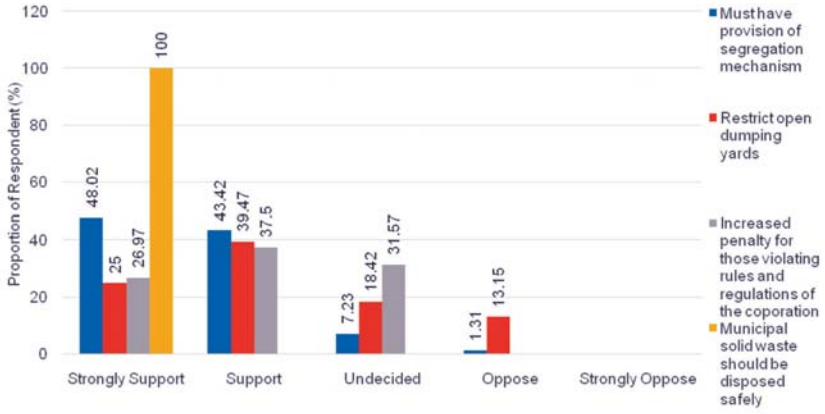
Data Analysis

Microsoft office and Microsoft excel were used to analyse the data obtained from the field work.

Fig. 1 & 2. Picture depicting manually hand sorting and weighing of solid waste

Results and Discussion

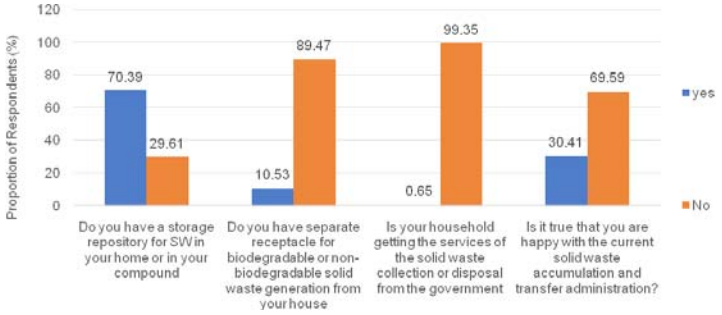
Figure 2 shows the public perception towards the practices of solid waste. When the villagers are asked about having a provision of segregation mechanism, 48.02% of the respondents strongly support this mechanism, 43.42 % support, 7.23 % are still undecided and 1.31 % of the respondents oppose the segregation mechanism. So, from the information obtained, more than 90 % of the respondents accepted the mechanism of solid waste segregation. The minority of the respondents who are still oppose/undecided for segregations may be due to lack of awareness. The other reason may be because of lower literacy from the village. When asked about Restrict open dumping yard, 25 % strongly support and 39.47 % support the action. But 18.42 % of the respondents were undecided and 13.15 % of the respondents are opposed of restricting the open dumping. This opposing of the restriction of open dumping may be due to the reason that government services are not provided for handling the household solid waste. Also, there is no land fill or composting facility. On the part of increasing penalties for those violating the rules and regulation, 26.97 %, and 37.50 % vote for strongly support and support respectively. But 31.57 % vote for undecided/ do not know. On disposing of the solid waste safely 100 % of the respondents vote for strongly supports. The people in Jant village are willing to corporate for better handling and disposing of their household solid waste if government or any non-government bodies provide them with facilities of formal segregation, resource recovery, composting facilities etc. are given.



(n=210 respondents)

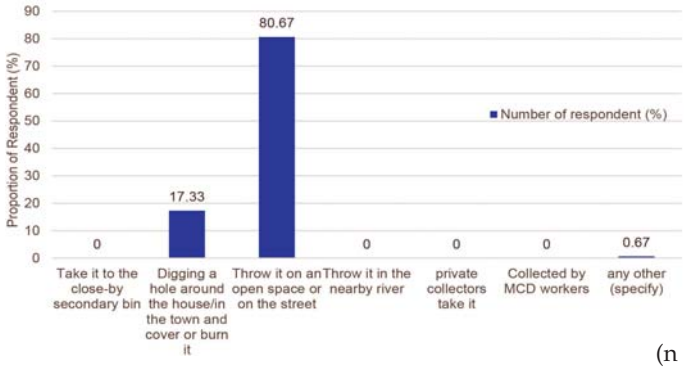
Fig. 2. Public perception towards solid waste practices.

Figure 3 shows the management of solid waste by the households. Majority of the households do not know the importance of segregating their household into different components viz, biodegradable, and non-biodegradable. It is found that 70.39 % have storage repository but 29.61 % do not have storage repository. From the survey, it is found that 89.47 % of the household do not have separate bins for biodegradable waste and non-biodegradable waste and 10.53 % do have separate bins for biodegradable and



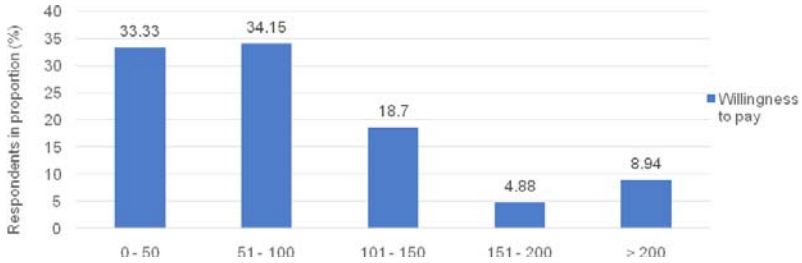
(n = 210 households)

Fig. 3. Household solid waste management by Jant villagers



(n = 210)

Fig. 4. Household solid waste disposal practices in Jant village



(n = 210 respondents)

Fig. 5. Proportion of rediness to pay for solid waste disposal service

Table 1. Total composition of solid waste generation in Jant village in Kg/ day. (n = 20 households)

Food waste	Plastic	Paper	Ash/ Earthenware	Textile	Glass	Metallic	Others	Total
83.899	13.689	7.5232	5.495	2.57	2.52	0.275	0.83	116.8012

(n = 20 households)

Table 2. Solid waste generation per person per day by 20 households in Jant village

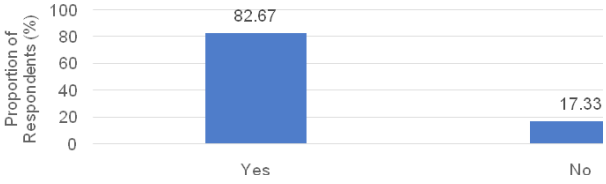
Total Households	Total Number of Days	Total household family Members	Total Solid waste (Kg)	Solid waste generation per person per day (Kg)
20	10	99	116.8012	0.117

non-biodegradable waste. In this village, it is found that no service for waste collection is present. Majority of the people here, 69.59 % are not happy with the current solid waste management and transfer administration. But 30.41 % of the respondent are happy by the administration of solid waste management in Jant village.

From Figure 4, it is found that 80.67 % of the household respondents throw their waste in an open space or on the street. The reason may be because of not getting the services of solid waste gathering or transfer from the government. There are no formal family unit squander isolation facilities, resource recuperation and composting are accessible. 17.33 % of the households dig a hole around the house and burn it. 1.33 % of the households follows both digging a hole around the house and throw it on an open space or on the street. From Figure 7 and Table 1, majority of the waste are organic which is thrown in the open space can be used as a resource. This unutilised solid waste can be managed if the people are given some basic skills like gardening or flowering then people will realize it as a resource.

Figure 5 represents the positive response of the public to pay for solid waste management service. And 82.67 % of the respondents give positive response that they are willing to cooperate. But 17.33 % of the respondents give a negative response. This may be because of monetary inclusion as the respondents have poor economic condition. Also, from the figure 6, which depict the range of monetary amount, as the amount of rupees increases the willingness to pay decreases. 33.33 %, 34.15 %, 18.70 %, 4.88 %, and 8.94 % of the respondents are willing to pay in the range of 0- 50 rupees, 51- 100 rupees, 101-150 rupees, 151-200 and 200 rupees respectively. So, the public willingness to pay affects the public opinion on how much they are to pay. It is most feasible to have 101-150 rupees range for the Jant village.

As per the figure 7 and table 1, kitchen waste or food waste constitute the highest portion of the waste, 71.83 % or 83.899 kg per day followed by plastic waste, 11.72 %, or 13.689 kg per day. Thirdly, paper waste constitutes 6.44 % or 7.5232 kg per day of the waste. Fourth highest constitute Ash/Earthenware waste, 4.7 %, or 5.495 kg per day of the waste. Fifth is constituted by textile, 2.2%, or 2.57 kg per of the waste. Sixth is constituted by glass, 2.16%, or 2.52 kg per day. Seventh place is constituted by some miscellaneous waste. And lastly, metallic waste constitutes 0.24% or 0.275 kg per day of the waste. The reason for low metallic waste may be because it can be reuse or are sale for scrapping purpose. According to the World Bank report 2016, the per individual solid waste is 0. 74kg. Table 2 reveals thatthe average amount of solid waste generated per person in Jant village is 0.117 kg which is relatively lower thanany cities of the world. The reason may be because the village is in remote location of Mahendragarh district of Haryana, in cities people live an affluent life style, the villagers used the refuse for fuel and they reused the products like plastic/ polythene, metals, cardboard, textiles, glass, etc. Also, the per capita per day generation of Metropolitan solid waste in India ranges from about 100g to 500g in huge town Surindra Suthar and Pavitra Singh (2014). The solid wastegeneration can be contrasted with urban communities of India and other developing cities like Delhi 0.60 kg/person/day, Bangalore 0.53 kg/person/day, Calcutta 0.51 kg/person/day, Hyderabad 0.35 kg/person/day, Sonipat 0.343 kg/person/day, Hardwar 0.40 kg/person/day, Meerut 0.45 kg/person/day, Dehradun 19.6 – 115.8 g/person/day, Dar- es- salaam city (Tanzania) 0.99 kg/person/day, Mexicali (Mexico) 0.981 kg/person/day, Ghana 0.24 – 0.66 kg/person/day Vijay Kumar *et al.*(2013), Surindra Suthar *et al.*(2014), Senzige *et al.* (2014), Benitez *et al.* (2008), Miezah *et al.* (2015).



(n = 210 respondents)

Fig. 6. Range of Amount in rupees willingness to pay for solid waste management service

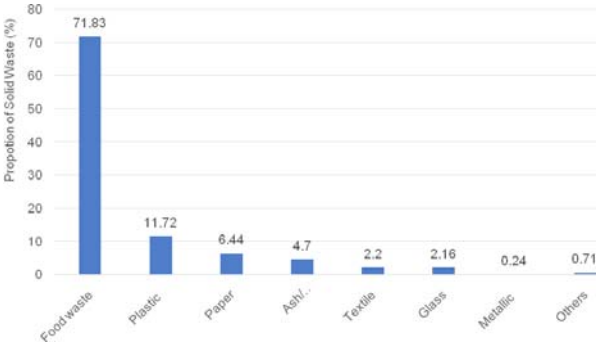


Fig. 7. Proportion of solid waste in Jant village

Conclusion

The results clearly suggest that people give a positive response for managing their household solid waste. But the problems arise from not having sufficient facilities like landfill for composting, recycling facility, refuse recovery, services from government, etc. There is need to give efforts for composting and bio- fuel conversion programmes as most of the household waste are biodegradable. The examination uncovered that there is lacking of facility for solid waste recuperation. And if this waste is utilised, the waste can become a resource for the community. The waste can be utilised for gardening as a manure. From the analysis of the result, it is found that 82.67 percent of the households are willing to pay to improve the services for solid waste management. As compared with the other cities of India and other emerging countries, the solid waste generated from the Jant village is comparatively very less. Most of the waste so generated especially the food waste from the household, they used it to feed their life stock like buffaloes. Others wastes like the paper, plastic and textiles are used to burn for cooking. These factors play the major roles for less generation of solid waste from the village. Also considering the environment and human health issues, the burning of these materials will have negative implication. The people in the village need to inculcate and give awareness on proper disposal of the solid waste, public participation for rendering the services of appropriate administration on solid waste, the value of waste as an asset, health, and environmental implication from burning of solid waste. For this proficient and compelling administration of solid waste, people participation is very important. The people can encourage one another to practice proper management. This study can be a reference for future studies and as per the information gathered from this study, more attention needs to be given on giving awareness to the people because people ignorant on the implication of improper disposal can exert a profound influence on the behaviour and attitudes towards both the consumption and waste generation.

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