

Municipal Solid Waste Management in Okhla Locality of South Delhi

Shabana Yasmin and Nasruddin***

ABSTRACT

With rapid urbanization and the never-ending process of migration to cities, the greatest challenge in front of civic authorities is the proper and safe disposal of solid waste. In the scenario of solid waste management, most important is the problems exist at household level. In face of unavailability in waste collection system, residents find their own ways to tackle the problem of solid waste management. The paper is based on the research work conducted at micro level focusing a highly congested locality of NCT of Delhi, observes the practices of municipal solid waste management at household level. Around 600 households belonging to various socio-economic strata were surveyed. The focus was on the amount of waste generated, its constituents and finally its disposal practices by the households. The paper highlights the generation of households waste from different socio-economic strata. The paper also highlights not only the role of people in managing the safe disposal of solid waste but the economics of solid waste management operating within these localities.

Keywords: *Solid Waste, Congestion, Households, Socio-Economic Strata*

Introduction

The concerns about solid waste managements system arise from the basic level of development i.e. the generation of waste to storage of waste and primary collection of household waste and the available infrastructure to not only dispose off but also recycle solid waste which is called garbage, rubbish, trash or refuse. Since solid wastes are all waste arising from human activities which are discarded as unwanted and useless, is thereby mean any garbage, refuse or throw away material of a particular nature coming from community activities, especially in urban areas.

With the never-ending process of huge populations being drawn to the limited space of cities, the greatest challenge in front of the civic authorities in almost all the nations is the proper disposal of solid waste generated. According to United Nations Development Programme (1997), the uncollected

* Associated With Jamia Millia Islamia, New Delhi, India

** Assistant Director, Regional Center for Urban & Environmental Studies, Lucknow University, Lucknow

waste in the urban areas is the second most important problems faced by the residents after unemployment. From one- to two - thirds of the solid waste is either not collected or not disposed off properly, which is lying strewn on the roads, entering into the drain, causing choked sewer and stagnant sewer water on the roads, urban flooding during rains, breeding of insects and rodent vectors and spread of diseases. Thus, the ultimate aim of solid waste management is to include all activities that can minimize impact of solid waste on health, environment and aesthetic.

The organic and biodegradable component of municipal solid waste is important since in densely populated parts of the cities, it causes adverse impact on public health and environmental quality. Apart from the stray animals and rodents, insects; it also leads to foul odors and unpleasantness. These impacts are not limited to only garbage disposal site but also garbage generation sites which suffer from accumulated waste. The other constituents of waste including hazardous chemical pollutants and sharps are sources of diseases and injuries especially among children, rag pickers and employees among waste management sector.

The disposal system is influenced by the inaccessibility of lanes and by lanes since the width of the lanes, congestion, unmettled surfaces are a common feature in large parts of Delhi. According to Asnani (2004), the legal framework of 2000 of MCD is being tried to be complied with the different wings of MCD. Still only 38% of the primary collection, 41% storage at source, 52% of the transportation of the solid waste is being complied with 2000 rules. The main causes assign to the non-compliance with the 2000 rule are - lack of civil sense and habits of people to litter garbage, lack of litter bins in the city, long distances between community bins, unavailability of primary collection vehicles and equipments, lack of personal door to door collection and lack of suitable containers. The ineffective transportation of waste is assigned to old vehicles which are difficult to replace.

In the scenario of solid waste management, most significant is the problem found at household level solid waste generation. In face of unavailability and inaccessibility to municipal bins and waste collection system, most of the households, shops and establishment throw their waste just outside their premises on the streets or any dumping site available nearby.

The quantity of solid waste being produced is calculated on average basis and is expressed as Kg/capita/day. The densities of solid waste range typically between 0.05 to 1.0gcm. The nature and character of solid waste have a direct bearing on the socio-economic status of the population generating it. The huge amount of solid waste being generated in cities has become a major

problem not only in developed countries but also in developing too. The inefficiency at part of municipal authorities to collect all the waste and dispose off properly is a major concern today.

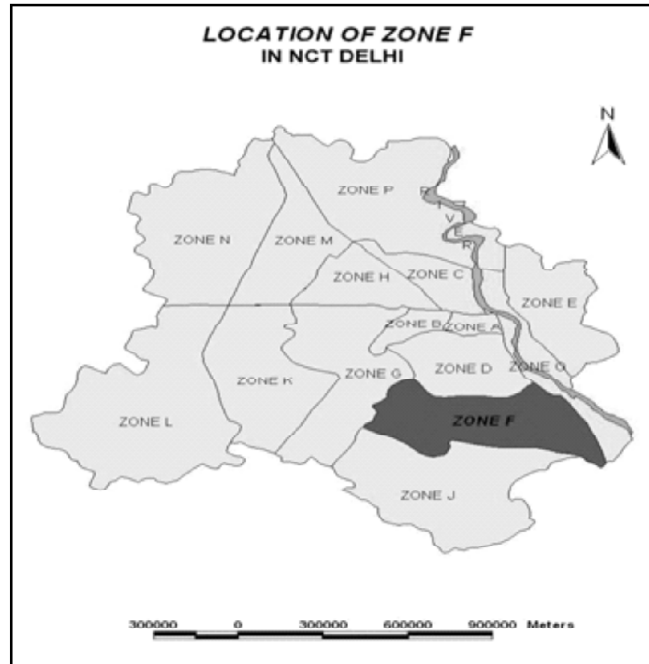
Selection of the Study Area

The National Capital Territory (NCT) of Delhi, the capital of India is one of the largest metropolitan cities. It has become the nucleus of a major metropolitan region, thus facing all the urban environmental problems. The urban population in Delhi is increasing at an alarming rate due to higher rate of migration from neighboring states as it forms a part of National Capital Region (NCR). However, the rapid rise in population growth could not be matched with expansion of geographical area of the city of Delhi (Fig.1). This has resulted in chaotic development of unplanned urban built environment, encouraging unplanned mixed land-use along with alarming increase of pollution levels. Due to the limited land for urban development, the cost of land is rising very rapidly.

To conduct the research, Okhla area of South district of Delhi is selected. In the context of Urban Delhi, Okhla is identifiable with its high density and green character. With increase in the number of educational institutes, health research centers and administrative offices, and also industrial units there is a heavy influx of population from all socio-economic background. Thus, south Delhi presents a landscape of contrast-posh colonies existing side by side with slums.

Therefore, to bring out the pattern of solid waste management in the households from various income groups living in different sets of socio-economic status of the locality, the study areas is divided into four economic categories. The first category is of the low income areas comprises of NaiBasti, Haji Colony, OkhlaVihar, MasihGarh, Khizrabad, and TaimoorNagar. The second category is of the middle income areas comprises of AbulFazal, SaraiJullena, Jogabai Ext., Noor Nagar, Batla House, Okhla Village and Bharat Nagar. The third category is of the uppermiddle income areas comprises of Zakir Nagar, Zakir Nagar (w), GaffarManzil and Johri Farm. Zakir Nagar and Zakir Nagar (w). The fourth category is of the high income areas comprise of SukhdevVihar, New Friends Colony and Friends Colony (Fig. 3).

Zone F covers considerable part of South District with a total area of 119.58 sq. kms (ZDP, DDA: 1998). The Zone F has been further divided in 19 sub-zones (Fig. 2). These sub-zones are originally demarcated in Master Plan of Delhi-1962 (MPD-1962) and still form the base for all DDA planning.



Source: DDA Zone Development Plan 1998

Aims and Objectives

The basic *aim* of the study is to gather information about the existing situation of solid waste management in metro city of Delhi. Since there are variations in social, economic and behavioral condition of population in one part of the area to another, a set of representative population belonging to various income group localities is studied to find out the practices of solid waste management practices. This is being achieved through the following *objectives*:

1. to find out the *outdoor living environment* of different localities,
2. to find out the socio-economic aspects of *generator* of municipal solid waste at *household level*,
3. to find out the *amount and constituents of solid waste generated* in different income group localities,
4. to find out the practices of *solid waste management by the target population* across different income localities,
5. to suggest, if any, the *line of action for effective management of solid waste* at both *lane and household level* to maintain a healthy environment of a highly densely populated part of a metro city of Delhi.

Methodology

Although waste management is supposed to be a domain of engineers and technical persons, it is essential to realize that the various elements of solid waste management from its generation to its collection and recycling are all influenced by mix of factors. Thus, not only the local, institutional and financial context is important which is influenced by national policies, legislation and policies but also by the socio-cultural and economic composition of population which is involved in each and every stage of solid waste management. Therefore, the approach to the present study is holistic and intends to follow an integrated approach through various determinates of solid waste management. This is being attempted through a number of steps, firstly to understand the physical environment of the generator of solid waste, their socio-cultural background influencing the type of solid waste generation, their economic background influencing the solid management techniques. Thus, the study has tried to integrate indicators of outdoor living environment to indoor socio-economic environment of the population belonging to various income level strata, residing in different economic status localities and behaving differently under their living circumstances. Thus, a cross income behavioral pattern of respondents is analyzed to find out the methods of household waste collection and its disposal as per their own levels of convenience.

To conduct the field survey, a pilot survey was carried out first. It was decided that MCD ward number 7 are fulfilling the set objectives since, these are occupied by high, upper middle, middle and low-income group of population and also exhibiting a highly diverse land-use pattern, where inter and intra sample variations are expected to be maximum. As per 2001 Census of India, the details of the surveyed localities in the study area of ward number 7 are as follows. The ward number 7 consists of total households of 17,790 in which the surveyed localities are NaiBasti, Haji Coloney, OkhlaVihar, MasihGarh, Khizrabad, and TaimoorNagar, The middle income areas comprises of AbulFazal, SaraiJullena, Jogabai Ext., Noor Nagar, Batla House, Okhla Village and Bharat Nagar, The uppermiddle income areas comprises of Zakir Nagar, Zakir Nagar (w), GaffarManzil and Johri Farm. Zakir Nagar and Zakir Nagar (w), The high income areas comprises of SukhdevVihar, New Friends Colony and Friends Colony.

Results and Discussion

Lane Level Analysis

- **Metaled Or Unmetaled Lanes:** The survey results show this percentage is almost constant in posh localities with 100% mettaled roads as found

Status of the Localities				
<i>Ward No.</i>	<i>Selected Areas</i>	<i>Total No. of Households</i>	<i>Economic Status</i>	<i>Number of Surveyed Households</i>
7	Haji Colony	551	Primarily Low Income	17
7	NaiBasti	584	Primarily Low Income	18
7	OkhlaVihar	1034	Primarily Low and Middle Income	31
7	MasihGarh	307	Low / Middle Income Group	10
7	Taimoor Nagar	1021	Low/Middle Income Group	31
7	Noor Nagar	600	Middle / High Income Group	18
7	Zakir Nagar	2263	Upper Middle/High Income Group	68
7	Zakir Nagar (West)	628	Upper Middle/High Income Group	19
7	Khizrabad	637	Primarily Low Income	20
7	AbulFazal	5533	Middle /Upper Middle Income Group	167
7	Bharat Nagar	426	Middle /Upper Middle Income Group	13
7	SaraiJullena	315	Middle/Upper Middle Income Group	10
7	Johri Farm	609	Upper Middle/High Income Group	19
7	Jogabai Ext.	1467	Middle Low Income Group	45
7	GaffarManzil	445	Upper Middle/High Income Group	14
7	SukhdevVihar	131	High Income Group	10
7	Friends Colony	309	High Income Group	20
7	New Friends Colony	1145	High Income Group	35
7	Okhla Village	1043	Middle /Upper Middle Income Group	32
7	Batla House	2037	Middle/Low Income Group	62

in Friends colony and New Friends Colony. While around 30% of the lanes in low and middle income areas generally inhabited by low and middle income groups like Haji Colony, NaiBasti, parts of Khizrabad and SaraiJullena, JogaBai Ext. and Batla House. At the time of the survey AbulFazal and OkhlaVihar was totally covered by unmettled roads with little or no sweeping by MCD.

- **Sewer System:** In the study area within the low and middle income group, around 46% households mainly from the unauthorized areas of Haji Colony, OkhlaVihar, JogaBai Ext. and AbulFazal do not have proper sewer lines while even in authorized areas, 10% sewer lines in Batla House, Bharat Nagar and SariaJullena are over flowing or waterlogged because of the chocking of sewer lines with household garbage due to ever increasing pressure of population in these areas. GaffarManzil is the only area in upper middle income group without proper sewer lines at the time of survey. However, the overall situation suggests that the whole area in upper middle and high income areas have sufficient and proper sewer lines though with chocked conditions mostly in Zakir Nagar.

- **Average Size of the Plot:** It suggests the overall space *congestion* and *crowding* is the number of persons living per 100 sq. yards. These two are very important parameters in studying solid waste generation in the study area. The average size of plot in low and middle income localities ranges from 50 to 250 sq. yards and crowding from 300 to 80 persons/100 sq. yards in low income localities and 820 to 112 persons/100sq. yards in middle income localities. In upper middle income group, the crowding decreases from 185 to 49 persons/100sq. yards. But it is surprising to note that the size of plot in upper middle income category decreases from 211 to 117 sq. yards. On the other hand, households occupying the well planned and posh localities of Friends Colony and New Friends Colony have large size of plots which ranges from 250 sq. yards to 350 sq. yards but crowding status varies in this level from 20 to 50 persons/100sq. yards. Thus with rising income, space congestion is increasing and the amount of solid waste generated is also increasing.
- **Availability Of Waste Disposal Sites:** 85% of the households within the planned and authorized areas of New Friends Colony, Friends Colony and Sukhdev Vihar responded that they have *proper disposal sites* in their areas. On the contrary, the situation becomes grave in low, middle and upper middle income localities of Batla House, Nai Basti, Haji Colony, Zakir Nagar and Johri Farm where almost all households responded that do not have proper disposal sites in near proximity therefore, are forced to manage the disposal of household garbage on their own. Narrow lanes and by lanes, due to the unplanned and haphazard growth of these areas, are also not fit for the construction of *dhalaoes* or placement of municipality bins since their mere placement is objected upon by local population for the reason of congestion, crowding and lack of frequent cleaning of such disposal sites.
- **Road Sweeping :** Checking the regularity of road sweeping it was found that 47% household in low income localities, 46% households from middle income localities, 64% from upper middle localities and 100% in high income localities admitted daily sweeping by MCD *karamcharies*.
- **Proper disposal sites:** In the absence of proper disposal sites provided by MCD in nearly all low, middle and upper middle income group localities, garbage dumping in vacant plots is very common especially by the very poor people earning less than. In low income localities of Haji Colony and Okhla Vihar there are 30 vacant plots which were used by the residents for dumping garbage. In AbulFazal, Joga Bai Ext., and Batla House, there are 264 vacant plots whether on the main road or inside the lanes and by lanes, are full of garbage as observed during the survey. On the other hand, there are only 19 vacant plots in financially well off as well as

congested areas of Zakir Nagar, Gaffar Manzil and Zakir Nagar (w) therefore dumping in vacant plots is less while there are no vacant plots in well planned and most sought after areas of New Friends, xFriends Colony and Sukhdev Vihar. Moreover these areas have proper disposal sites.

- **The Disposal of Waste in Proper Collection Sites:** The well planned areas of New Friends Colony and Friends Colony with wide roads have the facility of more number of MCD dustbins/ *dhalaoe*, therefore the around 80% residents responded that the dustbins are within a manageable distance from their houses, still nearly all (100%) the houses in these areas prefer to employ private waste collectors to collect the waste from their door step. However, the situation is very different in low, middle and upper middle income localities 100% complained that the disposal site is outside their lane and it takes longer than 10 minutes to walk to the disposal site since they cannot avail this facility. It is also observed that because of the absence of proper disposal site in the lanes, residents have to largely depend on private waste collectors who are generally very irregular and in the absence of private collectors their garbage finds its way in vacant plots. These vacant plots have become a breeding ground of flies and rodents in these areas creating problem of health and sanitation in the study area.

Household Level Analysis

- **Average Income:** The households with lowest average income around less than Rs. 5,000 spend nearly 65% of their income on food as food is their first priority while expenditure on non-food is only 35%. The percentage of expenditure on food decreases with rise in income from 65% to 32% in low income group in the areas comprising of Haji Colony, Nai Basti and Masih Garh. The expenditure on food further decreases from 43% to nearly 15% in middle income group areas comprising of Batla House, Noor Nagar and AbulFazal. This leads to an increase in the percentage of expenditure on non-food items with increase in income levels in all through the low, middle and also in upper middle income group localities. These results are also true for high income group occupying the areas of Friends Colony and New Friends Colony except in less than 20,000 income level which show a surprising results with 68% of the income being spend on food while rest on non-food as the family size is large despite low family income.
- **Dietary Habbits:** It is observed that there is an improvement in the diet of households in the form of fruits and snacks with rising income levels. This trend is observed in all the income localities where all (100%)

households eat vegetables and cereals, only 40% percentage of households eat fruits in low income areas of OkhlaVihar and Haji Colony and only 2% take beverages and snacks. This percentage of taking fruits, snacks and beverages increases with the family income as nearly 75% households take fruits in middle income areas of Batla House and Noor Nagar. In Muslim dominated areas of low and middle income localities, the main constituent of diet is meat which in lower income localities is generally beef; middle income localities is mutton, chicken and fish. But it is observed that up to a certain level of income, income affect the dietary habits and constituents of diet. After, economic stability and rising income levels, the dietary habits start depending on the mindset of the people. This phenomenon is noticed that all the 100% households of upper middle and high income group eat fruits and 80% include snacks and beverages in their diet irrespective of their religion.

- **Amount of Generation of Solid Waste:** At household level generation of waste is affected by the average income, religion, dietary habits and constituents of diet along with congestion and crowding, status of locality. Amongst these, average income is the most important. It is observed that waste generation is very less in low income localities of Nai Basti, OkhlaVihar and Khizrabad, which ranges from 1.1 kg to 1.4 kg/household as these households are poor and they discard very few items in their garbage bins and keep the milk sachets, rags, plastic bottles and cans to sell it to *Kabariwalas*. While the quantity of generation of waste increases with the rise in average income and the economic status of the localities. In middle and upper middle income group localities of AbulFazal, Noor Nagar, Zakir Nagar and Johri Farm, it ranges from 1.1 to 2.9 kg/ household because of the increase in expenditure on variety of fruits, vegetables, canned food and bottles of beverages while in high income group localities of SukhdevVihar and Friends Colony, generation of waste ranges from 3 kg to 4 kg/ household because they have large plots (which include lawns) which generate a lot of organic waste like garden waste, moreover, they buy a lot of 'use and throw' products which increases the weight of the waste.
- **Constituents of Solid Waste:** In low income localities of NaiBasti, Haji Colony and OkhlaVihar, vegetable peels and paper and polythene form almost an equal proportion of solid waste produced from the households within all income levels. However, there is a slight decrease in the percentage share of the vegetable peels and polythene with an increase in the status of income group localities, from about 39% in low income localities it decreases to 25% in high income localities since the other constituents of waste take over as noticed from the data like fruit waste

increases from 13% to 25% in low to high income localities. The content of bones in the kitchen waste are a character of the waste from Muslim dominated localities and low to upper middle income localities like Zakir Nagar, GaffarManzil, and Johri Farm were the percentage of bones increases from 6% to 12% . The most striking observation regarding organic waste is the increase in fruit waste, which is almost double from 13% in low income localities to 25% in high income localities. The content of garden waste is absent in low income localities and only 3% to 6% in middle to upper middle localities becomes a major component of the constituent of organic waste of high income areas with 23% of the constituent of solid waste.

- **Collection Of Waste:** In low and middle income group localities of NaiBasti, Okhla Vihar and Abul Fazal and Noor Nagar nearly 70% to 72% households dispose off their household waste to *private waste collectors* while 13% to 15% dump their household waste in nearby plots and only remaining 2% to 15% of households dispose off their household waste in nearby dustbins mainly from Taimoor Nagar and Masih Garh while another 2% to 12% throw their waste in any other place in their area. Nearly 78% households in upper middle income areas of Zakir Nagar, Gaffar Manzil, and Johri Farm give waste to private waste collector and only 15% dispose off in vacant plots, 3% in nearby dustbin while another 4% in any other place. While all (100%) the households of high income areas of New Friends Colony, Friends Colony and Sukhdev Vihar employ private collectors to dispose off their household solid waste. It shows the civic sense of the society in this part of the study area who despite of their limiting finances, are employing private waste collectors (*Kudewala*) to collect their household garbage/ waste.

Suggestions

In context with the problem of solid waste management in the study area, following are some suggestions regarding the efficiency of solid waste management:

- There is a critical absence of *litter bins* in low, middle and upper middle localities which are an essential requirement to make the streets litter free. This is especially required in congested and crowded streets of Zakir Nagar, GaffarManzil, Batla House, JogaBai Ext. and Bharat Nagar with a lot of eating outlets, *dhabas* and shops. These litter bins should be cleaned frequently to avoid over spilling.
- Daily sweeping of roads is an essential requirement in all the areas irrespective of their authorized or unauthorized status. With the

rapidly increasing density of population in the study area, the inner lanes and by lanes of especially low and middle income localities are badly ignored by MCD. With highly congested status of such area, the littering of garbage on roads is a critical area of environmental hygiene. Further more, the sewers especially in rainy season get clogged by free flow of garbage in sewers lines resulting in stagnant water and breeding of mosquitoes which causes many outbreaks of seasonal diseases.

- Clean and closed sewer system is an essential condition for a clean healthy society. As observed during field survey that near about 8% to 10% of the sewers in Batla House, Zakir Nagar, Noor Nagar, Joga Bai Ext. and Okhla Village are found to be over flowing though it was dry period (summers) at the time of survey. The residents complained that the percentage of choked sewer increases during monsoons. Therefore, it is suggested that the sewers should be cleaned and de silted regularly and especially before the on set of monsoon season in all the localities to avoid choking and thereby overflow of sewers water on streets.
- *Dhalaos* as secondary collection points are found to be over spilling with garbage, reflecting a scarcity in relation to their requirement. Therefore, *dhalaoes* and dustbins are important in every locality of the low, middle and upper middle income group therefore they should be built in all the localities and within short distances, for the locals to avail this facility.
- As *community bins* are very effective for collection of waste from households within the premises of their multi storied building and apartments like in Abul Fazal, Batla House and parts of Zakir Nagar and Zakir Nagar (W). It should be assured that these bins are emptied and cleaned almost daily to avoid further inconveniences like decaying garbage, rodents and insects since it promotes the syndrome of 'not in my backyard'.
- To improve the condition of roads/lanes sweeping in most of the low and middle income localities of Abul Fazal, Khizrabad, Haji Colony and Okhla Vihar where lanes / roads are unmetalled and full of pot holes. Therefore, it is suggested to make metalled roads/lanes in these areas as it will make the sweeping operation easy which will improve outdoor/ neighbourhood living environment.
- Although, the primary collection of waste from household is the second most important step in the processing of solid waste. In case of Bangalore, North Dum Dum and New Barrackpore in West Bengal,

and Ahmedabad municipalities have entered into contract with either private contractors, private sanitation workers, NGOs and RWAs for door to door collection of household garbage. Since MCD does not provide such facilities in face of an inefficient primary collection system, households have taken their own system of household waste through private waste collectors who are very irregular and unorganized as is observed during field survey. Therefore, it is suggested that the door to door collection of household waste should be provided by the municipal authorities on an organized basis by making a contract with the private sector. Municipal authorities can prepare reasonably sized economic packages to make such contracts viable.

- The organic waste like vegetable peels and fruits which are never segregated either at the source of generation of household waste should be given special attention. There is an immediate need for establishing low cost organic waste composting, vermin composting, anaerobic digestion, or any other appropriate biological processing for stabilization of waste. Since the bio-degradable waste procures low cost after processing, a private public partnership can pay well
- It was observed during the field survey and also analyzed through various variables like regularity, status of complains, status of sewers, nature of lanes, sweeping routine etc. that the MCD is more busy in satisfying and working for the privileged classes i.e. the high income group localities like New Friends Colony, Sukhdev Vihar and Friends Colony in the study area and neglecting the poor and middle class population. Nearly 70% of the households in low, middle and upper middle income localities of Abul Fazal, Zakir Nagar, Haji Colony, Okhla Vihar, Johri Farm and Batla House are not satisfied with the staff of MCD in the their areas. Therefore, it is suggested that the MCD should equally look after the needs of all income group population as everyone pays tax for the service provided by MCD.
- The growing congestion and crowding in the study area especially in low, middle and upper middle income localities, it is suggested that MCD should increase the number of its staff in the study area for road sweeping and work out the two important problems related with solid waste management in the study area: firstly, the primary collection of household garbage and its effective disposal, secondly, the proper road sweeping including the removal of unattended garbage littering the roads.
- The public awareness of and attitude towards the problems related with the waste generation and its effective disposal to the collection

sites either on their own or through public private partnership can affect the entire solid waste management system. All steps in solid waste management – from household waste storage to waste segregation, recycling, collection frequency, littering depend on public awareness and participation. Therefore, public awareness about all these aspects of solid waste management should be created by the NGOs working in this field such as ACCORD and Toxic Link working in the study area and also by municipal authorities.

- Segregation of waste should be promoted at the waste generation source itself since there are a number of polyclinics in the study area who throw their medical waste in municipal bins, it is the duty of the municipalities to act hard on such polyclinics to prevent the special waste from being mixed with ordinary municipal solid waste..
- As the overall responsibility of solid waste management is in the hands of municipalities and MCD in case of Delhi, it is important for the municipal authorities to collect useful information on quantity and quality of waste generated in different wards if they want to implement the 3Rs (Refuse, Recycle and Reuse) in the Municipal Solid Waste (Management and Handling) 2000 Rules successfully. They should also ascertain the physical and chemical composition of various categories of waste, such as waste generated from households, from shops and establishments, from polyclinic and nursing homes and so on in different wards which will help in facilitating the micro planning of waste management in compliance with the 2000 Rules. Therefore, it is suggested that the authorities must consider specialized strategies for different waste generators such as households, shops and commercial establishment, hospitals etc. and take appropriate measures for the different levels in the solid waste management chain (households level, neighborhood level and so on) and coordinate with the different actors involved in the management of solid waste at all levels
- As the garbage generation rate varies seasonally and mass of garbage is higher in monsoon season due to the presence of moisture in it, therefore, special arrangements of waste collection and disposal should be made by the authorities in monsoon season.
- Although, informal sector is doing a fruitful job by collecting, sorting and recycling waste material from domestic and commercial sources, a little involvement of municipal authorities with some manageable funds and technology can improve the solid waste management problem in congested localities of metro cities of India including the city of Delhi.

- The role of rag pickers practicing waste segregation 5% to 10%, at the disposal sites should be brought at the level of source of waste generation (household) itself as found in Vejalpur, Ahmedabad where rag pickers are mobilized by NGOs to collect recyclable waste directly from the house.
- It is observed during the field survey that only about 65% of the total solid waste generated, is collected by the MCD and the remaining 35% is left unattended which is the root cause of many environmental and health problems. Therefore, it is suggested that the MCD should increase its percentage of efficiency of collection of solid waste management in the study area.

Therefore, the present study despite its limitation has been successful in highlighting the solid waste management status as far as the generation and primary collection from the households is concerned. Further, the study successfully highlights the socio-economic status, dietary habits and the amount of organic waste which is finally disposed off by the households or collected by the private waste pickers. The study further, reflect the inhibition of the target population about the role of MCD and also there own rule of law to tackle with uncollected solid waste in the form of their willingness even to pay extra for keeping not only the households but also their door step clean. Therefore, it is suggested that the congested and crowded localities like the area under study, the public private partnership can take care of solid waste management effectively.

References

- Akolkar, A.B. (2005), *Status of Solid Waste Management in India: Implementation Status of Municipal Solid Waste, Management, and Handling Rules 2000*, New Delhi: Central Pollution Control Board.
- Asanani, P. V. (1987), *Modernization of Solid Waste Management Practices in India*, Govt. of India, Ministry of Urban Development.
- Asnani, P. U. (2006), *Solid Waste Management in India Infrastructure Report 2006*, Urban Infrastructure, ed. Anupam, R.160-89, New Delhi, Oxford University Press.
- Bhide, A.D., (1988), *Policy Paper on Waste Utilization in India*, Report for Ministry for Environment and Forest, NEERI, Nagpur.
- Bhinde, A.D. *et al.* (1975), *Studies on Refuse in Indian Cities, A Case Study*, Indian Journal of Environmental Health, Vol. 17 No. 1.
- Bhinde, A.D. *et al.* (1975), *Studies on Refuse in Indian Cities, Part II: Variation in Quantity and Quality*, Indian Journal of Environmental Health, Vol. 17, No.3.
- Bhinde, A.D. *et al.* (1975), *Studies on Refuse in Indian Cities, Part III: Cost Economic*, Indian Journal of Environmental Health, Vol. 17, No. 3.

- Bhumika, K. (2003), *This Garbage Raises No Stink*, Times of India, New Delhi.
- Botkin and Keller (1995), *Waste Management, Environmental Sciences-Earth as a Living Planet*.
- Chattnett, E. T. (1973), *Water Resources and Environmental Engineering*. Environmental Protection, McGraw Hill Series.
- Choudhary, B. K. (2007), *Managing Solid Waste in Delhi: a critical appraisal of the role of municipal bodies*, National Geographic Journal of India, vol. 53.
- CPCB (Central Pollution Control Board), (1995), *Management of Municipal Solid Waste - Status and Options*, CUPS/46/1994-1995, CPCB, Ministry of Environment and Forest, New Delhi.
- CPCB (Central Pollution Control Board), (1999), *Status of Municipal Solid Waste Generation, Collection, Treatment and Disposal in Class I Cities*, CUPS/46/1998-1999, CPCB, Ministry of Environment and Forest, New Delhi.
- CPCB (Central Pollution Control Board), (2000a), *Status of Municipal Solid Waste Generation, Collection, Treatment and Disposal in Class I Cities*, CUPS/46/1999-2000, CPCB, Ministry of Environment and Forest, New Delhi.
- CPCB (Central Pollution Control Board), (2000b), *Status of Municipal Solid Waste Generation, Collection, Treatment and Disposal in Class II Towns*, CUPS/48/1999-2000, CPCB, Ministry of Environment and Forest, New Delhi.
- EIONET (European Topic Centre on Resource and Waste Management) (2006), *An Introduction to Waste*.
- Environmental Protection Agency, (2006), *What is waste and type of waste*. Victoria.
- Gandok, T. K. *Risk in Delhi: Environmental Concern*, HSMI (HUDCO), New Delhi.
- Gosh, A. (2000), *Solid Waste Management In Delhi-an explanatory study*, Institute of Social Sciences, New Delhi.
- Infrastructure Development Cooperation(Karnataka) Limited, (2005), *Review of Contractual Aggrements in SWM Final Report*, Infrastructure Development Cooperation(Karnataka) Limited, Bangalore India.
- Jain, P.K. (1984), *Solid Waste Management in Delhi*, Civic Affairs, MCD, New Delhi, vol. 31, No. 12.
- Jain, V. (2006), *India Together: No wasteful business this! Household Waste in India and Germany*, Toxic Links, Jangpura, New Delhi.
- JICA(Japan International Cooperation Agency) (2004), *Final Report on Pilot Project on Segregation of Household Waste*, New Delhi: JICA.
- MCD, (2000), *A Survey Report*, New Delhi.
- MCD, (2001), *Survey Report* New Delhi.
- NEERI (National Environmental Engineering Research Institute) (1995), *Strategy Paper on Solid Waste Management in India*, NEERI, Nagpur, India.
- NEERI (National Environmental Engineering Research Institute) (2005) *Study on Composition and Per Capita Generation of Waste*, survey of solid waste management in 59 cities conducted in 2004 and 2005, NEERI, Nagpur, India.

- Pastore P. (2007), *Waste to energy is no quick fix for Municipal Solid Waste Management*, Toxic Links, Jangpura New Delhi.
- Ramachandra, T.V. (2006), *Management of Municipal Solid Waste*, Capital Publishing Company, Bangalore.
- Sakurai, Kunitoshi, (1990), *Improvement of Solid Waste Management in Developing Countries*, Tokyo: Institute for International Cooperation, Japan International Cooperation Agency.
- Shrishti (2002a), *Making the Most of a Mess: A Handbook on Municipal Solid Waste*, New Delhi.
- Shrishti (2002b), *Recycling Responsibility: Traditional System and New Challenges of Urban Solid Waste in India*, New Delhi.
- Singhal; Shaleen and Pandey, S. (2001), *Solid Waste Management in India: Status and Future Directions*, TEERI, Information Monitor on Environmental Sciences.
- Sinha, R. K. (2000), *Solid Waste Management in India* Delhi, Indian Publishers.
- TERI Project Report (2002), *Urban Services Environmental Rating System (USERS), Performance measurement and Management Information System, A manual for Municipal Corporation of Delhi (Solid Waste Management)*, No. 1999EE41.
- The Municipal Solid Waste (Management and Handling) Rules* (2000), New Delhi, Government of India Publication.
- Toxic Link (2002-03), *Case Studies Documentation: Review of Sustainability Community Based SWM Initiative*, Toxic Link, New Delhi.
- UNDP (United Nation Development Programme), (1998), *Lessons for Improving Service Delivery: Learning from Private and Non formal Sectors in Solid Waste Management, Water and Sanitation Programme-South Asia*, New Delhi.
- UNDP (United Nations Development Programme) (1999), *Profits from Waste: A NGO led Initiative for Solid Waste Management in Lucknow, Uttar Pradesh, India*, UNDP World Bank Water and Sanitation Programme South Asia, New Delhi, India.
- UNEP (United Nations Environmental Programme), (2002), *A Multitude of Approaches and Definitions (waste)*.
- White Paper on Pollution in Delhi with Action Plans* (1997), Government of India, Ministry of Environment and Forest, New Delhi.
- White Paper on Pollution in Delhi with Action Plans*, (2000), Government of India, Ministry of Environment and Forest, New Delhi.
- World Bank (2001), *Relation between the Amount of Biodegradable Waste and Income Level In World Development Indicator: 2001*, Washington,DC: World Bank.
- World Bank Water and Sanitation Program and India Ministry of Urban Development (1993), *Community- Based Solid Waste Management: Project Preparation Panaji Case Study*, Washington, DC.
- Zurbrugg; Christian; Drescher S; Patel, A. and Sharaichandra(2002), *Decentralized Composting- An Option for Indian Cities*, Report of a workshop held in Bangalore.