

Chapter 9

Summary and Conclusion

Summary and conclusion is most important aspect of research work which gives the complete information of the research work done. So in this last chapter it is tried to present whole research work in a brief systematic manner. The present chapter deals with a brief summary, major findings and conclusion of the work done on the Topic – ‘Domestic waste disposal and its management in Kanpur Metropolis’. Therefore this chapter is divided into three main sections. Section 9.1 represents summary of the research work done, whereas section 9.2 represents major findings which are observed during investigation and analysis of data, last section 9.3 focuses light on some of the valuable suggestions.

9.1 Summary :

Waste of one organism is considered as the wealth of other organism since ancient times. The man’s living was traditional hence eco-friendly and discards were reused or recycled. Urbanisation has changed the living and turned into consumeristic from traditional. Urbanisation and increasing population work hand in hand and are major factors responsible for ever increasing waste in the society. Urbanisation has provided tremendous job opportunities that encouraged migration of people and also increased per capita income. Urbanisation also provided a large variety of choices to mankind which was confined to daily needs earlier. Manifolds increased per capita income made all the variable, newer products accessible to common man. On the name of purity, genuine reasons and assurance each and every item related to daily requirement like food, fruits, vegetables, clothes, daily accessories, electric goods even water is packed. Consumption of these products leaves heaps of waste. The need of development and increasing demand were felt by planners and the policy makers but the threat originated by improper disposal remained neglected till now and have expanded in civilized society like a ghost’s hand. Waste minimization like other environmental issues is multi sectoral in nature and encompasses policy making, strategies thinking, the development of legal,

institutional, financial, development of more focused environmental legislation and the increase of man power capabilities through education and training.

Domestic waste disposal of Kanpur city is analyzed on the basis of collected information from the classified random sampling conducted by researcher from different socio economic residents. Waste generation pattern in our city Kanpur is studied on the basis of spatial analysis as well as socio economic status. The entire domestic waste disposal is studied on the basis of three categories such as disposal of domestic solid waste, disposal of kitchen waste and disposal of domestic effluent. The study also includes the environmental condition of the city which is degraded by improper disposal of wastes. Here in this work it is also tried to discuss management aspects related to disposal of waste.

Domestic solid waste disposals which mainly includes plastic, paper, metal, glass, linen, rubber and other material which are generally used in every household and disposed. All these wastes are analyzed comprehensively as well as separately along with the facts and spatial disposal pattern in Kanpur Metropolis. Domestic waste disposal is mainly influenced by per capita income. It has been observed that in all the zones waste generation increases with ascending income from economically weaker section till high income class. And then gradually in very high income class and exclusively high income class waste disposal decreases. In the classes of very low income and economically weaker section, waste disposal is negligible or very meager due to their low income. They have tendency of using it till its entire life or till it becomes part of Garbage. Average per person per day solid waste disposal is 0.542 kg and daily disposal range between 0.268 to 0.978 Kg. The spatial domestic solid waste pattern is analyzed with the help of three disposal categories such as the high domestic waste disposal (0.943 to 0.978 kg/person/day) is observed in zone 1 and zone 4 while the lowest amount of domestic waste disposal (0.268 to 0.329 kg/person/day) is observed in zone 2 and zone 5. The moderate domestic waste disposal (0.350 to 0.386 kg/person/day) is found to be in zone 3 and zone 6. We have also found that domestic solid waste in zone 1 is maximum (1.011kg/person/day) whereas in zone 2, the minimum domestic solid waste disposal (0.296 kg/person/day) is observed. Zone 1 of Kanpur Metropolis is also identified for highest disposal of plastic, paper, metal, glass, rubber, linen and others waste. For example 0.094 kg /person /day plastic, 0.346 kg /person/day

paper, 0.271kg/person/day metal, 0.215 kg/person/day glass, 0.033 kg/person/day rubber, 0.016 kg/person/day linen and 0.003 kg/person/day other waste is disposed. Zone 5 of Kanpur Metropolis is also identified for lowest disposal of domestic solid waste such as plastic (0.035 kg/person/day), paper (0.101 kg/person/day), metal (0.112 kg/person/day), glass (0.008 kg/person/day), rubber (0.001kg/person/day), linen (0.011 kg/person/day) and other waste (0.001 kg/person/day). Zone 2 is observed as second lowest in total domestic solid waste but it is the lowest disposer of plastic (0.033 kg/person/day) metal (0.107 kg/person/day) and linen (0.007 kg/person/day). It has been proved from our research result that disposal quantity of domestic solid waste is determined by people's income and livelihood. Maximum 1.582 kg/person/day domestic solid waste is observed in high income group in zone 1 while minimum 0.043 kg/person/day is measured in economically weaker section group. Exclusively very high (1.204 kg/person/day) and very high income group (1.408 kg/person/day) produces less waste than high income group (1.582 kg/person/day). The highest domestic solid waste disposal is observed in high income class where 1.582 kg/person/day and 47.471 kg/month/person is disposed while the lowest domestic solid waste disposal is observed in economically weaker section where 0.167 kg/person/day and 5.039 kg/person/month waste is disposed. Exclusively high income class produces (0.072 kg/person/day) lesser waste than the high income class (0.125 kg/person/day). People of zone 1 and zone 4 are the residents of business center in the city so domestic solid waste disposal is just double than in other zones even if belonging to the same economic groups. Rubber waste disposal is negligible in economically weaker section in all the zones.

Kitchen wastes disposal which mainly includes vegetable peels, fruit peels, food waste, residual waste and other materials which are generally used in every household and disposed. Kitchen disposal in the study region vary zone to zone, season to season and as per income also. In summer, fruit peels like mango, melons etc. are heavier and in winter vegetable peels like pea, cauliflowers, variety of *saag* etc. are heavier. Residual waste also increases in winters. Although egg shells are not included in studies but that also increases in winters. Packing material contribute to a large proportion including paper, plastic packets are around 50% of the kitchen waste. Rich class is responsible for disposing more packing material as they depend on ready to eat food or food from hotels. Whereas low income class dispose very less and negligible kitchen waste as they have very low income, so they use every

bit of it. Average kitchen waste disposal per person day ranges between 0.441 kg to 0.484 kg. The spatial kitchen waste disposal pattern is analyzed with the help of disposal categories such as the high kitchen waste disposal is observed 0.481 kg/person/day in zone1 and 0.484 kg/person/day in zone 4 whereas the lowest amount of disposal observed as 0.431 and 0.437 kg/person/day in zone 3 and zone 5 respectively. The moderate kitchen waste disposal is found to be 0.441 in zone 2 and 0.445 kg/person/day in zone 6. We have found that kitchen waste disposal is maximum (0.484 kg/person/day) in zone 4 while the minimum kitchen waste disposal 0.441 kg/person/day is observed in zone 2. Zone 4 of Kanpur metropolis is identified as highest disposer of vegetable peels, food waste, residual waste and other waste. For example 0.124 kg/person/day vegetable peels, 0.064 kg/person/day food waste, 0.067 kg/person/day residual waste and 0.065 kg/person/day other waste are disposed in the zone. Zone 3 of Kanpur metropolis has been identified as lowest disposer of all the kitchen waste such as vegetable peels (0.192 kg/person/day), fruit peels (0.064 kg/person/day), food waste (0.057kg/person/day), residual waste (0.067 kg/person/day) and other waste (0.057 kg/person/day). The maximum 0.074 kg/person/day fruit peels disposal is found in zone 1 which is 0.001 kg/person/day which is 0.001 kg/person/day is less than zone 4. It has been proved from our research results that the disposal quantity of kitchen waste is determined by people's income and livelihood. Maximum 4.213 kg/person/day disposal of kitchen waste is observed in very high income group while minimum 0.724 kg/person/day kitchen waste disposal is measured in economically weaker section group. The kitchen waste disposal quantity decreases gradually from very high income group to very low income group while exclusively very high income group produces comparatively less kitchen waste than the very high income and the high income group because they often don't use their kitchen depend on parties, hotels and restaurants. Kitchen waste disposal by exclusively high income group is found to be highest (0.705 kg/kitchen/day) in zone 4 while lowest (0.105 kg/person/day) kitchen waste disposal is observed in zone 3. The highest kitchen waste disposal is observed from very high income class where 0.742 kg/person/day and 22.27 kg/person/month waste is disposed while the lowest kitchen waste disposal is observed from economically weaker section where 0.142 kg/person/day and 4.27 kg/person/month is disposed. Zone 1 is old Kanpur particularly a center of trade and commerce where earning of people is higher and therefore the disposal of vegetable peels (0.323

kg/person/day) and other waste (0.127 kg/person/day) is maximum while the lowest (0.070 kg/person/day) is in economically weaker section. The disposal of fruit peels is maximum (0.177 kg/person/day) in exclusively high class because they use fruits more than food and vegetables. Maximum food waste (0.120 kg/person/day) and residual waste is disposed by very high income class. All types of kitchen waste like vegetable peels (0.070 kg/person/day), fruit peels (0.010 kg/person/day), food waste (0.020 kg/person/day), residual waste (0.015 kg/person/day) and other waste (0.027 kg/person/day) is found to be lowest in economically weaker section. Zone 2 is undergoing unplanned development where people of all the classes are found but due to lack of civic amenities and distance from main market, the disposal is lower than zone 1 and zone 4. Zone 3 and zone 5 are found to be influenced by nearby local resources like fresh vegetables from rural areas, so dispose the lowest Kitchen waste. In zone 6 people dispose moderate amount of kitchen waste due to working of Non Government Organizations and other social workers and consumption is found to be traditional. We found in our studies that economically weaker section do not dispose fruit peels waste in zone 2, zone 3, zone 5 and zone 6 due to their low income and high cost of fruits which becomes unaffordable for them. But economically weaker section in zone 1 and zone 4 disposes little fruit peels such as 0.010 kg/person/day and 0.012 kg/person/day respectively as people from this class even are better as their lifestyle is influenced and supported by high income class. The disposal quantity by different socio economic classes and disposal pattern of disposal is found to be same in all the zones.

Domestic effluent disposal mainly include water disposal from kitchen, bathroom, toilet, house cleaning, cloth washing, leakage and other usages which are generally used in every household and disposed. All these wastes are analyzed separately along with the facts and spatial disposal pattern in Kanpur Metropolis. Fragmentation of families, desire of better living standard, changing lifestyles and Socio economic conditions along with increasing population is responsible for ever increasing consumption of water in the city. Water consumption in the city is more than the estimated figures which is still increasing. It has been recorded that almost 400 L water is required per person per day. Consciously or unconsciously 150 L of water is wasted per person per day. Households are also indulged in commercial activities hence water consumption shoots up even higher. There are illegal borings in the city in almost every house. High income class people consume more water

and the consumption decreases with decreasing income. Zone 4 and zone 5 residents are found to consume maximum water, whereas zone 1 and 3 residents are reported with moderate consumption and zone 2 and 6 people show least consumption and disposal. The usage under category 'others' which is concerned with gardening, vehicle washing and usage in other purposes huge consumption is observed and so requires a serious thought for reducing usage or for these activities stored water can be reused. Water consumption per person per day is between 328 L to 436 L. The spatial domestic effluent disposal pattern is also analyzed with the help of three categories such as high effluent disposal (more than 400 L) is observed in zone 4 and zone 5 whereas lowest disposal (less than 340 L) is observed in zone 2 and zone 6. The moderate effluent disposal (340 to 400 L) is found in zone 1 and zone 3. It has been observed that highest domestic effluent disposal (436 L/person/day) is in zone 5 while the lowest domestic effluent disposal (328 L/person/day) is in zone 2. Zone 5 of Kanpur Metropolis is identified as the maximum domestic waste water disposer in various uses like in kitchen, bathroom, toilet, house cleaning, cloth washing, leakage and others. For example 50 L in kitchen, 84 L in bathroom, 43 L in toilet, 48 L in house cleaning, 53 L cloth washing, 11 L in leakage and 147 L in other uses water is consumed and disposed by the people in this zone. Zone 2 of Kanpur Metropolis has been identified for the lowest disposal of domestic effluent such as in kitchen (32 L), bathroom (67 L), toilet (25 L), house cleaning (30 L), cloth washing (35 L), leakage (10 L) and other uses (129 L). Maximum of 147 L water disposal is found to be used in other uses in zone 5 which includes gardening, vehicle washing etc. It has been proved from our research results that the disposal quantity of domestic effluent is also determined by people's income and livelihood. Maximum 4118 L/person/day water is observed to be consumed and disposed in exclusively high income group A while minimum 192 L/person/day water is disposed in economically weaker section. The domestic effluent disposal gradually decreases from exclusively very high income group to economically weaker section. It is also observed that exclusively high income group uses expensive and water efficient sanitary wares but still disposes highest amount of water because of lavish lifestyle and casual attitude. Domestic effluent disposal is highest (800 L/person/day) in zone 5 by exclusively very high income class and lowest (27.09 L/person/day) in zone 2. The highest domestic effluent disposal from exclusively high income class where 713.93 L/person/day and 21417 L/person/month is observed while the lowest

domestic effluent disposal is observed in economically weaker section where 33.95 L/person/day and 1018.5 L/person/month are disposed. Maximum water is used in Others usage by the exclusively high income class (291.9 L/person/day) and minimum in low income class (19.46 L/person/day) in all the zones. But disposal in others category is not observed by economically weaker section because they do not have either vehicles or garden for such consumption in all the six zones. Other than the consumption, Leakage is observed commonly in most of the households which ranges inversely between 4.2 L/person/day to 25.2 L/person/day from exclusively high income class to low income class. It is also observed that in exclusively high income class leakage is least (4.2 L/person/day) because they use good quality of sanitary wares. The amount of leakage increase in low income classes gradually because as the income decreases investment on luxurious and efficient sanitary wares also decreases and low quality sanitary wares are used. Very low income class and economically weaker section do not show leakage as they do not have their own source of water and depend on roadside water sources. Water usage and disposal in toilet by economically weaker sections is also very low as usually they use open space for this purpose or community toilet which varies between 1.75 L/person/day to 2.66 L/person/day. Households of zone 1 depend mostly on supply water while households of zone 3, zone 5 and zone 6 have both the facilities of underground as well as supply water. But the households of zone 2 mainly depend on underground water only. Disposal quantity and pattern is observed to be same in all the zones by different socio economic classes. The factors that are responsible for making the difference is availability of civic amenities like drainage facility, sewer line and source of water.

The degrading impact on environment and health due to improper disposal of domestic waste and domestic effluent is also analyzed. Increasing waste with increasing population and modernization and its uncontrolled, improper disposal is leading to havoc and towards unknown dangers. We have heard about the attack of many new viruses causing new diseases like chicken guinea, dengue, and mysterious fever over the recent years. In spite of several governmental plans and policies the condition in the city is deteriorating fast. Even after the working of private agencies like A2Z infrastructure and NGO like Kanpur Parivartan Forum in the city the pollution is increasing day by day and showing its drastic consequences on environment and health of people in Kanpur. Ugly and unhygienic dumps are

sheltering disease vectors and spoiling the carrying capacity of air, water and soil. People feel tired, weak and fatigued. Respiratory and digestive disorders are the synonyms of routine life. The consequences have reached the underground water level also. All these issues need to be highlighted. So that common man becomes aware and gives his fullest contribution to impair the losses.

The air quality problem mostly associated with solid waste collection is the dust created during loading operation which causes 40% air pollution. Dust is nuisance, eye irritant and also carries micro organisms which can be inhaled. Domestic solid wastes also contain toxic disposals in the form of cells and used batteries, various insecticides, detergents which cause soil pollution and land becomes infertile. Windblown litters and clandestine dumping spoils aesthetic and diminishes civic pride. The infiltration of rainfall produces leachates and if these leachates enter underground water or any other surface water body causes water pollution. The waste when improperly dumped produce green house gases which can lead to the destruction of ozone layer and may cause several disastrous effects on plant, animals and man along with causing cancer Shrinking vegetation further adds up to the problem of green house effect. There is only 1% vegetation cover found in Kanpur city instead of ideal 33%. Asthmatic patients have increased by 70%, heart attack patients by 30% due to degrading environment which is caused by improper waste disposal. Other than this degraded environment has also affected lungs, eyes, reproductive system and brain. Due to lack of greenery and increasing Carbon dioxide the city is becoming a graveyard of diseases. Due to improper disposal of domestic waste, kitchen waste and domestic effluent decaying of organic waste in stagnant water on the roadsides or streets becomes breeding grounds for number of virus, bacteria, algae, fungi, protozoans, helminthes, annelids, larval stages of various insects like mosquitoes, flies and pests. Contamination of food and water causes number of water, air and soil borne diseases. Stagnant water and uncollected wastes causes threat to the environment as well as endanger public health. It also causes occupational dangers to the municipal workers involved in waste handling. They suffer from illness like eye problem, respiratory, gastrointestinal and several skin problems. Due to eating up of waste generated food by milk cattle quality and quantity of milk products of the animals get affected and sometimes death of the animals ensues. Since rapid population growth accompanied by proliferation of culture of consumerism, industrialization and urbanization gave

birth to large amount of solid waste and hence waste generation is growing at fast rate.

The total quantity of waste generated in Kanpur Metropolis and its probable management options are discussed under Domestic Waste Management. It has been estimated that average per person per day disposal of solid waste is 0.542 kg and 0.453 kg kitchen waste in Kanpur Metropolis whereas high income class people produce 0.883 kg/person/day solid waste and 0.702 kg kitchen waste and low income class people generate 0.093 kg/person/day solid waste and 0.120 kg/person/day kitchen waste. Total kitchen waste generation in Kanpur is 11,54,217 kg by 25,51,335 people per day. Out of which only 54.36% is collected by A2Z infrastructure Ltd. by door to door collection which contributes only 25% of total municipal waste generated in the city. Similarly total solid waste generated in the city is 1354176.70 kg per day, out of that, 90.22% is collected by waste vendors which is 48.71% of the total municipal waste generated in the city per day and sent for recycling. Rag pickers also contribute to it by picking left over from streets and roads. Hence 74% amount of waste is properly disposed and 26.29% of total waste of the city remains ignored which is mainly organic in nature. In spite of this Kanpur Nagar Nigam claims that only 10% garbage is not collected. The left over waste is disposed off in open or vacant land, ruins surroundings and aesthetics and causes threat to health. Every year thousands of cases of Diarrhea, Jaundice, and Viral fever are reported by government hospitals and health department of Kanpur Nagar Nigam. Hence various waste management options are evaluated like open dumping, land filling, composting, recycling and incineration. Out of all such methods of waste management in Kanpur Metropolis land filling, composting and recycling is commonly done in Kanpur metropolis. Open dumping is uncontrolled, numerous and illegal, ignored by city administration. Incineration is a very important method of biological and hazardous waste disposal. As our study is confined to domestic waste disposal it has not been taken in account. There were five land fill sites in the city like Panki (16-20 acre), Krishna Nagar (40-50 acre), Bingawan, Rooma, Bhauti. Of these, Panki and Krishna Nagar dump sites were closed in the year 2007 With the beginning of A2Z functioning in the city, land fill from city has been removed totally and a large sanitary land fill in 1 acre area is constructed in the A2Z integrated waste management plant premises. There, only left out from city waste processing is dumped, not the biological and hazardous waste generated in the city

from other sectors. The organic waste is collected mainly from households along with other sectors of the city, which is composted and converted into manure and RDF (refuse derived fuel). This entire function of collection composting and RDF making is performed by A2Z infrastructure ltd. The recycling trade is governed by a large informal sector comprising of 15000-20000 waste vendors, scrap dealers and rag pickers. This collection to disposal of plastic, metals, glass, rubber etc. to the recycling units is handled very well in an organized manner which provides cent percent returns to the people involved in waste management and to Nation also by saving National resources like new raw material, electricity and in making of newer products.

As far as domestic effluent of the city is concerned, out of total disposal from households which is approximately 78.58 million liters per day, only 31% is treated and rest remains untreated. In our study we have suggested to treat the domestic effluent naturally and reuse in various day to day activity. Reusing will reduce the load on city sewerage system on one hand and also reduce over exploitation of underground water on the other hand. The microbial agencies of nature consisting of bacteria, green and blue algae, diatoms, fungi, protozoans and other small animal which live and thrive on the dead and decaying organic matter efficiently degrade the compostable contents present in domestic effluent. A strain of *Pseudomonas Aeruginosa* has been developed which is capable of reducing viscosity and surface tension at the oil water interface. The domestic effluent treated with micro organism turns into simple harmless constituents and is subjected to chemical treatment for disinfection. The water thus is naturally treated and can be now used in various day to day activities.

An NGO Kanpur Parivartan Forum is also working in the city although its contribution is not sufficient to fight the prevailing situation but its presence compels many to think on the same concept and encourage one's participation sooner or later. The Forum help to seek peoples participation and co operation in implementing solution for making Kanpur a clean and green city. In the year 2008 door to door collection of domestic waste in Swaroop Nagar was initiated by the Forum. The Forum also promotes composting on house to house basis and so helps to get three tier terra cotta composting unit in which all organic waste turns into

compost in an affordable cost. Members of the Forum contribute in cleanup programs and new plantations.

Similarly, an individual play a very important role in proper waste management right from segregation to its disposal to the recommended sites. Role of an individual is the basic requirement, as an individual is the bottom unit of waste management hierarchy and contributes in hundred percent resource recoveries.

9.2 Major Findings :

During our research work various observations related to domestic solid waste disposal, kitchen waste disposal, domestic effluent, environmental degradation in Kanpur Metropolis caused by improper disposal of waste and during assessing management options and practices done by municipal corporation (Nagar Nigam) in Kanpur have been explored. The continuous growth of solid waste and its disposal is a serious issue challenging the urban planners in fast growing cities. Unplanned growth of urban population causes reckless generation of solid waste and exerts tremendous pressure on existing service. Approximately 46.5 % was never collected before the establishment of A2Z Infrastructure Ltd in the city, before September 2010 and was disposed in vacant plots, low lying areas, roadsides which is now reduced to 26.21 % whereas now the amount of waste collected has also increased to 73.71% and now properly disposed processing it into city compost, RDF. The old technology of waste collection failed to manage the waste properly and collect around half of the total waste generated. Uncollected solid waste is a public nuisance, it encroaches on roadsides, diminishes aesthetics, cause unpleasant odor and irritating dust. Organic solid waste ferments and favors fly breeding. Unsustainable patterns of production and consumption are increasing the quantities and varieties of environmentally persistent waste at unprecedented rates. The trend could significantly increase the quantities of waste produced by the end of the century and will increase the quantities four to five folds by the year 2025. One factor that should not be forgotten is the geographical variation in the characteristics of waste. The difference in culture and climate affect waste generation significantly, even though the economy and the level of industrialization is comparable. The waste

audit was conducted in 700 households on the basis of seven different socio economic categories from June 2009 to 2011, collecting the information on wastes generated from residential areas. This data may also be used to estimate the quantity and composition of waste for the entire city. The quantity and the composition vary from season to season and place to place. The most important findings from the results of waste research are-

1. The variety of waste, quantity of waste and its spatial distribution depends on socio economic structure i.e. religion, culture, lifestyle and attitude. On an average about 4.920 kg of total per household was collected per day in the city.
2. Daily average quantity of waste per capita ranges from 0.120 kg to 0.702 kg/person / day from low income class people to high income class people which is consistent and similar to the estimated data of other government and non government agencies.
3. On an average about 2.300 kg of compostable waste per household was collected per day. This makes up for 63% of the total waste collected.
4. The percentage of compostable waste estimated in the study is similar to the percentages reported in survey studies of various cities of developing countries. The average percentage of compostable waste is 46% app.
5. Most of the non food waste generated in the kitchen comprises of plastic, polythene and paper packing that are thrown outside and usually found littered on streets and roadsides which is only handled by rag pickers.
6. Of the 1500 households asked to participate in the pilot program, 20% households refuse to participate and 20% withdrew after participating for few days. 13.3% could not understand and gave improper information.
7. The amount of paper, metal, plastic items in high income areas are disposed in a greater percentage as compared to low income areas.
8. Hawkers and rag pickers play a very important role in collection of the recyclable and reusable materials from door to door and also from streets and roadsides.
9. Rag picker, scrap vendors and scrap dealers together form a very well organized, channelized informal sector of domestic solid waste management. Their contribution is incredible and they help to carry out cent percent

recycling of recyclables.

10. Literate and educated people respond better towards environment management program and policies of Government and they desire neat and clean living conditions.
11. The literate community is even ready to pay for improvement of the deteriorating garbage disposal conditions. They also believe that people's participation followed by creating awareness amongst them about disposal at proper places is must. Whereas a large group also believes that it can be attained by enforcement of Law
12. The majority of residents preferred electronic and print media to be used for educating the people for proper waste disposal and for building environmental awareness. A good number of residents suggested that teaching in schools can help to educate good environmental habits in the long run.
13. Females are found to contribute more in waste management than a man. As they safely keep the discarded recyclables and sell it to scrap vendors. Females also cut down the disposals at source point by using tea leaves in gardens, by giving leftover food to stray animals and peels of vegetables to grazing animals like cows.
14. Mineral water bottles and plastic cold drink bottles are collected and then converted into 'tablet' and 'plastic threads' which is then used to make very low cost synthetic sarees and blankets
15. To make waste management efficient and effective, mass participation is must. Central Government and city administration now should concentrate and invest more on awareness of the people of the city. Mass awareness will curtail waste at source point and will solve the waste management issue at root level.
16. In many of the families where couples are working and seniors at home are responsible for waste disposal, they take more time in getting convinced and understanding the ways of disposal. So lot of patience is required in campaigns and training of awareness programs
17. Many of the families including some educated and high income class expressed that they would participate if they are provided with different waste bins.

18. The spatial domestic solid waste pattern is analyzed with the help of three disposal categories such as the high domestic waste disposal (more than 0.943 kg/person/day) is observed in zone 1 and zone 4 while the low amount of domestic waste disposal (less than 0.329 kg/person/day) is observed in zone 2 and zone 5. The moderate domestic waste disposal (0.329 to 0.943 kg/person/day) is found to be in zone 3 and zone 6.
19. We have also found that domestic solid waste is maximum in zone 1(1.011kg/person/day) whereas the minimum domestic solid waste disposal (0.296 kg/person/day) is observed in zone 2.
20. Zone 1 of Kanpur Metropolis is also identified as highest disposer of plastic, paper, metal, glass, rubber, linen and others waste. For example 0.094 kg /person /day plastic, 0.346 kg /person/day paper, 0.271kg/person/day metal, 0.215 kg/person/day glass, 0.033 kg/person/day rubber, 0.016 kg/person/day linen and 0.003 kg/person/day other waste is disposed.
21. Zone 5 of Kanpur Metropolis is also identified as lowest disposer of domestic solid waste such as plastic (0.035 kg/person/day), paper (0.101 kg/person/day), metal (0.112 kg/person/day), glass (0.008 kg/person/day), rubber (0.001kg/person/day), linen (0.011 kg/person/day) and other waste (0.001 kg/person/day).
22. Zone 2 is observed as second lowest in total domestic waste disposal but it is the lowest disposer of plastic (0.033 kg/person/day) metal (0.107 kg/person/day) and linen (0.007 kg/person/day).
23. It has been proved from our research result that disposal quantity of domestic waste disposal is determined by people income and livelihood.
24. Maximum 1.582 kg/person/day domestic waste disposal is observed in high income class of zone 1 while minimum 0.043 kg/person/day is measured in economically weaker section.
25. Exclusively very high (1.204 kg/person/day) and very high income class (1.408 kg/person/day) produces less waste than high income class (1.582 kg/person/day).
26. The domestic solid waste disposal quantity decreases gradually from high income class to economically weaker section.
27. The highest domestic solid waste disposal is observed from high income class where 1.582 kg/person/day and 47.471 kg/month/person is disposed

while the lowest domestic waste disposal is observed from economically weaker section where 0.167 kg/person/day and 5.039 kg/person/month waste is disposed.

28. Exclusively high income people reduces (0.072 kg/person/day) less waste than very high income people (0.125 kg/person/day) and very high income class produces less domestic solid waste less than high income class people where domestic solid waste disposal is maximum (0.165 kg/person/day).
29. The amount of domestic solid waste of rest class fluctuates between high incomes to economically weaker section.
30. People of zone 1 and zone 4 are the residents of business center in the city so domestic solid waste disposal is just double than in other zones even if belonging to the same economic classes.
31. Higher amount of domestic solid waste is disposed by different socio economic classes of zone 1 like plastic, paper, metal, glass, rubber, linen and others. But high income class disposes maximum of all the social classes. And paper disposed is highest by this class (0.557 kg /person/day) among all types of waste and other waste is lowest in quantity (0.004 kg/person/day).
32. Rubber waste disposal is not observed by economically weaker section in all the zones.
33. It has also been noticed that social group of very low income class and economically weaker section do not produce other waste also in all the zones.
34. Disposal pattern by different socio economic classes shows same trend as high income class produce maximum amount of waste in all the zones and economically weaker section produces lowest amount of waste.
35. In the same way domestic solid waste is observed to be maximum in zone 1 by all the social groups and minimum in zone 5 by all the socio economic groups.
36. The spatial kitchen waste disposal pattern is analyzed with the help of disposal categories such as the high kitchen waste disposal is observed 0.480 kg/person/day in zone1 an zone 4 whereas the low amount of disposal observed as less than 0.440 kg/person/day in zone 3 and zone 5. The moderate kitchen waste disposal is found between 0.440 to 0.480 kg/person/day in zone 2 and zone 6.

37. We have found that kitchen waste disposal is maximum (0.484 kg/person/day) in zone 4 while the minimum kitchen waste disposal 0.441 kg/person/day is observed in zone 2.
38. Zone 4 of Kanpur metropolis is identified as highest disposer of vegetable peels, food waste, residual waste and other waste. For example 0.124 kg/person/day vegetable peels, 0.064 kg/person/day food waste, 0.067 kg/person/day residual waste and 0.065 kg/person/day other waste are disposed in the zone.
39. Zone 3 of Kanpur metropolis has been identified as lowest disposer of all the kitchen waste such as vegetable peels (0.192 kg/person/day), fruit peels (0.064 kg/person/day), food waste (0.057kg/person/day), residual waste (0.067 kg/person/day) and other waste (0.057 kg/person/day)
40. The maximum 0.074 kg/person/day fruit peels disposal is found in zone 1 which is 0.001 kg/person/day which is 0.001 kg/person/day is less than zone 4.
41. It has been proved from our research results that the disposal quantity of kitchen waste is determined by income and livelihood of people.
42. Maximum 4.213 kg/person/day disposal of kitchen waste is observed in very high income class while minimum 0.724 kg/person/day kitchen waste disposal is measured in economically weaker section.
43. The kitchen waste disposal quantity decreases gradually from very high income group to very low income group.
44. It is observed that exclusively very high income group produces comparatively less kitchen waste than the very high income and the high income group because they often don't use their kitchen depends on parties, hotels and restaurants.
45. Kitchen waste disposal by exclusively high income group is found to be highest (0.705 kg/kitchen/day) in zone 4 while lowest (0.105 kg/person/day) kitchen waste disposal is observed in zone 3
46. The highest kitchen waste disposal is observed from class B where 0.742 kg/person/day and 22.27 kg/person/month waste are disposed while the lowest kitchen waste disposal is observed from economically weaker section where 0.142 kg/person/day and 4.27 kg/person/month are disposed. The amount of kitchen waste disposal of rest of classes fluctuates between from

high income class to economically weaker section.

47. Zone 1 is old Kanpur particularly a center of trade and commerce where earning of people is higher and therefore the disposal of vegetable peels (0.323 kg/person/day) and other waste (0.127 kg/person/day) are maximum while the lowest (0.070 kg/person/day) is in economically weaker section.
48. The disposal of fruit peels are maximum (0.177 kg/person/day) in exclusively high class because they use fruits more than food and vegetables.
49. Maximum food waste is (0.120 kg/person/day) and residual waste is disposed by very high income class.
50. All types of kitchen waste like vegetable peels (0.070 kg/person/day), fruit peels (0.010 kg/person/day), food waste (0.020 kg/person/day), residual waste (0.015 kg/person/day) and other waste (0.027 kg/person/day) is found to be lowest in economically weaker section.
51. Zone 2 is undergoing unplanned development where people of all the classes are found but due to lack of civic amenities and distance from main market, the disposals are lower than zone 1 and zone 4.
52. Zone 3 and zone 5 are found to be influenced by nearby local resources like fresh vegetables from rural areas so, dispose the lowest Kitchen waste.
53. People of zone 1 and zone 4 show better disposal ethics than people of other areas. They also respond better to government plans and policies.
54. In zone 6 people dispose moderate amount of kitchen waste due to working of NGO and other social workers and consumption is found to be traditional.
55. We found in our studies that economically weaker section do not dispose fruit peels waste in zone 2, zone 3, zone 5 and zone 6 due to their low income and high cost of fruits which becomes unaffordable for them. But economically weaker section in zone 1 and zone 4 disposes little fruit peels such as 0.010 kg/person/day and 0.012 kg/person/day respectively as people from this class even are better as their lifestyle is influenced and supported by high income class.
56. The disposal quantity and disposal pattern of disposal is found to be the same in all the zones by different socio economic classes thus proves that economic status is most important factor affecting waste disposal along with type of locality.
57. The spatial domestic effluent disposal pattern is also analyzed with the help

of three categories such as high effluent disposal (more than 400 L/person/day) is observed in zone 4 and zone 5 whereas low disposal (less than 340 L/person/day) is observed in zone 2 and zone 6. The moderate disposal (between 340 to 400 L/person/day) is found in zone 1 and zone 3.

58. It has been observed that highest domestic effluent disposal (436 L/person/day) is in zone 5 while the lowest domestic effluent disposal (328 L/person/day) is in zone 2.
59. Zone 5 of Kanpur Metropolis is identified as the maximum domestic effluent disposer in various uses like in kitchen, bathroom, toilet, house cleaning, clothe washing, leakage and others. For example 50 L in kitchen, 84 L in bathroom, 43 L in toilet, 48 L in house cleaning, 53 L clothe washing, 11 L in leakage and 147 L in other uses water is consumed and disposed by the people in this zone.
60. Zone 2 of Kanpur Metropolis has been identified for the lowest disposal of domestic effluent such as in kitchen (32 L), bathroom (67 L), toilet (25 L), house cleaning (30 L), clothe washing (35 L), leakage (10 L) and other uses (129 L).
61. Maximum of 147 lts water disposal is found to be used in other uses in zone 5 which includes gardening, vehicle washing etc.
62. It has been proved from our research results that the disposal quantity of domestic effluent is also determined by people's income and livelihood.
63. Maximum 4118 lts/person/day water is observed to be consumed and disposed in exclusively high income class while minimum 192 L/person/day water is disposed in economically weaker section.
64. The domestic effluent disposal gradually decreases from exclusively very high income group to economically weaker section.
65. It is also observed that exclusively high income class uses expensive and water efficient sanitary wares but still disposes highest amount of water because of lavish lifestyle and casual attitude.
66. Domestic effluent disposal is highest (800 L/person/day) in zone 5 by exclusively very high income class and lowest (27.09 L/person/day) in zone 2.
67. The highest domestic waste disposal from class where 713.93 L/person/day and 21417 L/person/month are observed while the lowest domestic effluent

disposal is observed from class G where 33.95 L/person/day and 1018.5 L/person/month are disposed.

68. The amount of domestic effluent disposal in rest of the classes fluctuates from high income class to economically weaker section.
69. Maximum water is used in Others uses by the social classes from exclusively high income class (291.9 L/person/day) to low income class (19.46 L/person/day) in all the zones. But economically weaker sections do show not other use because they do not have either vehicles or garden for such consumption in all the six zones.
70. Leakage is observed commonly in most of the households which varies between 4.2 L/person/day to 25.2 L/person/day from exclusively high income class to low income class.
71. It is also observed that in exclusively high income class leakage is least (4.2 L/person/day) because they use good quality of sanitary wares. The amount of leakage increase in low income classes gradually because as the income decreases investment on luxurious and efficient sanitary wares also decreases and low quality sanitary wares are used.
72. In social group very low income class and economically weaker section do not show leakage as they do not have their own source of water and depend on roadside water sources.
73. Water usage and disposal in toilet by economically weaker sections is also very low as usually they use open space for this purpose or community toilet which vary between 1.75 L/person/day to 2.26 L/person/day.
74. Households of zone 1 depend mostly on supply water, households of zone 3, zone 5 and zone 6 have both the facilities of underground as well as supply water. But the households of zone 2 mainly depend on underground water only.
75. Disposal quantity and pattern is observed to be same in all the zones by different socio economic classes. The factors that are responsible for making the difference is availability of civic amenities like drainage facility, sewer line and source of water.
76. Asthmatic patients increased by 70% and heart attack by 30%. Gastrointestinal, Thyroidism, Eye infections, Ageing increased by 50% due improper disposal of solid waste and its severe effect on environment.

77. In last seven years outbreak of mosquito borne diseases like Chickenguinea, Dengue and unknown Viral Fever have increased drastically due degrading waste in scattered heaps after monsoons. Although factual figures are not maintained yet.
78. Every year several deaths are reported by media due to pollution caused by degrading waste although it is not disclosed by Health Department.
79. Only 90.22% solid waste, 54.36% kitchen waste and 31% domestic effluent is disposed properly and 9.78% solid waste, 45.64% kitchen waste and 69% domestic effluent remains ignored which causes environmental degradation and loss of natural resources in making new products.

9.3 Suggestions :

As far as waste disposal in Kanpur Metropolis is concerned the disposal process and management methods are concerned it is observed that these are not sufficient to manage increasing heaps of waste in the city, control or minimize environmental and its effect on life. Therefore some suggestions have been recommended. If these suggestions will be applied then some concrete and valuable results will be obtained definitely. These suggestions are as below-

1. Awareness programs should be carried out on large scale in a cyclic manner in every ward and everyone's participation should be mandatory. A certificate of participation should be given to participants who must carry some rebate for civic facilities like in taxes for high income class and in Rashan quota for low income class. This would encourage household's participation.
2. Segregation of waste should be at source (households). To make this a practice of residents need to be instructed on the best way of waste segregation. This is also very essential aspect for saving time, money and man power used in segregation.
3. Domestic waste should be segregated into bio degradable and non degradable. The biodegradable material should be kept in composting box and non bio degradable should be further segregated into different recyclables like plastic, paper, metal, glass, rubber, linen etc. separately.
4. T V channels and theatres should get license on a condition of signing the agreement to telecast a short program for the purpose of creating awareness related to proper waste disposal methods. It should be mandatory for the T V

channels and the theatres to show a short program or documentary showing proper methods of disposal before starting main program or film by Central government.

5. As electronic and print media is very popular and accessible to common man, should be used for creating the awareness. As messages related to crossing of railway line, roads, fire safety is given, the emphasis should be given to make proper disposal methods popular by central government.
6. For mass practicing of segregation an expanded program should be launched by corporation authorities including providing waste bins to initially encourage residents to participate.
7. For an expanded program, the city should consider providing waste bins to initially encourage residents to participate.
8. An educative workshop should be organized by the trained environmentalists particularly who are working in waste disposal fields.
9. Composting unit must be given to each and every household for management of kitchen waste and other organic waste as electricity meter and water supply connection is given by KESCO and Jal Nigam. This will reduce the responsibility and expenditure of waste management on municipal authorities and waste will be managed at source point only by the households. The households will get manure which can be used by themselves or by selling it to manure collection centers. By this, households can save money on one hand and earn on other hand.
10. Collection points for various solid wastes like plastic, paper, metal, glass, rubber, linen etc. should be established in every ward by Nagar Nigam. It should be mandatory for the households to dispose all types of solid waste on the disposal centers of their ward on reasonable cost and accurate weight as scrap vendors involved in household waste disposal follow numerous malpractices for their monetary benefit.
11. A solid waste disposal Mandy should be established as there are *sabji mandy*, *fool mandy*, *galla mandy* etc. this will support the accountability of the transaction of whole solid waste generated in the city and the recycled amount.
12. A house tax rebate receipt could also be given from the related disposal sites. This will encourage citizens to participate in proper disposal of recyclables like plastic, paper, metal, glass, rubber, linen etc. This will give a double benefit of

proper house tax collection which people do not prefer to pay along with proper waste disposal.

13. In Kanpur Metropolis according to an estimate there are about 15000 to 20000 scrap vendors and scrap dealers but they are not listed or authorized by any agency therefore there is no account of disposed waste collection and their proper disposal.
14. Thus every rag picker and waste vendor must be given a license to collect scrap and other waste by the authorities of Nagar Nigam which will be monitored by state pollution control board.
15. The provision of heavy penalties like monetary fines as Nagar Nigam has formed a rule to impose 500/- as a fine for disposing waste on roadside or on the illegal dumps, should be executed strictly by the authority which is not in practice presently.
16. Monetary fine is not sufficient to control the prevailing habits of people therefore the provision of imprisonment should be made on violation of laws and standards of waste disposal.
17. Strict rules should not only be for residents but should also be for waste collectors and responsible authorities.
18. Burning of waste in containers, on roadsides and small dumpsites is often practiced by the residents and also by municipal sweepers and collectors. This practice is very harmful for human health because it emits dioxins and furons as lot of polythenes and plastics are there in waste which is so dangerous that it can choke respiratory system and a person can die. Hence it is suggested that burning of city waste particularly plastic and papers which are recyclables should be considered as criminal offence and heavy penalties or imprisonment should be imposed.
19. Best practicing families, vendors, and organizers should be awarded not only by corporation authorities but also by state, central pollution control board by giving them attractive prizes.
20. Most of the mineral water bottles are thrown carelessly after use instead they can be used to reproduce synthetic threads which are further used to make cost effective sarees and blankets. To achieve this benefit it is suggested that a provision should be made by the mineral bottle manufacturer that empty bottle will cost two rupees that will be deducted at source when next bottle is

purchased.

21. It is observed that demolition material is left as such in heaps by the Nagar Nigam after abolition of encroachment. People start throwing waste and rubbish on the heaps. Humans and animals defecate and urinate on these heaps which soon take a shape of illegal dump site.
22. Public and private agencies involved in construction also leave heaps of left over on road side which sooner or later takes the shape of illegal dump. Government and non-government agencies involved in demolition and developmental activities should be penalized heavily for leaving the left over material on the roadside.
23. In many service class households senior people are responsible for managing waste, thus during education and campaign seniors should also be considered and that too with patience.
24. The use of Bio composters should be mandatory. Micro treatment domestic plant or bio composters that provides 360⁰ solution to bio degradable waste by degrading kitchen waste and garden waste within 24 hr with the help of microbial inoculums and converts the waste into organic manure and bio gas. The bio gas thus produced is used for cooking and will help to face the LPG cylinder crisis.
25. The effluent treatment device treats domestic disposal and reduces the load from city sewerage treatment plant by 90% only 10% treatment liability is transferred to government treatment plants from domestic sectors. Hence the usage of this device should also be mandatory.

Conclusion

With the growing population huge waste is being generated day by day. There is wide use of plastics, advanced technology and other materialistic things. This resulted in different characteristics of waste which became a complicated problem for management of domestic waste and disposal techniques. This is such a burning problem concerned with environment that needs to be carefully studied and researched, as on every street waste is lying uncollected scattered around local bins and dumped around locality, consequently there is occurrence of bad smell as well as hazard to the human health and to passerby. As improper waste disposal spoils aesthetics, degrades environment and is a cause of several diseases.

Waste management at the source point is the need of the hour. The administration and authorities have to ensure waste management at the source point by the help of public participation. Sense of responsibility, habit and interest needs to be inculcated in public so that they feel moral responsibility towards waste management. Unless the common man's participation not ensured the government and the city administration cannot combat the situation alone. We have plenty of successful examples of mass participation like implementation of CNG in Delhi, Chipko movement etc. Many non profitable NGO's are also running successfully but at small scale. An NGO named Kanpur Parivartan Forum is encouraging households to adapt composting and turn surroundings clean and green and so promotes three tier terra cotta composting unit to compost all kitchen waste and dry leaves. The administration should join hands with them and such projects should be encouraged. A MBA businessman Manik Thaper in New Delhi is dealing with domestic waste at community level returns 1 kg organic manure for collection of waste from the community. Similarly A2Z Infrastructure ltd., working in our city should also involve people and should offer compost while collection of user's charges. Our Municipal Authorities along with A2Z Infrastructure should encourage public participation. Kanpur Nagar Nigam can also make mandatory to take composting unit as given by Kanpur Parivartan Forum like electric meter and water supply connection in every household on affordable prices. This will reduce the waste that needs to be managed by municipal authorities when comes on a large scale for the whole city and will certainly reduce financial expenditures. Waste management at source point is the most efficient and convenient method with returns of organic manure. For integrated solution authorities should make the installation of micro treatment domestic plant like Bio composter and Automatic sewage treatment device mandatory. The bio composter will not only serve to solve the waste disposal problem but also will be useful to solve the crisis of LPG required for cooking as we are aware that government has reduced the subsidy on cooking gas cylinders. The Bio composters provide cooking gas and organic manure in every 24 hrs. Similarly Automatic Sewage Treatment Device treats the effluent in such a way that it reduces 90% load from city sewage treatment plant. Apart from it implementation of all measures for the minimization of disposals should be

mandatory like 3R practices (reduce, reuse and recycle) which is now changed to 4R where 4th R stands for Rethink rather, 5th R philosophy is recommended where 5th are would denote “Refuse” to the things that we really do not need, to achieve sustainable living in the society.

For ongoing program residents need to be instructed on the best way of waste separation. This is also a very essential aspect for saving time, money and man power used in segregation at present. Many households agreed to participate in the waste separation if they were provided with separate waste bins. For an expanded program, the city should consider providing waste bins to initially encourage residents to participate. In many service class households senior people are responsible for managing waste, thus during education and campaign seniors should also be considered and that too with patience.

Due to limitation of time and paucity of funds Researcher was not able to analyze quantitative amount of domestic waste impact on environmental pollution particularly on air, water and soil. Qualitative form of the effects of waste disposal is available but quantitative aspects have not been studied so far by any scientists, environmentalists and medical departments. Therefore this study opened a lot of unanalyzed aspects of waste and its management for the future researcher who will work on these untouched subjects for a comprehensive and fruitful solution of environmental degradation and its management in the country. Initially what we assumed to obtain the results on the basis of analysis, after completion of work we have observed that they have become true.