International Journal on Emerging Technologies **8**(1): 490-496(2017)

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

A Smart Concept for Waste Management in Jalandhar City

Hanish Katnoria*, Manpreet Singh Saini** and Ravi Inder Singh Cheema***
**7th Sem. Civil Engineering DAV University Jalandhar, (Punjab), INDIA*
***Assistant Professor, DAV University Jalandhar, (Punjab), INDIA*
****Assistant Professor, Guru Ram Das School of Planning, GNDU Amritsar(Punjab), INDIA*

(Corresponding author: Hanish Katnoria)
(Received 25 December, 2016 accepted 22 January, 2017)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The solid waste scenario of Jalandhar city is taking an ugly shape by virtue of emerging metropolis i.e. Increased population and ever changing life styles and market trends, leading to increase in solid waste generation day by day. It's high time to pave concrete means to curb the growing problems that are posing serious threat to human health. The authorities in turn are worried and presently not in the position to frame out a perfect methodology to yield good outputs from this good resource which is eventually available free of cost at the source. Instead of deploying skill to convert the solid waste in to a useful state the drives are being initiated to reduce the quantum of solid waste which seems to be practically impossible. The present situation shows not only an acute shortage of money, manpower and other technological requirements but also shows total absence of suitable sites for solid waste treatment and disposal with jurisdictional boundaries of Jalandhar and its vicinity. The drive for solid waste collection and disposal by deploying a private player in recent past in Jalandhar has proved futile. The segregation of waste at source and separate collection, separate routing, separate treatment and separate disposal sites need to be arranged. The present need of the hour is to get rid of the traditional incineration plants for health and environmental concerns. The practicability of eco friendly green models not only for solid waste disposal but for energy generation as well need to be tested and brought into practice. The eco-friendly approach of SLRM (solid liquid resource management) can be very well replicated in case of Jalandhar in its true spirit.

I. INTRODUCTION

Solid waste refers to refuse. Solid waste contains organic as well as inorganic matters. Solid waste management includes the entire process of dealing with solid waste, starting from the collection from the primary source to ultimately disposing off it hygienically, so that it may not.

As per the reports of the committee constituted by the Hon'ble Supreme Court of India in March 991(*any new report of supreme court*), the lack of financial resources, inefficient institutional arrangement, inappropriate technology, weak legislative measures and unawareness in public towards solid waste management has made the service most unsatisfactory and inefficient. The solid waste management approach in India is extremely inefficient, using old and obsolete system, technology for storage collection processing, treatment and disposal. There is no formal organized system of segregation of biodegradable and non biodegradable solid waste. The recovery and recycling of waste is only done by scavengers and scrap dealers which is highly hazardous to those which are involved in this job.

Over the last few years, the consumer market has grown rapidly leading to products being packed in cans, aluminum foils, plastics, and other such non biodegradable items that cause incalculable harm to the environment. For example, today one will not see a single piece of plastic in the entire district of Ladakh where the local authorities imposed a ban on plastics in 1998*(some latest example*). Knowledge of the sources and types of solid wastes as well as the information on composition and the rate at which wastes are generated disposed is, therefore, essential for the design and operation of the functional elements associated with the management of solid wastes. In the last six decades with 285.35 million people living in urban areas as per the 2001 census.

Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly and its composition changing.

The existing landfills are neither well equipped nor well managed and are not lined properly to protect against contamination of soil and groundwater. Solid-liquid resource management is a concept for manage the solid and liquid waste that produced by us. If we think of the new idea, that solid and liquid waste is not a waste. It will be a new resource, that's by it call solid-liquid resource management. In SLRM everything appears formless, fresh raw material. That concept works in two phases. Firstly it makes, the waste will be a resource and second, it produced the employment. That's both are benefits for our nation. The industrialization and growth of population will rapidly increase, that effect and harm the environment. Solid waste management in Indian cities as becomes a greater concern over a few years. In India, the solid waste will be managing by the municipal corporation. But the municipal corporation is often unable to perform their duties due to lack of new ideas and proper concept. SLRM is the most effective way of managing the solid and liquid resources were to implement a decentralized process of disposing of the wastes wherein the wastes generated by different categories of service providers could be separately composted or safely disposed of by associations of the respective service providers.

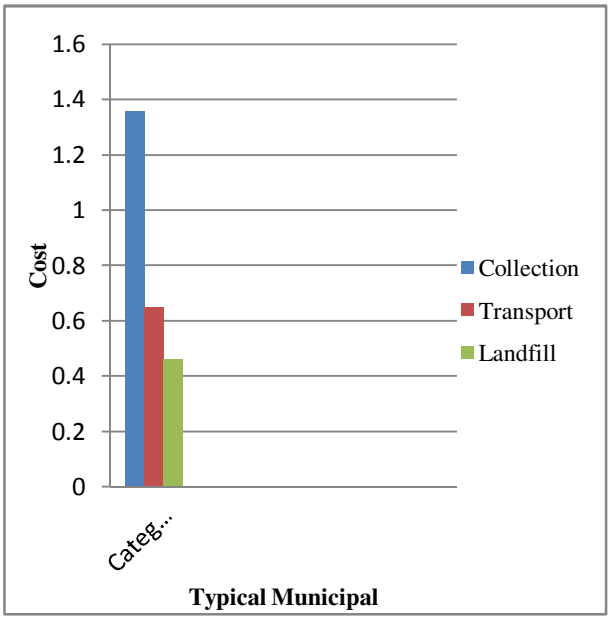

Fig. 1. Process of waste collection.

A. Waste Generation Rate Among Indian Cities

Poor country generates less waste AND Rich country generates more waste.

India is vast country, and its waste generation varies with behavioral pattern. The waste generation depends on various factors like household size, a number of people residing in the household, their living style, and other.

This influenced the rate of generation of several categories of waste, including packaging waste, kitchen waste, miscellaneous plastic waste, and miscellaneous combustible waste. Waste generation does not follow a linear graph in terms of the number of household and population growth. It is totally dependent on the behavioral pattern. Jones et al. (2008) have conducted a study in which they found that as household size increased, the rate of increase in waste generation itself declined. They also found the relationship between per capita waste productions by each family member the rapid fall that occurs in the amount of waste produced by each family member as the size of the family increases. In India, major cities produce 0.2 to 0.6 kg of waste per day per person. In terms of income group, the variation of higher – to lower- income group population varies from 800 to 180 g per person per day (toxic link 2014). The waste generation forms different cities is represented in pie chart below.

Most of the cities showed a substantial increase in waste generation. In some cities, waste generation doubled, and cities showed ever a decrease in waste generation. These cities must be assessed and mapped in terms of waste management, and the reason for waste reduction needs to be found out. Also, some of the big cities like Mumbai, Delhi, Bangalore, Ahmadabad, Chennai, etc. need to implement decreased or ward-wise scheme for waste management.

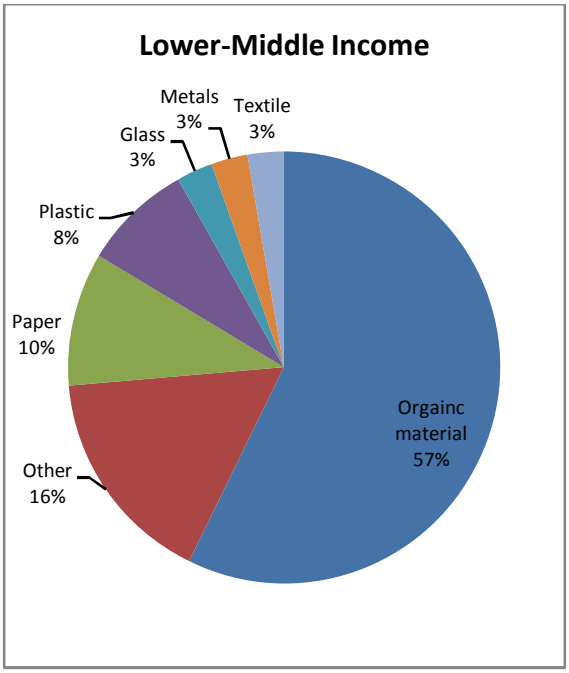

Fig. 2. City-with-lower-middle-income.

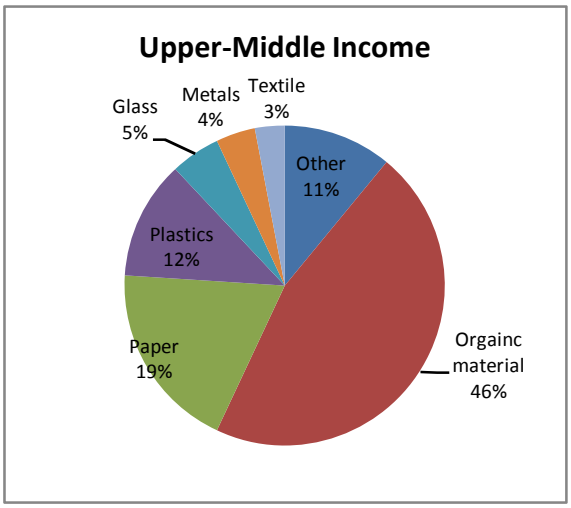

Fig. 3. City-with-upper-middle-income.

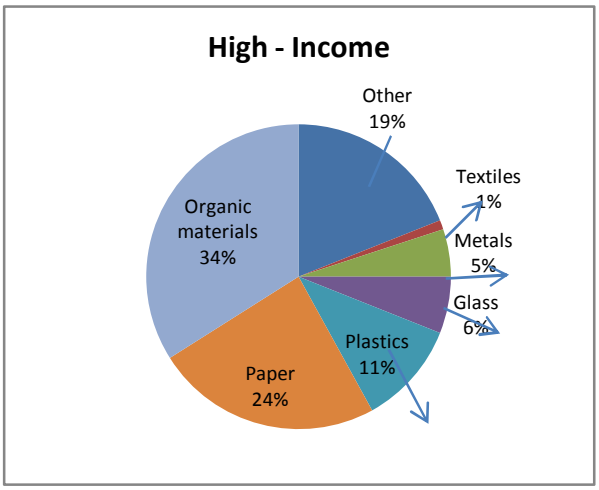

Fig. 4. City-with-Higher-income.

B. Key properties of waste

Table 1: Properties of waste.

Properties	Low Income Country	Middle Income Country	High Income Country
Moisture Content%	40 - 80	40 - 60	20 - 30
Density in truck (kg/m^3)	250 - 500	170 - 330	100 – 170
Lower Calorific Value (kcal/kg)	800 - 1000	1000– 1300	150 - 2700

Composition. Municipal solid waste (MSW) is commonly known as trash, garbage, refuse, rubbish. It is a waste type consisting of everyday items that are discarded by the public.

Moisture

To calculate dry weight:

Total Weight = Dry Weight + Moisture Content

therefore,

Dry Weight = Total Weight - Moisture Content

For food waste:

Total Weight = 9 lbs

Moisture Content = 70lb/100 lb= 0.7

Dry Weight= 9 – 0.7(9) = 2.7

We can calculate the dry weight for other waste components

Calorific value

Lower calorific value (LCV)

L.C.V (kcal/kg) = 40 (a+b+c+d) +90e – 46w * % of wet weight

a = paper, b = textile, c = wood and leaves, d = food waste, e = plastic and rubber, w = water 60%

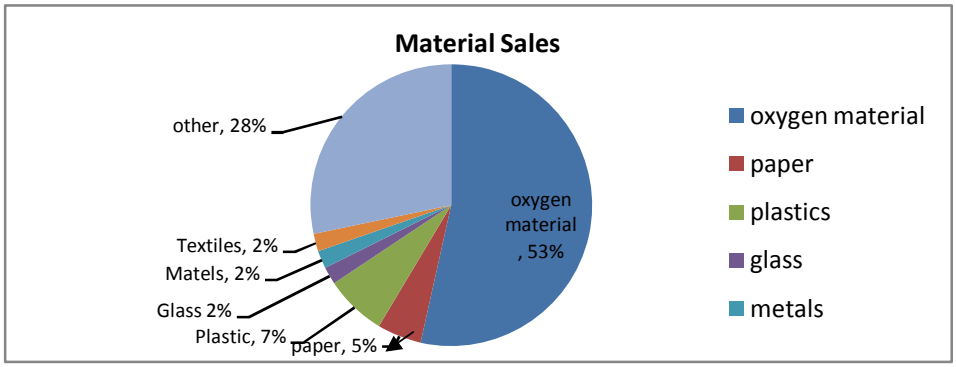

Fig. 5. Types of material for incineration.

Incineration without adding fuel require L.C.V > 1000 kcal/kg

Incineration with energy recovery require L.C.V 1500-1650 kcal/kg

II. WASTE SCENARIO IN PUNJAB

Punjab is the limit of a massive waste disposal crisis, but the solution is not accessible. The problem of waste is generally categorized on the basis of the capacity of cleaning and disposing waste. New devastation pattern and social linkage emerging. The governments and urban agencies have identified solid waste as a major problem that has reached drastic proportions. In municipal solid waste consist of household waste, industrial waste, construction waste, sanitation residue and waste from the streets. The major proportion of waste is generated mainly from residential and commercial complexes.

Jalandhar is the oldest and having rapid population growth and rapidly industrialized city in Punjab. It is located in the center of Punjab on N.H 1. There is total 25,798 commercial establishments according to the"Master plan 2011". And the latest survey carried out by the "The Tribune" newspaper reveals that the only 530 commercial establishment service the facility out of 56,000-60,000.

The total area of Jalandhar is 3401 kmsq (M.C Jalandhar). There are approx 2.13 lakh houses (M.C Jalandhar) in Jalandhar but approx 1.50 lakh urban households service the garbage collection facility and rest are unservice. The daily garbage generation per house is 1.5kg* (The tribune dec 2014) and the garbage collection in Jalandhar is 500 metric tons.

Table 2. Waste generation categories.

Source	Typical waste generators	Types of solid wastes
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes.).
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants.	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes.
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes.
Institutional	Schools, hospitals, prisons, government centers.	Same as commercial.
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants.	Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge.

A. Main motive of doing waste study

- Influence policy and measure for waste prevention and reduction.
- Determine capacity and number of collection vehicle and / or transfor station.
- Assess feaibility and scale of treatment option .
- Identify recycling opportunites.
- Estimate lifespane of landfilling .
- Estimate treand to plan for the future

B. Transfer and transport

This involves two steps: The transfer of wastes from smaller collection vehicle to larger transport vehicle and, the subsequent transport of the wastes usually over long distances. The routing must be done so that the tipper need not go inside small lanes, which create bottlenecks for traffic and take unnecessary extra time.

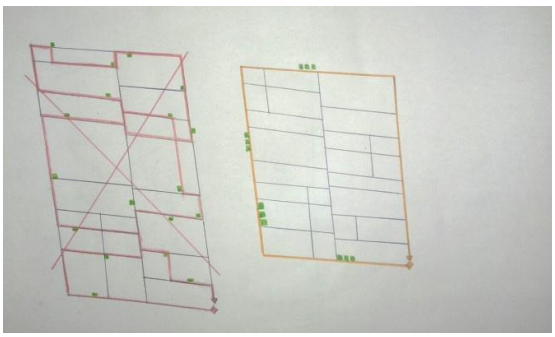

Fig. 6. Route selection.

C. *Use of Compactor Truck*

These trucks are mainly useful in high-income countries. Where waste is bulky and need to be compacted to efficiently transport the waste.

D. Disposal Non-engineered disposal

This is the most common method of disposal in low-income countries, which have no control, or with only slight or moderate controls. They tend to remain for longer time and environmental degradation could be high, include mosquito, rodent and water pollution, and degradation of the land.

E. Principal Problem of Waste Management

Not enough money

- Bring the cost down.
- Increase tax revenue.

The most expensive element in waste collection

- Trucks.
- Workers.

Reduction of time to load and unload waste.

- Equipment itself.
- Get better organized

III. SUSTAINABILITY

Management of Municipal Solid Waste (MSW) continues to remain one of the most neglected areas of urban development in India. Municipal agencies spend about 5-25% of their budget on MSWM. In spite of such a heavy expenditure, the present level of service in many urban areas is so low that there is a threat to public health in particular and to environmental quality in general.

Table 3. Sustainability drivers in M.S.W.

Legal Drivers (Laws and Regulation)	In the absence of a strong legislation, competition between cities, to provide a 'clean city' with good municipal environmental infrastructure, in order to attract (often foreign) investment can be a key driver. This appears to be particularly important in India where competition for foreign information technology investment is strong.
Regional and international drivers (Resource value of waste, e.g.: solid waste as a recyclable resource)	Clean development mechanism is extending this to developing countries (promoted by international financial institutions (IFIs). Provides a livelihood for large numbers of the urban poor. India still relies on imports of recycled materials as industrial raw materials
Socio-Economic Drivers (Population trends, public Awareness, public health)	Capacity building and good governance are key drivers (being promoted by IFIs). Focus is still on food, shelter, security and livelihoods – waste becomes an issue when public health or environmental damage impacts on these priorities. Public Health - Remains a key driver, particularly in hot climates. Outbreak of diseases such as Plague, Cholera, diarrheal diseases
Technology development and institutional drivers	Ability to perform this function is still limited. Various waste-to-energy alternatives will play a major role as key drivers in the solid waste management industry.
Environmental protection	Focus still on initial steps, to phase out uncontrolled disposal. For instance, climate change/energy from waste is emerging as a key driver worldwide – the clean development mechanism

A. Sustainability **= Low cost of collection and transfer.**

Low cost = Big containers.

- Big trucks.
- Reduced collection point.
- Organization and train thence.

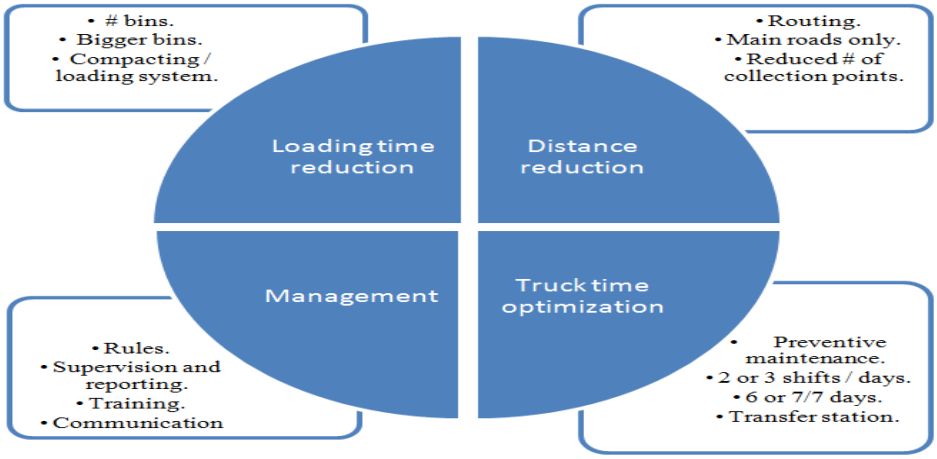

Fig. 7. Sustainability model.

B. Primary Collection Services of Waste

These are three types

1. Residents themselves bring the waste to the secondary collection.
2. The door to Door collection.
3. Collection and transport are a major part of waste disposal cost.
4. The cost of collection significantly varies from one city to another.

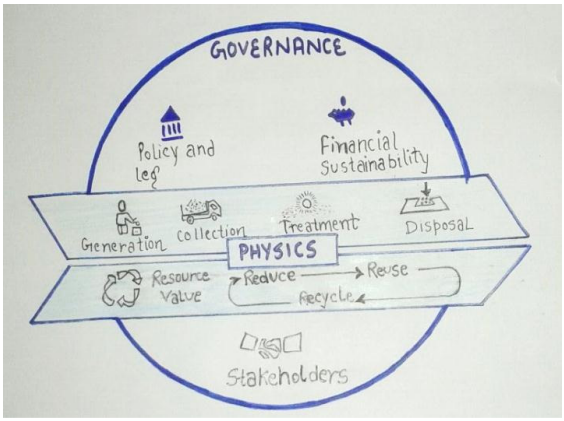

Fig. 8. Process of generation till disposal.

C. Reducing the truck loading time / Simple Routing Strategy

Collection Strategy for Cost Reduction

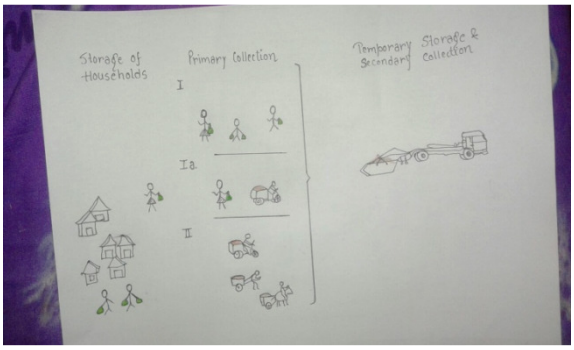

Fig. 9. Household collections.

While SWM was completely neglected in past and is now receiving some attention at the highest levels in several cities and states, many are lagging behind and several have not bothered to make any improvement at all. The national and state solid waste management missions need to be created to ensure that municipal authorities perform their obligatory duties regularly in compliance with MSW Rules 2000 within a predetermined time frame. ULBs need to be strengthened with handholding wherever necessary to meet the challenge. The national mission, in consultation with state missions, could prepare tender documents, designs and specifications, and concession agreements to facilitate expeditious procurement of tools, vehicles, and services. Though levels of SWM services in the country have started improving on account of active monitoring by the Supreme Court of India, the central and state pollution control boards and finance and technical support from proactive state governments there still is a long way to go. Key individuals within the governing system and the bureaucracy need to be educated to the magnitude of the crisis and motivated to use their power to influence the system and appropriately channelize resources to actively promote effective and progressive SWM projects and practices.

IV. CONCLUSION

While SWM was completely neglected in past and is now receiving some attention at the highest levels in several cities and states, many are lagging behind and several have not bothered to make any improvement at all. The national and state solid waste management missions need to be created to ensure that municipal authorities perform their obligatory duties regularly in compliance with MSW Rules 2000 within a predetermined time frame. ULBs need to be strengthened with handholding wherever necessary to meet the challenge. The national mission, in consultation with state missions, could prepare tender documents, designs and specifications, and concession agreements to facilitate expeditious procurement of tools, vehicles, and services. Though levels of SWM services in the country have started improving on account of active monitoring by the Supreme Court of India, the central and state pollution control boards and finance and technical support from proactive state governments there still is a long way to go. Key individuals within the governing system and the bureaucracy need to be educated to the magnitude of the crisis and motivated to use their power to influence the system and appropriately channelize resources to actively promote effective and progressive SWM projects and practices.

REFERENCES

[1]. Akolkar, A.B. (2005). "Status of Solid Waste Management in India, Implementation Status of Municipal Solid Wastes, Management and Handling Rules 2000", Central Pollution Control Board, New Delhi.

[2]. Central Pollution Control Board (CPCB 2006). "Assessment of status of municipal solid waste management in metro cities and state capitals", Ministry of Environment and Forests (MoEF), Government of India, New Delhi, India

[3]. CPHEEO, Ministry of Urban Development, Govt. of India (2005). Report of the Technology Advisory Group on Solid Waste Management.

[4]. International Directory of Solid Waste Management, 1998-1999, The ISWA Year book.

[5]. Report of the National commission on urbanization, Vol. **IV** 1988.

[6]. Saha J. K., Panwar N. and Singh M. V. (2010). "An assessment of municipal solid waste compost quality produced in different cities of India in the perspective of developing quality control indices", *Journal of Waste Management,* Vol. **30**, pp. 192–201, 2010

[7]. Sethi S., Kothiyal N.C., Nema A.K. and Kaushik M.K. (2013), "Characterization of municipal solid waste in Jalandhar city, Punjab, India", *Journal of Hazardous, Toxic and Radioactive Waste,* Vol. **17**, pp. 97-106, 2013.

[8]. Sharholy M., Ahmad K., Mahmood G., and Trivedi R. C. (2008). "Municipal solid waste management in Indian cities - A review", *Journal of Waste Management,* Vol. **28**, pp. 459–467, 2008.