Chapter-1

Introduction

Waste is a continually growing problem at global and regional as well as at local levels. Solid waste has been produced since the beginning of civilization .During the earliest periods, solid wastes were conveniently and unobtrusively disposed of in large open land spaces, as the Density of the population was low. However, today, one of the consequences of global urbanization is an increased amount of solid Waste. Solid waste management is one of the most neglected aspects of India's environment. Municipal solid waste (management and handling) Rules 2000 have made it mandatory for the administrative authority of any area to undertake responsibility for all activities relating to municipal solid waste management. The major problem is that- underestimation of generation rates and therefore, underestimation of resource requirements, lack of technical and managerial inputs, and lack of reliable and updated information to the public(Sudha Goel,2008). India is a developing country whose economy is currently growing at an extremely rapid annual growth

rate of 8 to 9%. It is clear that a growing economy and population are likely to result in growth rates of 11 to 12% in MSW generation. These growth rates are much higher than the current expert estimates of 1.3% for per capita MSW generation and 4.2% for total MSW generation. Present approach to MSW collection and transport results in insufficient utilization of resources. Modern technology and tools like remote sensing and mathematical optimatization method and GIS can be used for more efficient allocation and utilization of resource.

Solid wastes generate from human and animal activities that are normally discarded as useless or unwanted exodous. In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society and which have lost their value to the first user. As the result of rapid increase in production and consumption, urban society rejects and generates solid material regularly which leads to considerable increase in the volume of waste generated from several sources such as, domestic wastes, commercial wastes, institutional wastes and industrial wastes of most diverse categories. Management of solid waste may be defined as that discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations. In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in the whole spectrum of solutions to problems of solid wastes

thrust upon the community by its inhabitants. Solid wastes have the potential to pollute all the vital components of living environment (i.e., air, land and water) at local and at global levels. The problem is compounded by trends in consumption and production patterns and by continuing urbanization of the world. The problem is more acute in developing nations than in developed nations as the economic growth as well as urbanization is more rapid.

Solid waste management

Management of solid waste is associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations. In its scope, it includes all administrative, financial, legal, planning and engineering functions involved in the whole spectrum of solutions to problems of solid wastes thrust upon the community by its inhabitants.

Categories of Solid Waste

Table 1: Solid waste can be categorized based on source

Source	Typical facilities, activities, or locations where wastes are generated	Types of Solid waste
Agricultural	Field and row crops, orchards, vineyards, diaries, feedlots, farms, etc	Spoiled food wastes, agricultural wastes, rubbish, and hazardous wastes

Industrial	Construction, fabrication, light and heavy manufacturing, refineries, chemical plants, power plants, demolition, etc	Industrial process wastes, scrap materials, etc.; nonindustrial waste including food waste, rubbish, ashes, demolition and construction wastes, special wastes, and hazardous waste.
Commercial and Institutional	Stores, restaurants, markets, office and buildings, hotels, auto repair Institutional shops,	Paper, cardboard, plastics, wood, food wastes, glass, metal wastes, ashes, special wastes, etc.
Municipal solid waste	Includes residential, commercial solid waste and institutions	Special waste, rubbish, general waste, paper, plastics, metals, food waste, etc.

Source: (Hester, R. E and Harrison, R. M., 2002)

Municipal Solid Waste

The term municipal solid waste(MSW)is normally assumed to include all of the waste generated in community, with the exception of waste generated by municipal services, treatment plants, and industrial and agricultural processes. In the urban context the term municipal solid wastes is of special importance. The term refers to all wastes collected and controlled by the municipality and comprises of most diverse categories of wastes. It comprises of wastes from several different sources such as, domestic wastes, commercial wastes, institutional wastes and building materials wastes.

Types of Municipal Solid Waste

Table-2: The sources of municipal solid waste

Sources	**Examples**
Residential	Single family homes, duplexes, town houses, apartments
Commercial	Office buildings, shopping malls, warehouses, hotels, airports, restaurants
Institutional	Schools, medical facilities, prisons

Industrial	Packaging of components, office wastes, lunchroom and restroom wastes (but not industrial process wastes)

Source: (Tchobanoglous, G and Kreith, F., 2002)

Municipal Solid Waste Management

Municipal Solid waste management involves the application of principle of Integrated Solid Waste Management (ISWM) to municipal waste. ISWM is the application of suitable techniques, technologies and management programs covering all types of solid wastes from all sources to achieve the two objectives of (a) waste reduction and (b) effective management of waste still produced after waste reduction In the Municipal Solid Waste Management the major issues to be considered are:

- Increasing waste quantities
- Wastes not reported in the national MSW totals
- Lack of clear definition for solid waste management terms and functions
- Lack of quality data
- Need for clear roles in state and local government
- Need for even and predictable enforcement regulations and standards

Functional Elements of Municipal Solid Waste Management

To implement proper waste management, various aspects have to be considered such as Waste generation (source reduction), Waste handling and sorting, storage and processing at the source (onsite storage), Collection, Sorting, processing and transformation, transfer and transport, and Disposal (The Expert Committee, 2000). Figure 1, shows the interrelationship between the functional elements in solid waste management.

Municipal solid waste stream

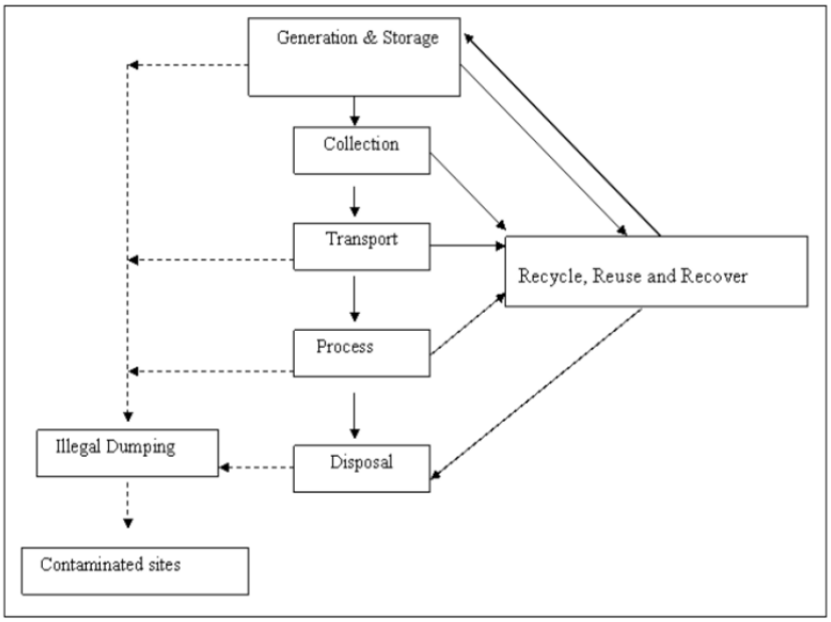


Figure 1: The Municipal Solid Waste Stream

Present Municipal Waste generation Scenario of the World

Solid waste is mostly an urban phenomenon, and is generally an Urban Issue. Today, more than 50% of the World's population lives in the cities and the rate of urbanization is increasing quickly. Solid Waste generation is the by-product of the Urbanization. It is highly related with Economic growth, degree of industrialization and consumption pattern. With the increase of urban population of the cities and towns all other activities associated with population also increases resulting in more and more generation of Municipal Solid Waste. And in the absence of technology and efficient and effective methods of disposing refuse worsen the quality of Air

of the urban centres which have detrimental impacts on human health. The most common problems associated with improper management of solid waste include disease transmission, odor, nuisance, atmospheric, land & water pollution, fire hazards, aesthetical nuisance and economic losses. More or less every human activity creates some kind of waste. As countries develop economically, socially, and technologically waste generation also increases. Both developed and developing countries face the problems associated with solid waste generation and its management. Rapid urbanization directs to the densification and an increase of large amounts of solid waste within a concentrated area. Global population rose to 6.9 billion in 2010 and the majority of people live in developing countries. A major challenge is how to manage the ever-increasing waste generated, especially in developing countries already lacking a sufficient public service infrastructure to manage municipal waste, and where poverty and unplanned settlements lead to unmanaged waste. (World Bank, 2012) Globally, we live in "throw-away" societies in which we consume packaged products that often do not last past a single use or even a year, and we discard as waste what we no longer want. This wasteful lifestyle seriously impacts the environment, public health, and produces social and economic problems. Waste disposal can have serious environmental impacts: landfills consume land space, and cause air, water and soil pollution - including the emission of greenhouse gases, while incineration results in emissions of dangerous air pollutants. Our consumptive and often wasteful behavior needs to be examined, and changed, so that we can live more sustainably.

(World Bank, 2012) Solid waste generation is the common basis for activity data to estimate emissions from solid waste Journal of Environment and Earth Science www.iiste.org ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online) Vol.5, No.8, 2015 84 disposal, biological treatment, and incineration and open burning of waste. Solid waste generation rates and composition vary from country to country depending on the economic situation, industrial structure, waste management regulations and life style. The availability and quality of data on solid waste generation as well as subsequent treatment also vary significantly from country to country. Statistics on waste generation and treatment have been improved substantially in many countries during the last decade, but at present only a small number of countries have comprehensive waste data covering all waste types and treatment techniques. Solid waste is generated from households, offices, shops, markets, restaurants, public institutions, industrial installations, water works and sewage facilities, construction and demolition sites, and agricultural activities. Solid waste management practices include: collection, recycling, solid waste disposal on land, biological and other treatments as well as incineration and open burning of waste. A new, far-reaching report on the state of municipal solid waste around the world predicts a sharp rise in the amount of garbage generated by urban residents between now and 2025. The report estimates the amount of municipal solid waste (MSW) will rise from the current 1.3 billion tons/year to 2.2 billion tons/year, with much of the increase coming in rapidly growing cities in developing countries (World Bank, 2012).

Globally, waste volumes are increasing quickly even faster than the rate of urbanization. World Bank report shows that the amount of municipal solid waste is growing fastest in China (which surpassed the US as the world's largest waste generator in 2004), other parts of East Asia, and part of Eastern Europe and the Middle East. In the last two decades the amount of waste generated in China is very high due to increased number of population and economic growth. For instance the waste generation in China is parallel to its economic growth, i.e. from 1979-1995 the average annual rate of increase in its solid waste had been 9% slightly below the average annual growth of its economy 10%. There is a direct correlation between the per capita level of income in cities and the amount of waste per capita that is generated. In general, as a country urbanizes and populations become wealthier, the consumption of inorganic materials (e.g. plastics, paper, glass, aluminum) increases, while the relative organic fraction decreases. As the world hurtles toward its urban future, the amount of municipal solid waste (MSW), one of the most important by-products of an urban lifestyle, is growing even faster than the rate of urbanization. Ten years ago there were 2.9 billion urban residents who generated about 0.64 kg of MSW per person per day (0.68 billion tons per year). This world report estimates that today these amounts have increased to about 3 billion residents generating 1.2kg per person per day (1.3 billion tons per year). By 2025 this will likely increase to 4.3 billion urban residents generating about 1.42 kg/capita/day of municipal solid waste (2.2 billion tons per year) (World Bank, 2012). Waste generation in sub-Saharan Africa is

approximately 62 million tons per year. Per capita waste generation is generally low in this region, but spans a wide range, from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day. (ibid) The annual waste generation in East Asia and the Pacific Region is approximately 270 million tons per year. This quantity is mainly influenced by waste generation in China, which makes up 70% of the regional total. Per capita waste generation ranges from 0.44 to 4.3 kg per person per day for the region, with an average of 0.95 kg/capita/day. In Eastern and Central Asia, the waste generated per year is at least 93 million tons. Eight countries in this region have no available data on waste generation in the literature. The per capita waste generation ranges from 0.29 to 2.1 kg per person per day, with an average of 1.1 kg/capita/day (World Bank, 2012). Latin America and the Caribbean has the most comprehensive and consistent data. The total amount of waste generated per year in this region is 160 million tons, with per capita values ranging from 0.1 to 14 kg/capita/day, and an average of 1.1 kg/capita/day. (ibid) In the Middle East and North Africa, solid waste generation is 63 million tons per year. Per capita waste generation is 0.16 to 5.7 kg per person per day, and has an average of 1.1 kg/capita/day. The OECD (Organizations for Economic Co-operation and Development) countries generate 572 million tones of solid waste per year. The per capita values range from 1.1 to 3.7 kg per person per day with an average of 2.2 kg/capita/day. In South Asia, approximately 70 million tons of waste is generated per year, with per capita values ranging from 0.12 to 5.1 kg per person per day and an average of 0.45 kg/capita/day. Uruguay has the

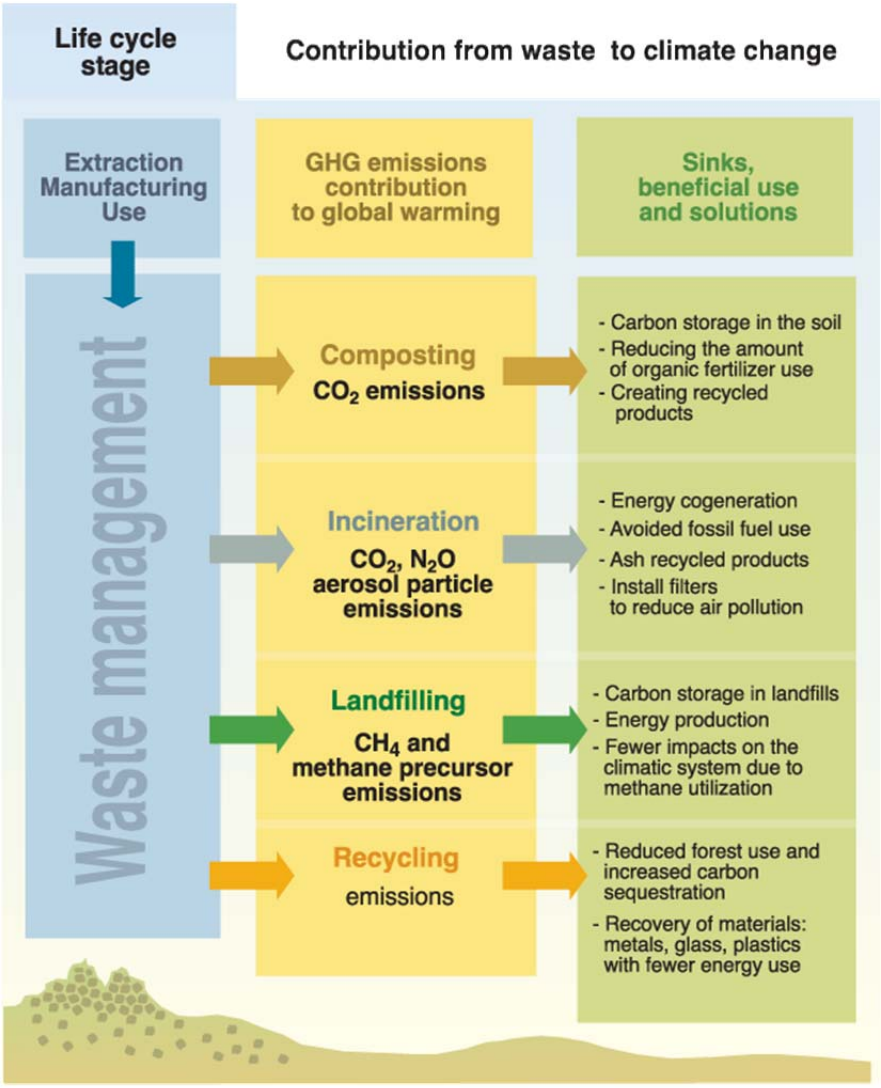
distinction of generating the least MSW that is 0.11kg/capita/day while Trinidad and Tobago generates 14.40 kg/capita/day, which is the highest in the world. And surprisingly both the countries lie in Latin America and the Caribbean Region.

Present Municipal Waste generation Scenario of India

India, one of the fastest growing economies in the world, faces a challenge of MSW Management. To address the issue, the Indian Government enacted MSW Rules in the year 2000 with a view to improve the Journal of Environment and Earth Science www.iiste.org ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online) Vol.5, No.8, 2015 85 present scenario. All Urban Local Bodies (ULBs) were supposed to have MSW management systems by end of year 2003. Being engrossed in their day-to-day activities and due to typical nature of Indian MSW, no single ULBs could achieve the targets. The Courts of Law in India are now issuing summons to ULBs for non compliance with the law of the land. Urban India generates about 1.0 lakh MT/day of Municipal Solid Waste and it requires more than 1500 Acres of land/year for land fill. This is a very imposing land demand, in a land-scarce India. Land filling is the ultimate disposal technology which is relevant even when other advanced options are being used for recycling and/or volume reduction. It is the method of choice in developing nations because it is the lowest cost disposal option. Indeed, most industrial nations, including many European Union countries and the USA, still rely on land filling as an integral part of solid waste management infrastructure. On the other hand, the lower middle income countries (that is, China, India,

Thailand, and Sri Lanka) and the lower income countries (that is, Ghana, Lao, Tanzania) had less generation rate between 0.60 to 0.78 kg/capita/day. Despite the fact that the urban local bodies utilize major part of its staff and resources for collection and disposal of MSW, nearly half of MSW generated remains unattended in many cities. Out of the funds spent on MSW management, ULBs typically spend about 65% funds on collection, 30% on transportation and a mere 5% on waste disposal. There is thus an urgent need to address the problem with a more scientific approach than the commonly adopted; crude dumping of MSW. Proper management of MSW can play significant role in national progress. Not many Municipalities have been able to take desired steps in this direction. SWM involves activities associated with generation, storage and collection, transfer and transport, treatment and disposal of solid wastes. But, in most Indian cities, the MSWM system comprises only four activities, i.e., waste generation, collection, transportation, and disposal. Poor collection and inadequate transportation causes the accumulation of MSW at every nook and corner.

Relation of Waste and Climate Change



Source: waste management and climate change paper (Fig.2)

Selection and Need of the Study

Jalpaiguri Municipality area that is 1to 25 wards were selected for the study. In Jalpaiguri town Waste Management is a serious problem and strictly need governmental concern. In west Bengal approximately total 12552 MT wastes per day. In jalpaiguri town approximately 52520 kg wastes produced every day. Out of total waste generation, 29490 kg wastes are bio degradable in nature and 23020 kg of waste are non biodegradable in nature. The solid waste management system for jalpaiguri municipality has been prepared for improvement of the present solid waste management system of the town. Project has been developed and requires 12.2 acres of land. Jalpaiguri municipality already has 14 acres of land for this purpose. At present solid waste management programmer is going through ward committee of different wards with direct supervision of the sanitary department of jalpaiguri municipality. This scheme has implemented in 16 wards. Jalpaiguri municipality has introduced a system to collect accumulated solid waste from individual premises in two separate container; bio- degradable wastes in green container and non bio degradable waste in yellow container. Collection waste is done through house to house collection and community bin collection. After collection waste is transferred to dumping ground. The function of entire system has been facing various problems such as non approval of vermi composting project, require number of vehicles, implements etc. Unhygienic open dumping is also prevalent in town. Medicinal wastes require recycling facility. Recycling facility, incineration facility is not available in town. Immediate

recycling facility should be implemented immediately. Adequate fund is also required to run the solid waste management programmer under Jalpaiguri Municipality as the system is a continuous process. Presently municipal authority has decided to engage private agency, NGO, and institution as recognized by the government to run the project of solid waste management.

The previous discussion and in order to understand the intestacies associated with the municipal waste management and all other important aspects of the present study has been conducted with the following objectives.

Objective- In this context the General objective of the study was Perception on Waste Management and Its scope for Usage in Agriculture.

The specific Objectives of the study were-

- To study the Socio-economic status of the respondents
- To understand the methods of waste management by the municipality.
- To know the people's perception on waste management
- To find out the possibility of recycling of waste for agricultural uses.
- Limitation of the Study

The study was undertaken in Jalpaiguri Town under jalpaiguri municipality in Jalpaiguri district of West Bengal. The investigation was based on the opinion expressed by the respondents from the recollection of memory by them. Being a student of M.Sc (Ag) beside the course and credit system the time available for collection of information from study area is less. Also the distance of the study area is very far from the institution. So it is not

possible to visit the study area regularly and collect information from them. It also sometimes happens that due to their pre occupation they are not willing to co-operate or providing any time for discussion. At municipality due to their hard work they cannot be able to give me enough time for the study. The findings of the experiment therefore are applicable in 25 wards of the town and their perception on Waste Management problems.