
ABSTRACT

The towns and cities have become the centres of population growth and require three essential services viz., water supply, waste water treatment and solid wastes disposal. The tremendous increase in population accelerates the amount of municipal solid waste (MSW) generation. Hence, the solid waste management (SWM) is one of the essential municipal services, to protect the environment, safeguard public health services and improve productivity.

In this context the case study is carried out for the integrated solid waste management system for GIET, GUNUPUR. The present population of the institute is 5000 and the projected population is about 7000 with floating population of 50 per day.

The study reveals that the institute generates about 1.25 tons of solid wastes per day and its annual production is about 456.25 tons. The study is been carried out for the characterization of MSW, to analyze the physical, chemical and biological characteristics of municipal solid waste.

The solid waste samples were collected from four sampling stations, and analyzed for physical and chemical characteristics. The average value of density of solid waste in the residential areas was 201.61 kg/m³. The moisture content of municipal solid waste varied from 10 percent to 20 percent and the pH of the MSW ranged from 7.07 to 7.99. The organic content in the solid waste is in the range of 40 percent to 50 percent a value slightly higher than other such institutions due to more waste inputs from 20 acres of lush green gardens. The average percentage distribution of the physical composition of solid wastes like papers, plastics, clothes, hazardous wastes, metal, glass, combustibles, bones, stones, rubber and organic wastes were obtained as 4.32, 6.52, 3.72, 0.4, 0.15, 0.57, 4.41, 0.11, 31.2, 0.12, 47.91 respectively. The average value of MSW generation rate is 0.201 kg/capita/day.

The study also reveals that, the effect of solid waste dumpsite on groundwater quality and soil. The main objective of the present study is to evaluate the impact of domestic solid waste disposal on the groundwater quality.

Urban solid wastes have become a threat to environment, both in developed and developing countries such as nuisance from odor, prevalence of unhygienic conditions, groundwater pollution etc.. Hence for a clean and healthy environment the MSW must be managed properly.

KEYWORDS: solid waste, unwanted material, Vermicomposting, ISWM,MSW.

INTRODUCTION

Solid wastes can be defined as unwanted materials in simplest term and it can also be termed as waste in the wrong place implying that a specific owner ceases to have use for it. The adverse effects of such landfills are contamination of underlying soil, groundwater and health hazards to the workers, waste pickers and neighbouring communities, proliferation of the vermin and poor air quality around landfill site due to the intentional burning of waste. Percolation of the leachate from uncontrolled land filled site into the soil aquifer is the serious problem of the water pollution.

Sources and Types of Solid Waste

The solid wastes arise in association with almost every activity of man as per IS: 9622-1980 report.

Table 1.1 Sources and Types of solid waste

SL. No	Source	Type
1	Residential	Sweepings, Fuel residue, Empty contained packages, waste, broken glass, cloths, vegetable matter etc.,
2	Commercial	Packaging materials such as fiberboards, containers, papers, plastics, wooden crates and paper packaging and office refuse such as paper, carbon paper, typewriter ribbon and fraction of food waste.
3	Institutional	Waste from schools, colleges, markets, hotels, hospitals.
4	Municipal	Waste from street and lane cleaning park and beach operation, leaves, landscaping, house gully, catch basins, sewer cleaning, repairs and dead animals.
5	Industrial	Building construction waste, factory waste and trade waste also waste from mineral extraction such as colliery waste, waste from metallurgical industries, waste from automobiles garages and garments.
6	Agricultural and animal Husbandry	Poultry Waste, urine storage refuse, straw husk etc.,

COMPOSITION OF MUNICIPAL SOLID WASTE

The total number of separate source on municipal refuse is very large which results in diverse characteristic of wastes as stated in IS: 9622-1980. The general composition of municipal refuse contain dust, cinder, vegetable, fruits, and putrescible matter, textiles, paper, metals, glass bones, combustible matters such as wood, non combustible materials such as stones and crockery pieces. The typical compositions of municipal solid waste are highlighted in Table 1.3 which shows the classification of materials comprising municipal solid waste.

Table 1.3 Classification of materials comprising Municipal Solid Waste

SL No.	Component	Description
1	Food Waste	The animal, fruit or vegetable waste from residence (also called garbage) resulting from handling, preparation, cooking and eating of foods. Because food wastes are putrescible they will decompose rapidly, especially in warm water.

2	Rubbish	Combustible or non – Combustible solid wastes excluding food waste or other putrescible materials. Typically combustible rubbish consists such as paper, cardboard, plastic textiles, leather wood, furniture and garden consists of such as glass, crockery, tin causes; aluminum causes dust and construction waste.
3	Dirt and Residue	Materials remaining from burning of wood, coal, coke and other combustible waste. Residues from power plants are normally composed of fine powdery materials, cinder, clinker and small amounts of burnt and partially burn materials.
4	Demolition And Construction	Waste from raged buildings and other structures are classified as demolition waste. Wastes from construction, remodeling and repairs of residential buildings and similar structures are classified as construction wastes.
5	Special Waste	Waste such as street sweepings, roadside litter, catch basin debris dead animals and abandoned vehicles are classified as special waste.
6	Treatment Plant Waste	The solid and semi solid wastes from water, waste water and industrial waste treatment facilities are included in this classification.

MUNICIPAL SOLID WASTE MANAGEMENT

Municipal solid waste is a heterogeneous mixture of various constituents (components).. Various processing technologies have been developed which decompose, stabilize the waste so that load on disposal site is reduced and some returns also occur.

The composition of the solid waste like Paper, Rubber, Leather and synthetics, Glass, Metal, Total combustible matter, inert are critically evaluated. It seems that, it contains nearly 30-50% organics, about 4-6% recyclable and certain constituents having calorific values.

The organic constituents of Municipal Solid Waste have inherent calorific value and can also be converted to manure. The processing of the waste is to reduce the pollution and also to recover some value can be achieved either by biological route or thermal route.

Processing of MSW

Processing techniques are used in Solid Waste Management system to improve the efficiency of Solid waste disposal system, to recover resources (usable materials), to recover conversion products and energy. This processing techniques used are Compaction, Incineration, Shredding, Manual and Mechanical separation and Drying and Dewatering

Recycling

Recycling will return raw materials to market by separating reusable products from the rest of the municipal waste stream. Recycling saves precious finite resources; lessens the need for mining of virgin materials, which lowers the environmental impact for mining and processing; and reduces the amount of energy consumed..

Composting

Composting is a controlled process by which, Biodegradable wastes (organic composition) gets decomposed through micro-organisms.

Decomposition of the organic solid waste may be done either aerobically or an aerobically. Aerobic includes even vermicomposting where earthworms are used to digest the wastes.

Compost is humus like materials that results from microbial action and degradable fraction of solid waste. It is stable, odour free and not attractive to yields, compositing is accelerated bio oxidation of organic matter through a haemophilic stage (45 C to 65 C) where microorganisms

Vermicomposting

Vermicomposting is a process of degradation of organic matter by microbes and consumption of organic material by earthworms. Only selected species of earthworms like *Eisenia foetida*, *Eudrilus eligeniae*, *Perionyx excavates*, *Lampito maturi*, etc., are suitable for vermicomposting process. These earthworm acts as crusher and aerator during the process

Aerobic digestion

Mainly aerobic processes are used to convert bio waste into compost. In these conditions, the bio waste is aerated during several weeks up to several months by forced suction or blowing

Incineration

Incineration is a technology where waste is burned in specially engineered machines. It is popularly linked primarily with hospital waste, because the use of incinerator is crucial need for the disposal of the pathological stream of Bio-medical wastes which includes body parts etc.

Incineration is a process of controlled combustion for burning solid, liquid and gaseous combustible wastes to gases and residue containing non-combustible material.

INTEGRATED SOLID WASTE MANAGEMENT (ISWM)

Integrated solid waste management (ISWM) can be defined as the selection and application of suitable techniques, technologies and management programs to achieve specific waste management objectives and goals.

Planning, development and implementation of ISWM is essentially a local activity that involves the selection of the proper mix of alternatives and technologies to meet changing local waste management, flexibility in meeting future changes and the need for monitoring and evaluation. 1) The amount of wastes separated for reuse and recycling. 2) The amount of waste that is composted. 3) The amount of waste that is combusted. 4) The amount of waste to be disposed of in landfills

MATERIALS AND METHODS**STUDY AREA**

G.I.E.T is an engineering institute in Gunupur, Odisha and is located on the Paralekhamundi-Gunupur (SH04) National highway at 19.0489°N latitude and 83.8338° E longitude. It receives annual rainfall of 1268 mm. The current population of the institute is about 5000 and floating population of about 50/day. It is having an average connectivity by road and rail. The G.I.E.T institute plan extends over an area of 62 acres. The entire area is divided into four zones for the different land use.

MSW generation rate was determined by load count analysis and was calculated using the following expression.

Table 3.1 shows the volume of vehicle and no of trips in the town.

$$\text{No of trips / day} \times \text{volume m}^3 \times \text{density kg / m}^3$$

Generation rate kg / capita / day

Population

IMPACT OF MSW DUMPSITE ON GROUNDWATER QUALITY

To study the impact of MSW dumpsite on ground water quality. Groundwater samples at eight different locations were collected from a distance of 1km radius from the MSW dumping site, as per the standard method and analyzed for physical, chemical and biological parameters. The sampling and analysis were carried out using standard methods (APHA, 1995). Physico-chemical parameters namely pH, electrical conductivity, calcium, magnesium, sulphate, nitrate, chloride, total dissolved solids were determined and compared with water quality standards prescribed by WHO, ICMR and BIS.

Impact of MSW Dumpsite on Soil

The various parameters of soil characteristics like pH, electric conductivity, organic carbon, phosphate, zinc, iron, potassium, calcium, magnesium, chloride and sodium are analyzed and compared with the permissible standard values for soil at 4 feet depth at the dumpsite. The standards for physico-chemical parameters of soil at various depth.

RESULTS AND DISCUSSION

The sample collected from various sampling stations during the pre-monsoon and monsoon season were analyzed for the following parameters pH, potassium, phosphorus, carbon, nitrogen, oxygen, hydrogen, calorific value, fusing point and C: N ratio.

Effects of solid waste dump site on soil quality

Soil pH is indicative of acidity or basic of soil. pH of soils plays a very important role in making the nutrients available to plants

Electrical Conductivity

Since ions are the carrier of electricity, the electrical conductivity (EC) of the soil water system raises according to the content of soluble salts concentration of the soil at any particular temperature

Groundwater sampling locations within the 1km radius from the dumpsite, Leachate at dumpsite, Groundwater samples at dumpsite and near to the dumpsite (100ft away from the dumpsite) & soil sample at 4ft depth at the dumpsite were considered for analysis.

Results of the study shows the parameters are not within the standard permissible limits which indicate that, the groundwater is polluted in and around the dumpsite. Hence it is suggested to identify the suitable site for landfill for waste management system.

The Future waste prediction is done by simple linear correlation model by assuming 20% increment from the mean value of every year. The future waste prediction shown in table 6.1.

Table 6.1 Future waste prediction

Years	Rate of waste generation (ton/day)
2006	50
2011	77
2016	93

2021	112
2026	135
2031	162

CONCLUSION

It is evident from the solid waste characterization that the waste should be managed in an appropriate way for sustainable SWM. Accordingly, the different units designed for the landfills necessitated the design of composting yard, runoff collection basins curing piles

- The percentage of paper varies from 3.9 to 5.22 percent therefore it can concluded that incineration method can be adopted for burning of paper and other combustible materials such as clothes hazardous wastes, bones , leaves, coconut shells, and jute
- The pH of the MSW ranges from 5.99 to 6.7, hence it is concluded it will be helpful for composting process.
- It is evident from the observations that the causes and sources of pollution in the study area are due to onsite disposal system of the solid waste.
- Dump site effects on polluting soil and water shall be stopped.
- The quality of groundwater near MSW dumping site is unsuitable for human consumption.
- The soil was also affected due to dump site of solid waste.
- The parameters like soil pH, electrical conductivity phosphates, zinc, iron, potassium, and chlorides etc., exceeded the permissible value.
- It can be concluded that the selection of dumping site is more important to protect the various environmental attributes.
- To go for long term sustainable solution aiming at zero waste management.
- To go for enzyme based plants for quick conversion of organic waste into organic manure to be located in high waste generating areas.
- To educate the people and to create public awareness for managing the waste.
- To manage the SW arising in & around Hosur, to provide a clean environment over the entire area.
- Incentive based plastic & other recyclable waste clearance for local rag pickers.
- Dedicated garbage clearance teams for high waste generating areas.
- Rewards/recognition, scholarship for children etc for municipal sanitation workers.

A case study conducted on the college G.I.E.T gives us the major example of community participation by its NSS team .The organization always emphasizes on the cleanliness of the environment and the health of its staff and students.

The government of India initiative of “Swachh Bharat Abhiyan” is the best and great example of cleanliness and also provides opportunities for the innovative waste recycle or reusable techniques as well as for deduction in waste generation and evolvment of sustainable growth of society and country.

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