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Solid Waste Management and Regulatory Mechanism; A Key to Sustainable Development

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Abstract: - **The Sustainable Development Goals (SDGs) cannot be met unless waste management is addressed as a priority1. This paper includes the detailed study on one of the pillars of sustainability; The Pillar of Environment. This paper aims at current status of waste management & its effects on public health, the prospects of introducing a holistic Integrated, sustainable environment. Also aims at efficient solid waste management strategies in urban local bodies (ULBs) of the state of Telangana.**

Further, assessment of quantity, Characterization and classification of Municipal Solid Waste (MSW), Situation/Gap Analysis of the existing condition with respect to SWM Rules, 2016. Detailed planning for resource requirement & implementation strategies are discussed. Also suggested innovative processes and their enforcement for making the habitations litter free, bin free and dump free to prevent the health hazard thus achieving environmental sustainability. An attempt made to generate energy from waste – Waste To Energy (WTE).

This paper also aims at exploring various challenges and constraints in policy making and the regulatory mechanism for sustainable development in urban context with respect to its waste management. Effort was made to arrive at solutions that the ULBs and the state governments could implement by improvising on administrative systems, making attitudinal changes and utilizing relevant technologies to augment human performance and efficiency.

Keywords--- Waste management; Policy making; Regulatory Mechanism; Waste to energy

I. INTRODUCTION

Rapid pace of urbanization, industrialization and economic growth are the causes of consequent rise in the generation of solid waste. Poor attitude of the human in urban areas has made solid waste management an important area of concern. The environmental impacts associated improper management along with an increased awareness on the resourceful potential of wastes has created an urgent need to develop systems for recovery of useful resources as well as safe disposal of wastes.

The average per capita generation of solid waste in India is 0.4kg/day. The solid waste generated in Indian cities has a higher organic content as compared to the developed countries as indicated by the biodegradable content of 52%. While the percentage of paper and plastics is about 6%, metal scrap, rubber, c;oth, and other such products is higher at 11%.

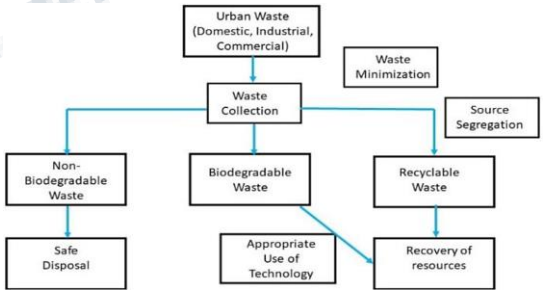

Fig.1

Question 1. What are the best measures and technology to be selected for waste to energy for MSW treatment?

Question 2. How can we improve the systems and processes for sustainable municipal solid waste management?

II. BACKGROUND & PURPOSE OF STUDY I. CHALLENGES & GUIDELINES FOR WASTE MINIMIZATION

Countries over time experience development with the growth of industrialization and globalization. Thus, a discussion has been developed if this development is sustainable. "Development practitioners have focused on sustainable development as an environmental concept placing the

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emphasis on intergenerational equality focus on future development of the world" (Carter, 2001). According to World Conservation Strategy (WCS) development depends on environmental conservation (Adams, 2009, p.275). Sustainable use of the environmental resources and services are very important for sound environmental development. Thus, the human way of life has placed a lot of pressure on the environment because of their high consuming behaviour which is accelerating simultaneously with economic development. This matter has raised awareness of sustainable development which integrating the natural world and the human social world towards future prosperity. Therefore, development practitioners, policy makers and international organizations realize the point that there must be a harmonious co-existence among human society, development and environment in order to achieve sustainable development.

2.1. CHALLENGES & GUIDELINES FOR WASTE MINIMIZATION

Its been a challenge for the proper disposal of waste to avoiding significant environmental impacts and adverse effects on human health.

2.1.1 The challenges in developing countries may include:

1. Lack of awareness of 3R waste management strategies – Reduce, reuse and recycling of Municipal waste for cleaner environment.
2. Lack of standard policies and implementation.
3. Lack of Waste management technologies
4. Lack of Capital and know how
5. Lack of damping sites
6. Lack of good governance to enforcement of policies.
7. Lack of public commitment and production energy from waste

2.2 waste minimizations

Basic steps in solid waste management begin with the strategies to be adopted for waste minimizations Fig.1

Use material that can minimize the waste generation for example Use cloth for cleaning instead of tissue paper and use a large cloth shopping bag when purchase of goods rather than plastic or paper bags.

III. LITERATURE STUDY

1. Characteristics of MSW (Municipal Solid Waste)
2. Segregation of wastes
3. Resource recovery or recycling
4. Processing of waste
    1. Treatment techniques for waste processing
    2. Thermal Processing
    3. Biological Processing
    4. Composting – various methods of composting
    5. Anaerobic digestion systems for energy and resource recovery
    6. Landfilling
        1) Basic steps for setting up landfills
        2) Estimation of landfill volume
        3) Site selection
        4) Landfill design
5. Estimation of energy generation potential from wastes

3.1) Characteristics of MSW (Municipal Solid Waste)

As per initial studies on compositional analysis Municipal Solid Waste (MSW) on of urban areas, it has been found that the MSW contains a high amount of sand grit, and ash. The moisture content and organic compostable matter is also high as compared to grass and metals. The chemical characteristics indicates a high carbon, nitrogen ratio and nitrogen phosphorus and potassium value, and has a calorific value of 960 kcal/kg. The percentage of volatile matter is about 30%.

3.2) Segregation of Wastes

Next stage in waste management is the segregation of collected waste for recycling and recovery of useful products for efficient resource recovery and appropriate treatment for resection of the waste segregation of waste at source is essential this can be achieved through the multiple system at every waste generation source local authorities should provide different colour bins for different categories of waste

3.3) Resource Recovery or Recycling

- Explore the possibility of recycling items that cannot be reused.
- Avoid disposing paper and cardboard waste along with other organic waste such as vegetable and food waste items facilitate recycling of these items through the local person engaged in these activities.
- Recycle glass bottles and jaws plastic bottles containers made of pet polyethylene perforate aluminium cans and foils metallic atoms such as Steel cans scrap such as old pipes and appliances made of steel copper and brass

IV. PROCESSING OF WASTE

Treatment Techniques for Waste Processing

The quality and characteristic of solid weight determines the type of treatment system that need to be adopted in addition the site and climatic conditions of particular region also influence the decision to follow a particular system the moisture and carbon contents of waste or essential to evaluate whether a particular technology or combination of treatment system is is appropriate for a particular session of waste

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4.1) Waste Processing

The waste of leftover after the removal of the fraction for recycling can be processed by appropriate technology such as landfilling composting and repeat the degradation or thermal decomposition.

4.2) Thermal Processing

This method of processing includes director indirect burning of waste material resulting in heat generation the two techniques under this process processing technique or explain below.

4.2.1) Palletization Or Briquetting: of marketing this process involves the separation of combustible person from the non-combustible portion of the solid waste which is then either used directly or as pellets and wickets to replace the conventional fuel for thermal application or power generation.

4.2.2) Incineration this technology of disposal of waste which is more suitable for hazardous waste requires burning of waste material at a high temperature of 2000 degrees 10 centigrade in presence of air.

4.3) Biological Processing This technique is most appropriate for organic and highmore surveys and include to main processing mechanisms composting and anaerobic digestion for bio methanation composting and anaerobic digestion or techniques that involves the conversion of biodegradable waste into useful products this results in the generation of useful resources either manually or both manual and energy in the form of high calorific value of fuel

4.4) Composting

Heterotrophic microorganisms act on organic matter. As a result of the action of enzymes the organic compounds are first converted into simpler intermediates like alcohol or organic acids, and letter into simple compounds like sugars. This results in humic acid and available plant nutrients in the form of soluble in organic minerals like nitrates sulphates and phosphates. Figure 5 gives various stages in the conversion of organ waste into enriched manure through composting.

Optimum Conditions For Composting
Carbon/nitrogen ratio 30:1
particle size 1/8 to 2inches
Oxygen 15% - 20%
Temperature 55 - 65.50 C
Moisture 40% - 60%
pH value 6.5 - 7.5

4.4.1) Different Methods Of Composting

The decomposition of organic matter for production of compost fertilizer can take place in absence of presence of air and is referred to as anaerobic and aerobic decomposition and aerobic compass composting requires the presence of oxygen achieved through mixing of waste there are various methods of composting that can be undertaken at the residential or community level.

4.4.2) Vermicomposting

This is a process where food material and kitchen waste, including vegetable and fruit peels, and papers, can be converted into compost through the natural action of worms. An aerobic condition is created due to exposure of organic waste to air. Many Asian countries are adopting this process for waste disposal. Although there are thousands of species of earthworms Eisenia foetida Eisenia andrei or widely used for decomposition of organic waste.

4.5) Anaerobic Digestion System for Energy and Resource Recovery

Aerobic division involved the decomposition of organic compounds by microorganisms in absence of oxygen to produce biogas, which is a mixture of methane and carbon dioxide. The optimum temperature for anaerobic digestion process is 370 C with a pH of 7. In addition the waste treatment, the process of anaerobic degradation is advantageous because of the generation of clean fuel that can be used for various thermal applications and for power generation. The digested search can be also used as manure.

4.6) Landfilling

Landfilling is a naturally occurring biological process which is more commonly used for mixed wastes. Due to a decrease in the available and area the MoEF, GoI, has come up with rules for solid waste management and handling that do not allow the disposal of organic biodegradable waste in the landfill. According to this rule, the landfill technology is to be limited to the disposal of non-biodegradable waste and residue from the other processing techniques such as incineration.

4.6.1) Basic Steps for Setting Up Landfills

- Estimate the landfill volume required based on the density of waste to be landfilled.
- Select inside keeping in mind the transportation as well as the impact of landfilling
- Estimate the benefits in terms of resource recovering such as energy from landfill gas.
- Use the landfill site post closer to the landfill.
- Develop a drainage plan for the leachate.

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- Develop a plan for the collection of landfill gas.
- Possibly utilise the landfill gas for thermal application of power generation.
- Make arrangements for covering the landfill.
- Develop a protocol for monitoring the size site for many for any groundwater contamination and gaseous emissions.
- Formulate a plant for the maintenance of landfill till closure.

4.6.2) Estimation of Landfill Volume
Parameters required include the following

- Rate of decomposition:
- The decomposition rate of the reduction in higher in height is taken as 80% to 85% of the organic quantum of 11 field based in five years.
- Quantity and density of Waste:
- Use projections based on the population growth waste generation and collection efficiency.
- Estimate the quantity to be filled double and field after accounting for the quantum of waste winn process with the various technologies in the fraction being recycled.
- Consider the additional quantity of soil added to the waste daily in the range of 2:1 or 5:1 by volume.

4.6.3) Site Selection
A need and benefit assessment of the following factors should be considered before setting up at site at the identified area

- Population and just to be benefited by the site.
- Estimate the quantity of waste to be disposed.
- Life of the size site and should be required to support waste disposal of the area after 20 years.
- End use of resources by the beneficiaries.
- Transportation route and distance from the city that is accessibility.
- Site should not in buildings of archaeological importance and fertile land where agricultural activities are possible.
- Evaluate the proximity of site to airport wetlands areas prone to flooding or earthquakes.
- Evaluate the environmental and social impacts, such as health proximity to groundwater and surface water sources and adjacent land use.
- Estimate the possibility of leakages at the site by drinking boreholes that reach below the water table. Monitoring the increase in water level in the holes would help determine the vertical and horizontal flow.

For assessing the appropriateness of the selected site data pertaining to geology and hydrology of the site such as depth to groundwater.
Groundwater quality construction characteristics of the soil for moisture content, permeability, density, porosity and pH required.

4.6.4) Landfill design

- After the initial steps of estimating the landfill volume and identification of the site, the next important step in the design of landfills. The basic steps in in landfill design or given below: Specifications of the dimensions of the site area that is the width depth and length.
- Type of lining material and required wild almost amount of soil required for incinerating mixing and for final layer etc

V. ESTIMATION FOR ENERGY GENERATION POTENTIAL FROM WASTES

Energy generation depends on the following factors of MSW

- Size
- Moisture content
- Density
- Fixed carbon
- Volatile solids
- Calorific value

VI. SUMMARY

In this paper, an attempt has been made to study the changing trends of quantity and characteristics of MSW. Waste composition emphasizes the segregation of waste at source enable the successful operation of MSWM facilities. Municipal authorities or the ULBs should maintain proper storage facilities and provide healthy and hygienic condition of living. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analysed to obtain statistically reliable results..

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