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Climate Change Energy And Decentralized Solid Waste Management

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ABSTRACT
India Is The Second Largest Nation In The World, With A Population Of 1.21 Billion, Accounting For Nearly 18% Of World's Human Population, But It Does Not Have Enough Resources Or Adequate Systems In Place To Treat Its Solid Wastes. Its Urban Population Grew At A Rate Of 31.8% During The Last Decade To 377 Million, Which Is Greater Than The Entire Population Of Us, The Third Largest Country In The World According To Population. India Is Facing A Sharp Contrast Between Its Increasing Urban Population And Available Services And Resources. Solid Waste Management (Swm) Is One Such Service Where India Has An Enormous Gap To Fill. Proper Municipal Solid Waste (Msw) Disposal Systems To Address The Burgeoning Amount Of Wastes Are Absent. The Current Swm Services Are Inefficient, Incur Heavy Expenditure And Are So Low As To Be A Potential Threat To The Public Health And Environmental Quality. Improper Solid Waste Management Deteriorates Public Health, Causes Environmental Pollution, Accelerates Natural Resources Degradation, Causes Climate Change And Greatly Impacts The Quality Of Life Of Citizens With Increasing Population And Urbanization, Municipal Waste Management In Our Cities Is Emerging As A Major Problem, Which Is Going To Get Even Worse In The Future. The Total Msw Generated In Urban India Is Estimated To Be 68.8 Million Tons Per Year (Tpy) Or 188,500 Tons Per Day (Tpd) Of Msw. This Will Lead To The Generation Of Even More Wastes With Serious Implications For Urban Sanitation And Health, The Environment And Global Warming And Climate Change. And Where Will This Waste Be Disposed, Considering That Large Cities In The Country Are Already Finding It Difficult To Locate The Land Needed To Dispose Their Waste? Of The Green House Gas (Ghg) Emissions (Which Include Carbon Dioxide, Methane, Nitrous Oxide, Etc) That Cause Global Climate Change, The Bulk, About 40 Per Cent, Comes From The Energy And Transport Sectors. Other Sources Include Chemical-Intensive Agriculture, Particularly The Heavy Use Of Nitrogen Fertilizer, Which Accounts For 15-25 Per Cent, And Open And Decaying Urban Waste Dumps. Studies Have Shown That Open Waste Dumps Contribute About 2 Per Cent Of The Total Global Ghg Emissions, Mainly Methane Which Traps Much More Heat Than Carbon Dioxide (But Is Less Abundant And Short-Lived In The Atmosphere Than Carbon Dioxide). Open Waste Dumps Account For About 12 Per Cent Of The Total Global Emissions Of Methane. A Study By The Energy Research Institute (Teri), New Delhi, Estimated That, In 1997, Waste Dumps In India Released About 7 Million Tonnes Of Methane, And This Is Likely To Rise To 39 Million Tonnes By The Year 2047. The Country's Net Emissions (In Terms Of Carbon-Equivalence) From Wastes Grew At 7.3 Per Cent Annually During The Period 1994-2007, According To A Recent Report By The Union Ministry Of Environment And Forests. Most Big Municipalities Continue To Dump Wastes In Open Grounds. Such Central Dump Sites Create Serious Health And Environmental Problems And Release Ghgs. Much Of These Wastes Going To Central Waste Dumps Can Be Reused And Recycled, And The Rest Converted Into Compost/Fertilizer And Energy (Methane And Electricity) Using Low-Cost Technologies. Besides Creating A Cleaner Environment, This Will Help Conserve Materials, Offer A Sustainable Source Of Renewable Energy And Reduce Ghg Emissions -- Goals That Need To Be Strongly Pursued In The Face Of An Acute Shortage Of Energy And Climate Change.

KEYWORDS: Climate Change Energy , Decentralized, Solid Waste Management

I. INTRODUCTION

Solid wastes are the wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted. The term solid waste as used in this text is all inclusive, encompassing the heterogeneous mass of throwaways from the urban community as well as the more homogeneous accumulation of agricultural, industrial, and mineral wastes. From the days of primitive society, humans and animals have used the resources of the earth to support life and dispose of wastes. In early times, the disposal of human and other wastes did not pose a significant problem, because the population was small and the amount of land available for the assimilation of wastes was large. Although emphasis is currently being placed on recycling and fertilizer value of solid wastes, the farmer in ancient times probably made a bolder attempt at this.

Indications of recycling may still be seen in the primitive, yet sensible, agricultural practices in many of the developing nations where farmers recycle solid wastes for fuel or fertilizer values. Problems with the disposal of wastes can be traced from the time when humans first began to congregate in tribes, villages, and communities and the accumulation of wastes became a consequence of life. Littering of food and other solid wastes in medieval towns-the practice of throwing wastes into the unpaved streets, roadways, and vacant land-led to the breeding of rats, with their attendant fleas carrying bubonic plague.

The relation between public health and improper storage, collection, and disposal of solid wastes is quite clear. Public health authorities have shown that rats, flies, and other disease vectors breed in open dumps, as well as in poorly constructed or poorly maintained housing, in food storage facilities, and in many other places where food and harborage are available for rats and the insects associated with them. Ecological phenomena such as water and air pollution have also been attributed to improper management of solid wastes.

Solid waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservations , and that is also responsive to public attitudes.

1.2 Need For Study

Nowadays metropolitan cities have facing a biggest problem on solid waste. Due to solid waste many areas are affected and lead to danger for people and green environment.

In this faster world how to manage the solid waste in a quick manner. In this present study how to manage the solid waste in faster manner like how to collect, disposal, treatment and etc.,

1.3 Objectives

- Pollution control
- Prevent Ground water contamination
- Minimize the waste
- Recycle and reuse
- Green environment
- Healthier world

1.4 Scope Of Solid Waste Management

In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in solution to all problems of solid wastes. The solutions may involve complex interdisciplinary relationships among such fields as political science, city and regional planning, geography, economics, public health sociology, demography, Communications, and conservation, as well as engineering and material science.

II. CLIMATE CHANGE

Climate change is a global phenomenon that will have varying regional impacts. These impacts are projected to intensify as global atmospheric concentrations of greenhouse gases continue to rise. In Salem, changes in the region's climate over the next century are likely to have serious impacts on the region's economy, infrastructure (including housing, roads, and utilities), and natural environment.

2.1 Determine how climate change will affect salem diverse regions

Although we already have useful information that can be acted upon, additional information in the hands of decision-makers is essential if we are to successfully address climate change. We must collect new information and develop new analytic tools in order to most effectively enact a response.

- **Business-as-Usual is Not Climate as Usual:** A change in the Earth's climate of unprecedented magnitude is now inevitable, but concerted action to reduce greenhouse gases can help reduce the degree to which our climate changes.
- **Our Climate is Changing Faster Than Anticipated:** Recent scientific work indicates that the climate is changing faster that had been anticipated even three years ago5, and that we may be approaching a less favorable climate regime to sustain Salem's economic health.
- **Significant Economic Threat:** Research shows that climate change will ultimately produce significant adverse economic impacts on most sectors of Salem's economy.
- **Significant Human Health Threat:** Climate change brings with it significant new health threats, such as new diseases and new disease vectors.
- **It is Urgent that We Act Now:** A broad scientific consensus tells us that it is urgent that we act immediately to reduce the release of greenhouse gases if we are to keep climate change manageable, and to prepare for the impacts of warming that are now inevitable.
- **There are Significant Costs to Delay:** Waiting to act is not a wise choice, as the costs of inaction in terms of disruptions to the economy

far outweigh the costs of implementing mitigation, preparation, and adaptation.

- **Preparation and Adaptation are Mandatory:** The changes to the climate are significant, and will require all parts of civilization – our food, shelter, transportation, and energy systems – to invest considerable thought and capital to successfully prepare and adapt.
- **Uncertainty is a Fact of Life:** Lack of scientific certainty should not preclude action; in fact, continued research will play a key role in our success in preparation and mitigation.
- **Decoupling Our Economy from Greenhouse Gas Emissions:** Since we must reduce our emissions dramatically while facing a growing population, we must decouple the growth in our economy from rising emissions and move rapidly towards a low-carbon economy.
- **An Economic Development Opportunity:** While climate change represents a risk, the transition to a low-carbon economy and climate change preparation activities will not only make Salem more resilient to a changing climate, but also represents an economic development opportunity that Salem is particularly well-suited to seize.
- **Solutions Improve Quality of Life:** Many of the solutions we implement will not only make Salem more resilient to a changing climate and related economic impacts, they also will improve our quality of life.
- **Planning in a Time of Rapid Change and Uncertainty:** We can no longer rely on our past experiences to help us predict and plan for future environments.

2.2 Centralized and decentralized solid waste management

The Salem Municipal Corporation practice centralized solid waste management. The disadvantage of

Fig: No: 2.1Over Flowing Garbage Bins

centralized control of solid waste management is that the wastes are not collected in an efficient manner As a result; overflowing garbage bins at the public collection sites, scattered garbage all over is common scenario prevailing in most colonies in the city.(Fig.2.1)

2.3 NEED FOR DECENTRALIZED SOLID WASTE MANAGEMENT

Mosquitoes breed in blocked drains and in rainwater that is retained in discarded cans, tyres and other objects. Mosquitoes spread disease, including malaria and dengue. Rats find shelter and food in waste dumps, consume and spoil food and spread disease.

2.4 Need for decentralized solid waste management

For the city like Salem, decentralized solid waste management system will be more appropriate. Directly proportional to population increase, the solid waste problem has become one of the prime concerns for the city Government. Salem Municipal Corporation is finding difficult to dispose their wastes.

2.5 Benefits of decentralized solid waste management

Apart from providing a sustainable solution to waste management, this system has many direct as well as indirect economic, social, health and environmental benefits. Some of the important benefits are:

2.5.1 Economic Benefits

This model is labor intensive rather than capital intensive. Thus, a solid waste management system of this kind provides livelihood option. Proper and skilled segregation of recyclable material fetches higher prices. Consequently, the quality of end products made from these recyclables improves many folds, which in turn, fetches higher prices and helps in preserving and promoting the faith of committed consumers in these recyclable goods plus it can give a new impetus to the recycling industry.

2.5.2 Health Benefits

The provision of formalizing the working conditions of waste collectors provides them with the opportunity to work in healthier conditions. The provision of gloves, uniforms and

Fig: No: 2.2 Non- biodegradable collection site at MGPG College

other safety equipment improves their working condition. The neat and clean neighborhood makes the area less prone to diseases. The reduction in number of mechanized vehicles used for primary transportation of waste results in reduced emission of many harmful gases, which indirectly benefit the health of the all the residents of the city. Fig:2.2 shows Nonbiodegradable collection site at MGPG College

2.6 Waste generation by various socio-economic groups in intervention area

Average Solid Waste generation every day by households of Higher Income Group (HIG), Middle Income Group (MIG) and Lower Income Group (LIG) in the intervention area Salem is shown in the Fig.2.3

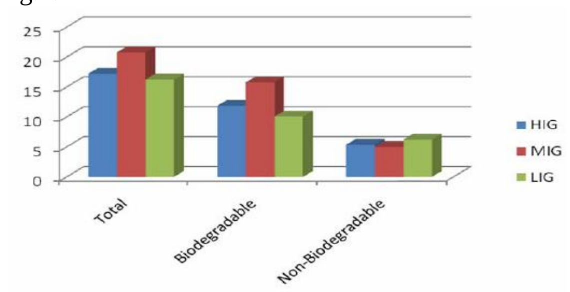

Fig.2.3 Waste generation by various socio-economic groups

III. STUDY AREA & COLLECTION

3.1 Primary Collection:-

There are 1,80,323 House Holds are available in this Corporation. The Municipal Solid Waste Generated from the above House Holds is 350MT/day. The Generated Solid Waste generated is collected by the 1310 Corporation Employees in 39 Divisions. (Fig.3.1)

Fig No 3.1 collected the Solid Waste generated

Remaining 21 Divisions, Corporation is engaged 644 Labour under Daily wages and collected the Solid Waste generated. About 400 Push Cart in being utilized for the primary collection Door to Door collection is being Implemented in 21 Divisions.

3.2.Secondary Collection:-

For Secondary Collection, the following Vehicles are available in this Corporation.

1) Tractor with Trailers - 31
2) Tipper - 16
3) Dumper Placer - 12
4) Compactor - 8
5) Dumper Bins, Compactor Bins - 471

The Solid Waste in having collected 2126 People in the entire City. The collected Solid Waste is taken to the Disposal site at Chettichavadi Village.

3.3 Scientific Disposal:-

The Ground water in the surrounding area gets polluted and frequently agitation was taken place by the people of that area for dumping of the garbage. Disposal of garbage is big problem to the Corporation. In this situation it is decided to establish the scientific disposal facility to dispose the garbage generated in the City as per Municipal Solid Waste 2000 (MSW 2000) rules and as per orders of Supreme Court of India.

3.4 Methodology

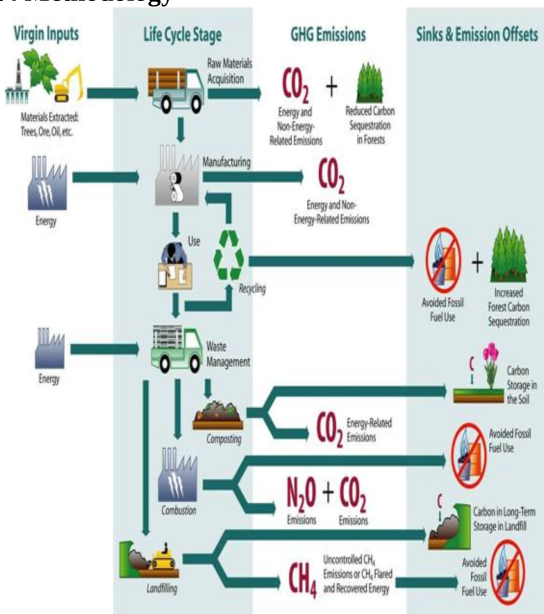

Fig No 3.2 Methodology

IV. SOLID WASTE DISPOSAL

4.1 GENERAL

Until relatively recently, solid waste was dumped, buried, or burned, and some of the garbage was fed to animals. The public was not aware of the links of refuse to rats, flies, roaches, mosquitoes, fleas, land pollution, and water pollution. People did not know that solid waste in open dumps and backyard incinerators support breeding of diseases vectors including typhoid fever, endemic typhus fever, yellow fever, dengue fever, malaria, cholera, and others. Thus, the Cheapest, quickest, and most convenient means of disposing of the waste were used. Rural areas and small towns utilized the open dump or backyard incinerator. Larger towns and cities used municipal incinerators. Later, land filling became the method of choice for disposing of solid waste.be satisfactory. Disposal of solid waste has to be accomplished without the creation of nuisance and health hazards in order to fill full the objectives of solid waste management program. These are:

- Improvement of esthetic appearance of the environment
- Avoidance of smells and unsightliness.
- Reduction of disease by curtailing fly and rodent breeding
- Prevention of human and stray dogs from scavenging

In disposal of solids wastes, it is recommended that the following will be done to avoid any risks:

- The disposal site to be 30 meters from water sources in order to prevent possible Contamination
- Prevention of underground water pollution should be taken into account
- Radioactive materials and explosives should not be together.
- Site should be fenced to keep way scavengers.
- All surface of dump should be covered with materials

4.2 SOLID WASTE DISPOSAL METHODS

Generally there are several methods of solid waste disposal that can be utilized. These methods are:

1. Ordinary open dumping
2. controlled tipping/burial
3. Hog feeding
4. Composting
5. Grinding and discharge in to sewer
6. Dumping into water bodies
7. Disposal of corpus
8. Incineration
9. Sanitary landfill

4.2.1 Open dumping

Some components of solid waste such as street sweepings, ashes and non-combustible rubbish are suitable for open dumping. Garbage and any other mixed solid wastes are not fit or suitable because of nuisance and health hazard creation. Generally, solid waste is spread over a large area, providing sources of food and harborage for flies, rats and other vermin.(Fig.4.1)

The following points should be kept in mind and must be considered before selection and Dumping .

- Sources of water supply and distance from it
- Direction of wind
- Distance from nearest residents disposal site to the nearby farm areas and main land
- Distance that flies can travel from living quarter as well as the distance that the rodents can travel from disposal areas and living quarters.

Fig No 4.1: Open Dumping

4.2.2 Controlled tipping/burial

Indiscriminate dumping of garbage and rubbish create favorable conditions for fly-breeding, harborage and food for rodents, nuisances etc. In order to avoid such problems, garbage and rubbish should be disposed of under sanitary conditions. One of the simpler and cheaper methods is burning garbage and rubbish under controlled Conditions. Controlled or engineered burial is known as Controlled Tipping or Sanitary LandFill System.

If properly done this system can prevent fly-breeding, rodent harborage, mosquito-breeding and nuisances. It can be applied in areas where appropriate land is available for such practice. This system can be considered an adaptation of what is technically called the SANITARY LAND FILL system in municipal solid wastes management service. Principally it consists of the following steps.

- Choosing suitable site, usually waste land to be reclaimed within reasonable distance from habitation.
- Transporting the generated wastes to the site by appropriately designed vehicles.
- Laying the wastes in appropriate heap to a pre-determined height.
- Compacting the layer mechanically
- Covering the compacted layer with a thin layer of earth 22 cm depth at the end of each work day. The same steps are repeated for each work period.

4.2.3 Hog feeding

The feeding of garbage to hogs has been practiced for many years in different parts of the world. But there is surprising high incidence of trichinosis among hogs which are fed with uncooked garbage.

4.2.4 Composting

Composting is an effective method of solid waste disposal. In composting, biodegradable materials break down through natural processes and produce humus. It involves the aerobic biological decomposition of organic materials to produce a stable humus-like product. Biodegradation is a natural, ongoing biological process that is a common occurrence in both human-made and natural environments.

Up to 70 percent of the municipal solid waste stream is organic material. Yard trimmings alone constitute 20 percent of municipal solid waste stream. Composting organic materials can significantly reduce waste stream volume and offers economic advantages for communities when the costs of other options are high.

Developing and Operating Successful Composting Programs Presents Several Challenges

These challenges include the following:

- Developing markets and new end uses
- Inadequate or nonexistent standards for finished composts
- Inadequate design data for composting facilities
- Lack of experienced designers, vendors, and technical staff available to many municipalities
- Potential problems with odors
- Problems controlling contaminants
- Inadequate understanding of the biology and mathematics of composting.

The Feedstock Determines the Chemical Environment for Composting

Several factors determine the chemical environment for composting, especially:

a) The presence of an adequate carbon (food)/energy source,
b) A balanced amount of sufficient nutrients,
c) The correct amount of water,
d) Adequate oxygen, e) appropriate pH, and
f) The absence of toxic constituents that could inhibit microbial activity.

The Ratio of Carbon to Nitrogen Affects the Rate of Decomposition

The ratio must be established on the basis of available carbon rather than total carbon. An initial ratio of 30:1 carbon: nitrogen is considered ideal. To lower the carbon: nitrogen ratios, nitrogen-rich materials (yard trimmings, animal manures, bio solids, etc.) are added.

Moisture Content Must Be Carefully Monitored

Because the water content of most feedstock is not adequate, water is usually added to achieve the desired rate of composting. A moisture content of 50 to 60 percent of total weight is ideal. Excessive moisture can create anaerobic conditions, which may lead to rotting and obnoxious odors. Adding moisture may be necessary to keep the composting process performing at its peak. Evaporation from compost piles can also be minimized by controlling the size of piles.

Maintaining Proper Ph Levels Is Important

pH affects the amount of nutrients available to the microorganisms, the solubility of heavy metals, and the overall metabolic activity of the microorganisms. A pH between 6 and 8 is normal.

Planning a Composting Program Involves These Steps

- ❖ Identify goals of the composting project.
- ❖ Identify the scope of the project—backyard, yard trimmings, source-separated, mixed municipal solid waste, or a combination.
- ❖ Get political support for changing the community's waste management approach.
- ❖ Identify potential sites and environmental factors.
- ❖ Identify potential compost uses and markets.
- ❖ Initiate public information programs.
- ❖ Inventory materials available for composting.
- ❖ Visit successful compost programs.
- ❖ Evaluate alternative composting and associated collection techniques.
- ❖ Finalize arrangements for compost use.
- ❖ Obtain necessary governmental approvals.
- ❖ Prepare final budget and arrange financing.
- ❖ Construct composting facilities and purchase collection equipment, if needed.,etc.

Technologies for Composting

The four composting technologies are windrow, aerated static pile, in-vessel and anaerobic composting. Supporting technologies include sorting, screening, and curing. The technologies vary in the method of air supply, temperature control, mixing/turning of the material, and the time required for composting. Their capital and operating costs also vary considerably.

The Biological Composting Processes

Peak performance by microorganisms requires that their biological, chemical, and physical needs be maintained at ideal levels throughout all stages of composting. Microorganisms such as bacteria, fungi, and actinomycetes play an active role in decomposing the organic materials. Larger organisms such as insects and earthworms are also involved in the composting process, but they play a less significant role compared to the microorganisms.

Chemical Processes

The chemical environment is largely determined by the composition of material to be composted. In addition, several modifications can be made during the composting process to create an ideal chemical environment for rapid decomposition of organic materials. Several factors determine the chemical environment for composting, especially: (a) the presence of an adequate carbon food)/energy source, (b) a balanced amount of nutrients, (c) the correct amount of water, (d) adequate oxygen, (e) appropriate pH, and (f) the absence of toxic constituents that could inhibit microbial activity.

Carbon/Energy Source

Microorganisms in the compost process are like microscopic plants: they have more or less the same nutritional needs (nitrogen, phosphorus, potassium, and other trace elements) as the larger plants. There is one important exception, however: compost microorganisms rely on the carbon in organic material as their carbon/energy source instead of carbon dioxide and sunlight, which is used by higher plants.

Nutrients

Among the plant nutrients (nitrogen, phosphorus, and potassium), nitrogen is of greatest concern because it is lacking in some materials. The other nutrients are usually not a limiting factor in municipal solid waste or yard trimmings feedstock. The ratio of carbon to nitrogen is considered critical in determining the rate of decomposition. Carbon to nitrogen ratios, however, can often be misleading. The ratio must be established on the basis of available carbon rather than total carbon. In general, an initial ratio of 30:1 carbon: nitrogen is considered ideal. Higher ratios tend to retard the process of decomposition, while ratios below 25:1 may result in odor problems. Typically, carbon to nitrogen ratios for yard trimmings range from 20 to 80:1, wood chips 400 to 700:1, manure 15 to 20:1, and municipal solid wastes 40 to 100:1. As the composting process proceeds and carbon is lost to the atmosphere, this ratio narrows. Finished compost should have ratios of 15 to 20:1.

Moisture

Water is an essential part of all forms of life and the microorganisms living in a compost pile are no exception. Because most compostable materials have lower-than-ideal water content, the composting process may be slower than desired if water is not added. However, moisture rich solids have also been used. A moisture content of 50 to 60 percent of total weight is considered ideal. The moisture content should not be great enough, however, to create excessive free flow of water and movement caused by gravity. Excessive moisture and flowing water form leachate, which creates a potential liquid management problem and potential water pollution and odor problems. Excess moisture also impedes oxygen transfer to the microbial cells. Excessive moisture can increase the possibility of anaerobic conditions developing and may lead to rotting and obnoxious odors. Microbial processes contribute moisture to the compost pile during decomposition. While moisture is being added, however, it is also being lost through evaporation. Since the amount of water evaporated usually exceeds the input of moisture from the decomposition processes, there is generally a net loss of moisture from the compost pile. In such cases, adding moisture may be necessary to keep the composting process performing at its peak.

Oxygen

A 10 to 15 percent oxygen Concentration is considered adequate, although a concentration as low as 5 percent may be sufficient for leaves. While higher concentrations of oxygen will not negatively affect the composting process, they may indicate that an excessive amount of air is circulating, which can cause problems. For example, excess air removes heat, which cools the pile. Too much air can also promote excess evaporation, which slows the rate of composting. Excess aeration is also an added expense that increases production costs.

pH

Physical Processes

The physical environment in the compost process includes such factors as temperature, particle size, mixing, and pile size. Each of these is essential for the composting process to proceed in an efficient manner.

Particle Size

The particle size of the material being composted is critical. As composting progresses, there is a natural process of size reduction. Because smaller particles usually have more surface per unit of weight, they facilitate more microbial activity on their surfaces, which leads to rapid decomposition. However, if all of the particles are ground up, they pack closely together and allow few open spaces for air to circulate. This is especially important when the material being composted has high moisture content. The optimum particle size has enough surface area for rapid microbial activity, but also enough void space to allow air to circulate for microbial respiration. The feedstock composition can be manipulated to create the desired mix of particle size and void space. For yard trimmings or municipal solid wastes, the desired combination of void space and surface area can be achieved by particle size reduction. Particle size reduction is sometimes done after the composting process is completed to improve the aesthetic appeal of finished composts destined for specific markets.

Temperature

All microorganisms have an optimum temperature range. For composting this range between 32° and 60°C. For each group of organisms, as the temperature increases above the ideal maximum, thermal destruction of cell proteins kills the organisms. Likewise, temperatures below the minimum required for a group of organisms affect the metabolic regulatory machinery of the cells. Although composting can occur at a range of temperatures, the optimum temperature range for Themophilic microorganisms is preferred, for two reasons: to promote rapid composting and to destroy pathogens and weed seeds. Larger piles build up and conserve heat better than smaller piles. Temperatures above 65° C are not ideal for composting. Temperatures can be lowered if needed by increasing the frequency of mechanical agitation, or using blowers controlled with timers, temperature feedback control, or air flow throttling. Mixing or mechanical aeration also provides air for the microbes.

Mixing

Mixing feed stocks, water, and inoculants (if used) is important. Piles can be turned or mixed after composting has begun. Mixing and agitation distribute moisture and air evenly and
promote the breakdown of compost clumps. Excessive agitation of open vessels or piles, however, can cool the piles and affect the compost process.

Benefits of Composting

Municipal solid wastes contain up to 70 percent by weight of organic materials. Yard trimmings, which constitute 20 percent of the municipal solid waste stream, may contain even larger proportions of organic materials. In addition, certain industrial by-products those from the food processing, agricultural, and paper industries are mostly composed of organic materials. Composting organic materials, therefore, can significantly reduce waste stream volume. Diverting such materials from the waste stream frees up landfill space needed for materials that cannot be composted or otherwise diverted from the waste stream.

4.2.5 Grinding and discharge into sewers lines

There are three methods for the disposal of garbage into sewers.

1. Installation of individual grinders in houses and commercial establishments.
2. Installation of municipally operated grinding station located centrally.
3. Installation of grinders at sewage treatment plant and discharge grounded materials directly into incoming raw sewage or digestion tanks.

House hold grinders

They contribute no difficulties in sewer collection systems. Of course it may lead to an increase of solids in sewage treatment plants.

Municipal grinding stations

The location of central grinding stations at convenient points along the sewer system or at the sewage treatment plant is required. It requires the separation of garbage from the refuse by households prior to collection to the disposal areas. Central grinding station should not be objectionable although care should be taken to provide treatment of odor that arises from the accumulated garbage. If at all garbage of all contributing population is discharged into sewer lines there will be an increase of suspended solids to 50 % or less. The water consumption with grinders will be about four liters per capita per day.

Dumping into water bodies

The dumping of solid waste into water bodies such as streams, rivers, lakes, seas, and oceans was once been one of the means of disposal. This is still practiced in some cities and towns located on banks of rivers or sea shores, even though it can be ineffective due to the washing of the wastes to the shores and interference of sanitation of the bathing area. Such a disposal method would be effective if the risk to animals (fish) is taken into consideration and direction of wind blow looked before dumping.

Disposal of dead bodies

There are certain methods that can be practiced in relation to disposal of dead bodies.

Embalming

To delay the purification of dead bodies by injection of preservatives.

Cremating

Burning of dead bodies which are practiced in certain religious sectors. It is considered to be the best and sanitary method. In addition, it helps in conservation of land .It is cheap as far as cost is concerned.

Disposal into water bodies.

This method is usually practiced by travelers in sea water such as Fishers, Naval forces and those army forces deal with submarines.

Burial into the ground

It is the most common, old and traditional method practiced in area where there is no digging and land problem. The minimum depth for such method is 2 meter. It should be undisturbed for another burial in the same pit.

4.3 REDUCE, REUSE AND RECYCLE

Waste reduction, reuse and recycling, starting at the individual and household levels, form the most basic approach to waste management. As discussed earlier, it involves changes in lifestyles and consumption patterns which are also key components of sustainable development.(Fig.4.2& Fig.4.3)

Many groups – individual households, local residents' groups, NGOs and schools - are today adapting this approach. They try to reduce the waste generated at home or schools, avoiding the use of plastic bags, packaged food and other products, etc. Whatever waste is generated is first separated into "dry" (non-biodegradable such as glass, metal, paper and cardboard) and "wet" (bio-degradable such as kitchen and market waste) wastes. Some of the dry wastes are

Fig No 4.2: Reduce, Reuse And Recycle

reused in innovative ways as, say, paper bags, greeting cards, envelopes, paperweights, and lightweight containers; the rest goes to organized recyclers. The wet wastes go to municipal dumps, or some groups convert them into compost.

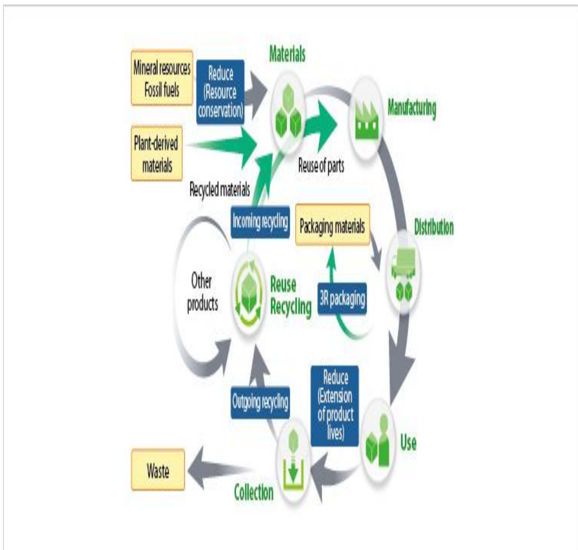

Fig No 4.3: Reduce, Reuse And Recycle

The process of reducing wastes starts at home, says the group, Are you Reducing, Reusing, Recycling (RUR), set up by five young eco-conscious women. Repelled by the piles of garbage in their neighbourhood, they first turned their own homes into "zero waste zones", and then enlisted others into a campaign to reduce and recycle wastes. They reuse 'wastes' in various ways (for example, vegetable and fruit wastes for cleaning, used paper and envelopes for repacking); they make it a point to buy notebooks made of recycled paper and use cloth bags instead of plastic bags. Considering that each tonne of recycled paper not only reduces wastes but can save 17 trees, this is significant from the point of protecting the environment and cutting down GHG emissions.

4.4 SANITARY LANDFILL

4.4.1 Landfill design, construction, and operation

The problem of managing the increased volume of solid waste is compounded by rising public resistance to siting new landfills. There are five general phases of landfill construction:

- Site selection;
- Site investigation;
- Design;
- Daily operation; and,
- Landfill completion or closure.

These stages are discussed in further detail below.

Site selection criteria include items such as availability of land, good drainage, availability of suitable soil for daily and final cover, visually isolated, access to major transportation routes, certain distance away from airport, not located in wetlands, and out of a floodplain. The engineer should also consider what the final use of the site will be and how long-term management of the site will impact this final use.

Magnetite mines from Yercaud hills select as suitable site for future safe disposal. The site investigation includes items such as performing:

1) A topographic survey for surface contours and features (used also to estimate amount of available soil),
2) A hydrologic survey that looks at how the local hydrology will impact drainage requirements, and
3) A hydrogeology survey that will determine underlying geological formations and soil types, the depth to the groundwater table, the direction of groundwater flow, and the current quality of the groundwater

During daily operation, topsoil is removed and stored; refuse is transported into the site, dumped, and compacted; daily soil cover is placed over the refuse; groundwater is monitored; and, leachate is collected and treated.

The primary methods used for landfill are called:

1) The area method;
2) The trench method; and,
3) The depression method.

Area Method

The area method is used when the site conditions do not allow the excavation of a trench. Typically an earthen levy is constructed and refuse is placed in thin layers against this levy and compacted. In a day, the compacted waste will reach a height of approximately 200 to300 meters and at the end of the day, a minimum of 15 centimeters inches of daily soil cover is applied as a barrier to disease vectors (e.g., it prevents the hatching of flies and the burrowing of rodents) and also prevents fires, odors, scavenging, and blowing litter. When the final design height is reached, a final soil cover is placed on top of the material. Each of the day's work of refuse is entombed in a "cell."

Trench Method

The trench method is most suitable in locations where the depth to the groundwater table does not prevent one from digging a trench in the ground. In this method, a trench is excavated with a bulldozer. Refuse is then placed in the trench and placed in thin layers that are compacted. The operation continues for the day until the desired daily height is reached. Again, daily cover is placed over the refuse to produce a "cell."

Depression Method

The depression method occurs at sites where natural features such as canyons, ravines, dry borrow pits, and quarries are available that can be filled in. Care is given to the hydrology of the site. For example, canyons are filled from the inlet to the outlet to prevent backing up of water behind the deposited refuse.

If compacted clay is used, it is typically 15 t0 120 centimeters thick and it is very important that the clay liner be compacted properly and not be allowed to dry out or crack. Geo synthetic liners are gaining widespread popularity and their installation is extremely important so that seams are sealed properly. Lying on top of this liner system is a leachate collection system, and on top of this is the compacted solid waste.

Most sanitary landfill designs attach considerable importance to preventing polluted water (leachate) from escaping from the site. It has been shown that large quantities of leachate can be produced by landfills, even in semi-arid climates. Most designs include expensive and carefully constructed impermeable layers which prevent leachate moving downwards into the ground and drainage systems to bring the leachate to a treatment plant or a storage tank.

4.4.2 Landfill operation site layout

In planning the layout of a sanitary landfill site, the location of fill must be determined by:-

a. Access roads
b. Equipment shelters
c. Scales to weigh wastes of needed
d. Storage site for special wastes
e. Top soil stock pile sites
g. Landfills area and extension

4.4.3 Operation schedule

- Arrival sequence for collection vehicles
- Traffic patterns at the site
- Time sequence to be followed in the filling operation.
- Effects of wind and other climatic conditions
- Commercial and public access

4.4.4 Equipment requirement

The type, size and amount of equipment required for sanitary landfill will be governed by size of community served, the nature of site the selected, the size of the landfill and the methods of operation. The types of equipment that have been used at sanitary landfill include:

1. Crawler.
2. Scrapers
3. Compactors
4. Water trucks.

4.4.5 Personnel

If there are advanced mechanical equipment without the facilities for a sanitary land fill serving less than 10,000 persons, the equipment operator would be the only person employed at site. On large scale operations it is desirable to employ supervisor.

In this case the supervisor should be able to operate the equipment in order to replace the employed operator in case of absence.

4.4.6 Accessory facilities

In addition to the equipment and personnel indicated above certain facilities are required at the Site. These are:-

1. Shade or shelter for equipment and personnel
2. Rest room facilities
3. Signs to direct trucks
4. Portable or semi portable fencing
5 Scale for weighing of trucks
6. Hand sprayer for insecticidal application
7. Portable pump for removal of accumulated surface water

4.4.7 Uses of fill lands

Sanitary landfill can be used to improve eroded areas, marshy and other marginal lands. After settling such lands could be used as parks, golf sport fields, other recreational areas, sometime for air ports, parking lots and small construction sites, etc.

4.4.8 Advantages of sanitary landfill

- It is relatively economical and acceptable method
- Initial investment is low compared to other proven methods
- The system is flexible - can accommodate increase in population may result in low collection cost, as it permits continued collection of refuses. All types of refuses may be disposed of.
- The site may be located close to or in populated areas, thus reducing the length of hauling cost of collection
- It enables the reclaiming of depression and sub marginal lands for use and benefits of the community
- Completed landfill areas can be used for agricultural and other purpose
- Unsightliness, health hazards and nuisance of open dumping can be eliminated may be quickly established several disposal sites may be used simultaneously

4.4.9 Landfill gas utilization

Landfill gas utilization is a process of gathering, processing, and treating the methane gas emitted from decomposing garbage to produce electricity, heat, fuels, and various chemical compounds. The number of landfill gas projects, which convert the gas into power, went from 160 in 2005 to 250 in 2009 in the India, according to the Environment Agency. Integrated RDR-APS-Digester System shown in Fig.4.4

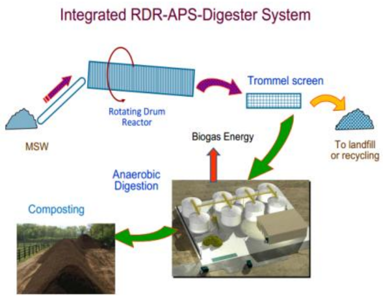

Fig no. 4.4 Integrated RDR-APS-Digester System

These projects are popular because they control energy costs and reduce greenhouse emissions. These projects collect the methane gas and treat it, so it can be used for electricity or upgraded to pipeline-grade gas. These projects power homes, buildings, and vehicles.

V. CONCLUSION

From past data's obtained, it could be concluded that as like many other developing countries, SWM in **SALEM** till now remains the responsibility of municipality. By comparison of all other techniques it shows that every method has its own advantages and disadvantages. To achieve an efficient management system,

- Public involvement becomes very important where emphasis should be laid to minimize the amount of waste produced and to achieve value added products from the waste.
- It is seen that the landfills have a lot of potential for energy recovery which can be used for commercial applications such as power generation. Methane generated could be supplied as pipeline gas also. It could thus be proposed that the unutilized energy trapped in landfills could be properly used which otherwise wasted adding to global is warming.
- As considering on-site incineration can be adopted which results in refuse collection and disposal could be much reduced satisfactory by using on-site incineration with less Environmental pollution.

Also, role and collective responsibility of urban planners, designers, government bodies and above all general public plays a vital role in effective ecological and economic solid waste management .Thus it can be concluded that solid waste generation cannot be stopped at one go and it requires innovative approaches for efficient management.

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