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Home Composting: ASustainable Approach for MSW Managementin Itanagar Capital Complex

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Abstract—Solid waste can be defined as any solid or semi-solid substance or object resulting from human or animal activities, discarded as useless or unwanted. It is an extremely mixed mass of wastes, which may originate from household, commercial, industrial or agricultural activities. Improper disposal of solid wastes pollutes all the vital components of the living environment (i.e., air, land and water) at local and global levels. The problem is more acute in developing nations than in developed nations, as their economic growth as well as urbanization is more rapid.Currently the capital complex (Itanagar, Naharlagun, Nirjuli including NERIST, Banderdewa, Doimukh, Yupia) area is plagued by acute problems related to solid waste. Due to lack of serious efforts by town/city authorities, garbage and its management has become a tenacious problem and this notwithstanding the fact that the largest part of municipal expenditure is allotted to it. Municipal solid waste generated from Itanagar Capital Complex in the year 2011 was 9690.393 tonnes. A large portion of it (7885.445093 tonnes) was organic waste [3]. This clearly indicates the significance of composting in management of MSW from Itanagar Capital Complex. The present paper stresses on the Home Composting as a sustainable approach for MSW management in Capital Complex, Itanagar.

Keywords—Bin composting, Compost product, Organic Waste, Municipal Solid Waste, Disposal

I. INTRODUCTION

Solid waste is a broad term, which encompasses all kinds of waste such as Municipal Solid Waste (MSW), Industrial Waste (IW), Hazardous Waste (HW), Bio-Medical Waste (BMW) and Electronic waste (E-waste) depending on their source & composition. It consists of organic and inorganic constituents which may or may not be biodegradable. On one hand, the recyclable components of solid waste could be useful as secondary resource for production processes. On the other hand, some of its toxic and harmful constituents may pose a danger if not handled properly. Source reduction, recycling and composting, waste-to-energy conversion facilities, and land filling are the four basic approaches to waste management.

There has been a significant increase in MSW (municipal solid waste) generation in Itanagar capital complex area in the last few decades. This is largely because of rapid population growth. Due to rapid growth as well as constraint in resources, the management of solid waste poses a difficult and complex problem for the society and its improper management gravely affects the public health and degrades environment. This trend can be ascribed to our changing lifestyles, food habits, and change in living standards.

Currently the Itanagar capital complex (Itanagar, Naharlagun, Nirjuli, Banderdewa, Doimukh, Yupia) areas are plagued by acute problems related to solid waste. Due to lack of serious efforts by town/city authorities, garbage and its management has become a tenacious problem and this notwithstanding the fact that the largest part of municipal expenditure is allotted to it. Despite this, there has been a progressive decline in the standard of services with respect to collection and disposal of municipal solid waste as well as measures for ensuring adequacy of environmental sanitation and public hygiene.

In many part of the capital complex solid waste generated remains unattended, giving rise to insanitary conditions. Solid Waste Management is a part of public

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health and sanitation, and according to the Indian Constitution, falls within the purview of the State list. Since this activity is non-exclusive and essential, the responsibility for providing the service lies within the public domain. The activity being of a local nature is entrusted to the Urban Local Bodies. The Urban Local Body undertakes the task of solid waste service delivery, with its own staff, equipment and funds. In a few cases, part of the said work is contracted out to private enterprises. There has been no major effort to create community awareness either about the likely perils due to poor waste management or the simple steps that every citizen can take which will help in reducing waste generation and promote effective management of solid waste generated. The degree of community sensitization and public awareness is low. There is no system of segregation of organic, inorganic and recyclable wastes at household level. Door to door collection is not practiced.

The organic fraction of municipal solid waste (MSW) is the most active in terms of producing greenhouse gases and contaminated leachate [1] while also representing a major fraction of the MSW mainstream, especially with the recycling of metals, paper, glass and plastics. Over the past decade, the growth of MSW along with its urban organic waste (UOW) fraction has added further environmental and economic pressure to urban centres [2].

The collection and disposal of municipal solid waste is one of the pressing problems of Itanagar capital complex area, which has assumed great importance in the recent past. With the growing urbanization as a result of planned economic growth and industrialization, problems are becoming acute and call for immediate and concerted action. The proper disposal of urban waste is not only absolutely necessary for the preservation and improvement of public health but it has an immense potential for resource recovery.

Organic waste in the municipal waste stream consists mainly of garden waste and organic household waste (OHW). Garden waste consists of woody material, grass clippings, branches, leaves, soil etc. and OHW is the Biodegradable fraction of household waste, which is mainly food waste (fresh and cooked). The benefits of composting are linked to resource recycling. When composting, carbon (C) and nutrients (N, P and K) may be recycled and used again in soils.

Composting can potentially help to restore organic matter in soils, reduce the use of mineral fertilisers and peat in growth media, reduce the need for pesticides, improve soil structure, reduce erosion and improve the water holding capacity of soil. Furthermore, the process can help increase the diversion of organic waste away from landfills. The EU landfill directive was introduced to divert organic waste away from landfills, but around 40% of biowaste is still being landfilled in the EU (up to 100% in some EU countries) (European Commission, 2010). A larger proportion of this organic waste will thus be diverted away from landfills in years to come, and more waste will then become available for alternative treatment routes (such as composting).

II. Law Provisions for MSW Management

The Ministry of Environment and Forest has notified the Municipal Solid Waste (Management & Handling) Rule, 2000 under the Environment (Protection) Act, 1986 to manage the Municipal Solid Waste (MSW) generated in the country. According to this rule there is specific provision for Collection, Segregation, Storage, Transportation processing and Disposal of MSW & it apply to all Municipal authorities. Under the Management of Municipal Solid Waste section, it is stated that any municipal solid waste generated in a city or town, should be managed & handled in accordance with the compliance criteria and the procedure laid down in Schedule-II of the rule.

A. Collection

Collection is the component of waste management which comprises lifting and removal / passage of a waste material from the source of production to either the point of treatment or final disposal. Collection of generated solid waste is the crucial part in MSW management. Efficiency in collecting solid waste & segregating it decides how well solid waste is managed. Collection includes not only the gathering of solid waste, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material processing facility, a transfer station or a landfill disposal site.

B. Segregation of waste

The waste dumped in community bins is a mixed type of waste, i.e. all types of waste biodegradable, recyclable, inert & non- biodegradable waste is found in one bin, which become very hard to manage. If collected waste is well segregated, then it will be treated well in the end.

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Segregated recyclable waste, if reused, then quantity of waste can be reduced.

C. Storage of Municipal Solid Wastes

Following criteria shall be taken into account while establishing and maintaining storage facilities, namely:-

- A storage facility shall be so placed that it is accessible to users.
- Storage facilities to be set up by municipal authorities or any other agency shall be aesthetically acceptable and user-friendly;
- Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black;
- Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

D. Transportation of Municipal Solid Wastes

Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteriashall be met, namely:-

(i) The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing;

(ii) Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.

E. Disposal of Municipal Solid Waste

Disposal is referred to the 'different treatments which are given to the waste for avoiding environmental & health hazards'. Success of Solid Waste Management System is directly related to Disposal efficiency. To dispose waste in efficient way technology knowledge, trained Manpower, appropriate infrastructure & availability of land is required. For disposal of solid waste commonly used methods are open dumps, landfills, sanitary landfills, and incineration plants. One of the important methods of waste treatment is composting. Selection of proper disposal method is necessary & primarily it depends on the quantity of MSW generated & type of waste to be disposed'.

III. Quantity of Solid Waste Generated in Itanagar Capital Complex [3]

1) Total Quantities of MSW generated per year from NERISTCampus

=168.7061952tonne.

2) Total Quantities of MSW generated per year from Itanagar

= 3845.78 tonne

3) Total Quant. of MSW generated per year from Naharlagun

= 4,710.33tonne

4) Total Quant. of MSW generated per year from Banderdewa/Doimukh/Yupia

=1,051.08tonne

5) Total quantities of MSW generated per Year in Itanagar capital complex

= 9,690.393tonne.

IV. Composting

The problem of solid waste has become so huge in capital complex as the treatment plants are either not working or there is no landfills to safely dispose of the waste. Open dumps allow breeding of pathogenic bacteria and viruses, release greenhouse gases and affect our environment & health - they represent public health devils. .Composting is the most practical and convenient way to handle organic wastes. It can be easier and cheaper than bagging these wastes or taking them to the transfer station. Compost also improves soil and the plants growing in it. Compost returns organic matter to the soil in a usable form. Organic matter in the soil improves plant growth by helping to break up heavy clay soils and improving their structure, by adding water and nutrient-holding capacity to sandy soils, and by adding essential nutrients to any soil. Improving soil is the first step toward improving the health of plants. Healthy plants help clean our air and conserve our soil, making our communities healthier places in which to live. Anything that was once alive can be composted.

Home composting returns organic matter to the soil, provides an excellent cheap potting mix or garden mulch, makes a useful fertilizer for home use when mixed with

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blood and bone, and is a good way to dispose of fruit and vegetable waste. Home composting also means less rubbish for the garbage bin and a constant on-hand supply of compost for the garden. The rewards of home composting are considerable and everybody benefits. An excellent range of home compost bins is available at the many gardening and home improvement outlets in Darwin. One probably need is quick and easy to install, is ideal for Darwin's tropical conditions and provides a clean and very manageable system for home composting.such as bun composting (Rotary Drum , Wood bin, Plastic bin).

Composting is a natural form of recycling, which continually occurs in nature. Composting is the transformation of organic material (plant matter) through decomposition into a soil-like material called compost. Invertebrates (insects and earthworms), and micro organisms (bacteria and fungi) help in transforming the material into compost.Composting is a natural biological process that carried out under controlled aerobic or anaerobic conditions. The effectiveness of the composting process depends upon various environmental conditions such as oxygen, temperature, moisture content etc.

A. Types of composting

Composting may be divided into two categories by the nature of the decomposition process. In anaerobic composting, decomposition occurs where oxygen (O_2) is absent or in limited supply. Under this method, anaerobic micro-organisms dominate and develop intermediate compounds including methane, CO_2, organic acids, hydrogen sulphide and other substances. In the absence of O, these compounds accumulate and are not metabolized further. Many of these compounds have strong odours.

Aerobic composting takes place in the presence of oxygen. In this process, aerobic micro organisms break down organic matter and produce carbon dioxide (CO_2), ammonia, water, heat and humus, the relatively stable organic end product. The heat generated accelerates the breakdown of proteins, fats and complex carbohydrates such as cellulose and hemi-cellulose. Hence, the processing time is shorter. Moreover, this process destroys many micro-organisms that are human or plant pathogens, as well as weed seeds, provided it undergoes sufficiently high temperature.

B. Composting methods

In-Vessel Composting

In-vessel composting is production of compost in drums, silos or channels using a high-rate controlled aeration system, designed to provide optimal conditions. Aeration of the material is accomplished by continuous agitation using aerating machines which operate in concrete bays, and/or fans providing air flow from ducts built into concrete floors. In-vessel composting represents a high technology and low labour approach, producing a uniform product.

Aerated Static Pile Composting

Aerated static pile composting is production of compost, in piles or windrows with mechanical aeration. The windrow or pile is located above air ducts, and aeration is achieved by blowing or drawing air through the composting material. Aeration systems can be relatively simple, using electrical motors, fans and ducting, or sophisticated, incorporating various sensors and alarms. Aerated static pile composting offers a medium technology and low labour approach, sometimes resulting in a non-uniform product. In some systems, mechanical aeration may occur near the end of the active compost period.

Passive Windrow Composting

Passive Windrow Composting the production of compost in piles or windrows. Compost is produced by natural aeration, over long periods of time. Passive windrow composting represents a low technology and labour approach. Attention to details such as the porosity of the initial mix, uniform product mixing and particle size greatly improves the speed of the process and product quality.

Turned Windrow Composting

Turning windrow composting is the production of compost in windrows using mechanical aeration. The compost mix is aerated by a windrow turner, which can be powered by a farm tractor (PTO), self powered or self-propelled. Turned windrow composting represents a low technology and medium labour approach and produces uniform compost.

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TABLE I: Summary of various composting methods

Particulars	In-vessel	Aerated static pile	Passive windrow	Turned windrow
General	Large-scale systems for commercial applications	Effective for farm and municipal use	Low technology quality problem	Active systems most common on farms
Labour	Requires consistent level of management /product flow to be cost efficient.	System design and Planning important. Monitoring needed.	Low labour required	Increases with aeration frequency and poor planning
Site	Very limited land, due to rapid rates and continuous operations	Less land required given faster rates and effective pile volumes	Requires large land areas	May require large land areas
Bulking agent	Flexible	Less flexible, Must be porous	Less flexible, Must be porous	flexible
Active period	Range: 21-35 days	Range 21-40 days	Range 6-24 month	Range 21-40 days
Aeration system	Extensive mechanical turning and aeration	Forced positive/negative air flow through pile	Natural convection only	Mechanical turning and natural convection
Process control	Initial mix. Aeration,temperature and/or time control. Turning.	Initial mix. Aeration, temperature and/or time control	Initial mix only	Initial mix turning
Odour factor	Odour can occur. Often due to equipment failure or system design limitations.	Odour can occur, but controls can be used, such as pile insulation and filters on air system.	Odour from thewindrow will occur. The larger the windrow the greater the odours	From surface area of windrow. Turning can create odours during initial weeks.

V. Factors Influencing Composting Process

Various factors affect the composting processes and determine the level of biological activities. The main factors are moisture, pH, initial recipe C/N ratio, oxygen and temperature:

A. Moisture

The moisture content of compost mixture at the starting of composting is an important factor influencing the composting process [4]. The initial moisture of the composting substrate depends on the type and structural strength of the OW to be composted [5]. Depending on the type of composting material, the moisture content varies from 50 to 85% [6]. The composting mixtures should be maintained within a range of 40% to 65% moisture and preferably 50- 60%, [6]. Adhikari et al. [7] successfully composted organic waste with initial moisture of 80%. A moisture level below 45% is considered rate limiting and under 20%, no biological processes are possible [6].

B. pH

For active microbial growth during composting, a neutral to slightly alkaline pH range is required. Organic substrates offer a wide range of pH levels ranging from 3 to 11 and this pH must be neutralized [6]. The pH of initial compost mixture varying from 5 to 6.5 can be composted [6] due to the natural buffering capacity of the composting material. Generally, the pH level drops below 5 at the beginning of the composting process because of the acids formed by the acid-forming bacteria, which initialize the process by breaking down complex carbonaceous materials. The later break down of proteins and liberation of ammonia account for the subsequent rise in pH [8]. The preferred range of pH is 6.5 to 8 [9]. The finished composed may have pH above 7,between 7 to 8.5 [6].

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C. C/N Ratio

The decomposition of OM depends on the carbon to nitrogen ratio (C/N) of the material. During the process of decomposition carbon declines due to the release of carbon as CO_2, while nitrogen remains within the system, hence as composting process continues, the C/N ratio becomes lower. The C/N ratio ensures the necessary nutrients for the synthesis of cellular components of microorganisms [6]. For an active aerobic metabolism, a C/N ratio of 15 to 30 is suggested [10]. The lower C/N ratio produces excess ammonia and unpleasant odour while the high C/N ratio limits the N for microbial growth and lowers the composting process rate [9]. The C/N ratio of a composted product should not be above 20 or it becomes N deficient in the soil while lower C/N ratio facilitates the N loss by volatilization from the soil and can have a toxic effect on plants [8].

D. Aeration

Aerobic composting requires large amounts of O, particularly at the initial stage. Aeration is the source of O, and, thus, indispensable for aerobic composting. Where the supply of O is not sufficient, the growth of aerobic micro-organisms is limited, resulting in slower decomposition. Moreover, aeration removes excessive heat, water vapour and other gases trapped in the pile. Heat removal is particularly important in warm climates as the risk of overheating and fire is higher. Therefore, good aeration is indispensable for efficient composting. It may be achieved by controlling the physical quality of the materials (particle size and moisture content), pile size and ventilation and by ensuring adequate frequency of turning

E. Temperature

The process of composting involves two temperature ranges: mesophilic and thermophilic. While the ideal temperature for the initial composting stage is 20-45 °C, at subsequent stages with the thermophilic organisms taking over, a temperature range of 50-70 °C may be ideal. High temperatures characterize the aerobic composting process and serve as signs of vigorous microbial activities. Pathogens are normally destroyed at 55 °C and above, while the critical point for elimination of weed seeds is 62 °C. Turnings and aeration can be used to regulate temperature. During anaerobic composting as the released heat is quite small and as part of it is lost from the surface only a marginal rise in temperature occurs.

The increased temperature results in increased rate of biological activity and hence results in faster stabilisation of the material. The studies carried out have shown that the activity of cellulose enzyme reduces above 70°C and the optimum temperature range for nitrification is 30° to 50°C beyond which nitrogen loss is known to occur. The temperature range of 50° to 60°C is thus optimum for nitrification and cellulose degradation. The high temperature also helps in destruction of some common pathogens and parasites.

VI. HOME COMPOSTING

Organic wastes, such as materials from the kitchen and garden, have a common characteristic that distinguishes them from other household wastes. They decompose quickly.The most common materials include cut grass, dead leaves, clippings or pruning from hedges, dead weeds and other plants that have been pulled up from the garden. It is best to mix green with dead materials because the greener waste decays more rapidly and helps break down the more fibrous matter. When this material is separated from other household waste, and allowed to decompose in the presence of air and a certain amount of water, organic waste is converted into a crumbly soil-like material called compost.

Composting is a well-established method for stabilising and sanitising biomaterials and its application as a major treatment technique in waste management is expanding rapidly in response to new legislation aimed at reducing landfill disposal of biodegradable wastes.

Composting is the microbial degradation of organic solid material that involves aerobic respiration and generally includes a thermophilic stage. The main products of the aerobic microbiological transformation of putrescible, bulky organic waste are CO_2, and a humus-like material which is comprised primarily of stable, lignicellulose compounds. The residual compost has been described as the stable, sanitised and humus-like material rich in organic matter and free from offensive odours resulting from the composting process of separately collected biowaste. The definition of composting may also be broadened to include cooler aerobic breakdown of bulky wastes in small scale composters, as is the case with small pile composting in the domestic context, and by 'slow-stack' treatment methods, where temperatures are in the psychrophylic (0-20 ºC) to mesophilic (20-45 ºC) ranges.

Home composting (HC) is traditionally considered as a horticultural recreational activity. However, more

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recently, it has been identified as a potential major opportunity for managing part of the domestic biodegradable waste stream, to minimise the amount of waste collected for landfill disposal and therefore contribute to achieving compliance with reductions in biodegradable waste disposal to landfill required by the Landfill Directive [11]. A unique aspect of this approach is that homeowners take responsibility for treating and recycling their biodegradable waste. Many factors influence the effectiveness of this approach, but encouraging homeowners to participate in HC schemes has major potential advantages in providing a low cost approach to waste management and facilitating the sustainable recycling of biodegradable organic waste. Home composting is a potentially unique waste management practice in that it offers the only means by which the producer can be the processor as well as the end-user of the recycled product.

The effective management of organic waste (OW) offers major potential benefits [12]. Home composting of organic waste provides an opportunity for people to play a role in contributing to recycling by returning valuable nutrients to the soil and diverting waste from its main stream [13]. With the implementation of onsite organic waste composting, environmental and economic issues faced by urban centres could be mostly mitigated with trace amounts of greenhouse gas emissions from home composting bins [14]. If Home composting can divert a substantial amount of organic, the final product needs to be demonstrated as safe in terms of composting process, environmental issues and quality of composted product. Nevertheless, the composting process depends on various factors that influence compost quality and environmental issues.

A. Home composting in wastemanagement

The geology of the UK has allowed long-term reliance on landfilling as the principal method of solid waste disposal. However, the sustainability of this method of waste disposal has been questioned and the availability of landfill space is becoming critical in some areas, particularly in SE England. European policy is striving to achieve more sustainable, alternative methods to landfill for managing waste to conserve the remaining landfill space and reduce the potential public health and environmental implications associated with landfilling biodegradable waste. Biodegradable waste disposal in landfill potentially has major implications for climate change due to emissions of greenhouse gases, causes landfill subsidence and potential pollution of surface and ground water. Undue reliance on disposal to landfill is also considered to have inherent risks including missing opportunities for recovering value from waste and being too inflexible to meet changing needs.

The potential importance of composting as a sustainable biodegradable solid residue (biowaste) disposal option is emphasised by the following drivers:

- EU Landfill Directive targets to progressively reduce biodegradable waste disposed to landfill.
- Waste Strategy 2000 stated that an essential part of achieving municipal waste recovery targets was to increase household waste recycling and composting. The UK Government's target for 2005 was to recycle or compost at least 25 % of household waste, increasing to at least 30 % by 2010.
- Landfill tax will increase the cost of disposal and encourage the recycling of organic materials.
- Rapidly declining landfill space - It is estimated that at current rates of landfilling, voids could, in parts of the country, be filled within 20 years.
- Recycling Credits - Financial incentives for local authorities to recycle all types of waste. This was replaced by the Landfill Allowance Trading Scheme in April 2005.
- Government objective to increase the replacement of peat with alternative waste derived materials for use as soil conditioners and in growing media.

B. Benefits of home composting

Household recycling and composting has a key role in the UK Government's waste management strategy. The importance of developing HC as part of an integrated waste management strategy is being increasingly recognised by local authorities; their associated financial, environmental and technical benefits are considered below.

Financial

Importantly, HC can provide local authorities potential waste management cost savings in terms of refuse collection and disposal. In addition, home produced composts reduce the need for proprietary soil conditioning and mulching products. The householder may also gain greater satisfaction from improved growth and quality of plants in compost amended soil.

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Environmental

Home composting satisfies the proximity principle and is arguably the most sustainable management option available for dealing with biodegradable household waste in that the producer is responsible for the segregation, treatment and ultimate end-use of the waste.

Compost and organic matter is a renewable and sustainable resource and HC will assist in conserving natural peatland habitats. Peat substitution by home compost at no increased cost to the homeowner is achievable for soil improving and mulching by HC. Reliance on landfill and negative environmental associations with waste disposal by this method will be reduced. Compost is an effective soil conditioner replacement, which conserves soil organic matter and maintains and improves soil physical properties.

Technical

Composted materials have a beneficial liming value, and the organic matter improves moisture retention and soil structure. Nitrogen availability is relatively low in stabilised composted residues and this allows large rates of organic matter application to be supplied to improve soil physical properties without adding excessive amounts of labile nutrients. Therefore, nutrient leaching losses are minimised. Properly composted waste is a stable material with low odour. There is also evidence that organic composts are effective at suppressing some plant and soil-borne diseases.

C. Types of Compost Bins

Holding units are low maintenance, and are good choice for those with limited space, such as apartment dwellers. These units do not require turning, however the lack of aeration causes the composting process to take 6 months to 2 years. Holding units are available from stores and catalogues.

Portable bins are similar to holding units, except that they can be taken apart and moved. Materials can also be mixed with this type of bin. Plastic units are available for purchase, or you may construct a bin from wire fencing framed in wood.

Turning units are designed so that they may be aerated. Turning units produce compost faster because they supply oxygen to the bacteria in the pile. These units may also have less odour problems, which are associated with poor aeration.

Turning units may be either a series of bins or a structure that rotates, such as a ball or barrel. These systems often cost more and are more difficult to build. Materials must also be saved until a unit can be filled to the correct level. Once these units are filled and the turning process begins, new materials should not be added.

Heaps are an option for those who do not wish to build or purchase a bin structure. Turning the heap is optional, but the composting process will be slowed if the pile is not turned. Woody materials may take a very long time to decompose with this method, and food scraps may attract pests.

Sheet composting can be done in the fall. With this method, a thin layer of materials such as leaves (that have not been composted) are worked into the garden. By spring, the material will be broken down. The decomposition process ties up soil nitrogen, making it unavailable to other plants. Because of this, sheet composting should only be done in the fall when the garden is fallow.

Soil incorporation is also known as trench composting. Organic material are buried in holes 8-15 inches deep, and then covered with soil dug from the hole. Decomposition takes about a year, as limited oxygen slows the process. It is recommended to avoid planting that area for a year, as the nitrogen available to plants may be limited by the decomposition process.

Home composting returns organic matter to the soil, provides an excellent cheap potting mix or garden mulch, makes a useful fertiliser for home use when mixed with blood and bone, and is a good way to dispose of fruit and vegetable waste.

Bin composting

As an alternative to centralized facilities, on-site treatments such as home composting can reduce recycling costs. various types home composting systems (HC), namely the Plastic (P) and Wood (W) Bins, the Rotary Drum (RD) and the Ground Pile (GP) are available.Bin composting methods are commonly used for yard waste; smaller amounts of manure; and for poultry, or pork mortalities. Turning compost can reduce decomposition time to two months or less. Wastes in bins must be mixed on a regular basis. Frequent turning speeds up the composting process by providing aerobic bacteria with the oxygen required need to break down materials. A set-up often includes a series of bins. High temperatures, from 32º to 60ºC (90º to 140ºF), are

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produced when piles are turned every five to ten days. These actions are necessary to kill disease organisms and fly larvae, to help kill weed seeds, and to provide an environment necessary for the most efficient decomposer organisms.

VII. Things to be Included and Excluded for Composting

A. Materials to be composted

Vegetables/kitchen refuses, garden trimming, grass clippings leaves, dry leaves(straw),twigs and shredded branches, food refuses; bread buns etc, egg shells, farm animal manure (e.g., cow, sheep, goat, poultry) fruit refuses, woos ash etc.

Material to be excluded

Non biodegradable waste; polythene, plastics, glass, metal etc. human faeces, pet manure(dog, cat),dairy products, diseased plants, fish, meat scraps and bones ,slow degradable material like coconut shell, coconut husk etc., fats/cooking oils, hazardous material like batteries, bulbs, electronic components, chemicals

Preparation

A proper bin is needed to store waste and initiate the composting process. The amount of organic waste produced at home will determine the size of the container. There are many different types of viable containers including those made from plastic or ceramic. Special compost buckets that are particularly durable can be ordered however, simple, cheap buckets are great and as effective as any other container. A good example of an excellent container is a big trash can. Furthermore, a stand is needed in order to prevent rusting. Lastly, the bucket should be placed in a sunny area to ensure optimal composting.

Waste Separation

Organic waste such as vegetable waste and fruit peels along with some old newspaper etc. all that you need for composting.

Storage

The easiest part, all organic waste place in the container daily and close the lid.

Maintenance

The compost should neither kept too dry nor too wet. If it is too dry, water should be added; if it is too wet, add dry leaves to it. Stir the contents of the container from time to time in order to encourage decomposition. Remember, sunlight is important.

Ready compost

After around 60-90 days your compost should be ready. The compost should be dark brown with a good odour this means that it contains plenty of nutrients. The compost either use in own garden for growing vegetables or can simply return it to nature.

How to speed up compost

The quickest way to speed up compost is to add a compost activator. A compost activator is a solution or dry powder that contains a concentrated dose of compost bugs. By adding a compost activator compost will be super charged with bacteria to eat organic material. The more regularly you turn your compost heap, the more air for the compost bugs and the quicker they will work. Watch what you feed your compost, a balanced diet is essential. You should add a bucket of side nitrogen material such as food scraps, green grass and leaves to 2 buckets of Dry Carbon Material dry brown leaves, grass, shredded paper or cardboard. Too much of the carbon material with no nitrogen material will slow your compost system.

VIII. CONCLUSIONS

- There is no system of segregation of organic, inorganic and recyclable wastes at household level at Itanagar Capital Complex. With the growing urbanization and population growth, problems are becoming acute and call for immediate and concerted action.
- MSW generated in the Naharlagun and Itanagar area is approximately 8556.110841 tonnes year.
- Currently the capital complex Itanagar is plagued by acute problems related to solid waste may be due to the lack of serious efforts by town/city authorities, garbage and its management has become a tenacious problem.
- Composting can potentially help to restore organic matter in soils, reduce the use of mineral fertilisers and peat in growth media, reduce the need for pesticides, improve soil structure, reduce erosion and improve the water holding capacity of soil.
- Adoption of composting process will lead to reduction of. Waste to be disposed at dumping site
- Utilisation of large quantities of organic waste generate at the house hold yard.
- The most basic formula of home compost, which is:

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Raw materials (i.e. organic waste)

+ Time (2 - 3 months)

+ Container (to keep the waste)

+ Natural organic decomposition process

= COMPOST that nourishes the earth.

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