Technology Fact Sheet for Mitigation

I. Composting [i]

Introduction

The term composting is defined as biological degradation of waste under controlled aerobic conditions. The waste is decomposed into CO_2, water and the soil amendment or mulch. In addition, some carbon storage also occurs in the residual compost. Today many developed and developing countries practice composting of mixed waste or biodegradable waste fractions (kitchen or restaurant wastes, garden waste, sewage sludge). It is best suited for source segregated biodegradable waste. Figure 7 illustrates the process of composting.

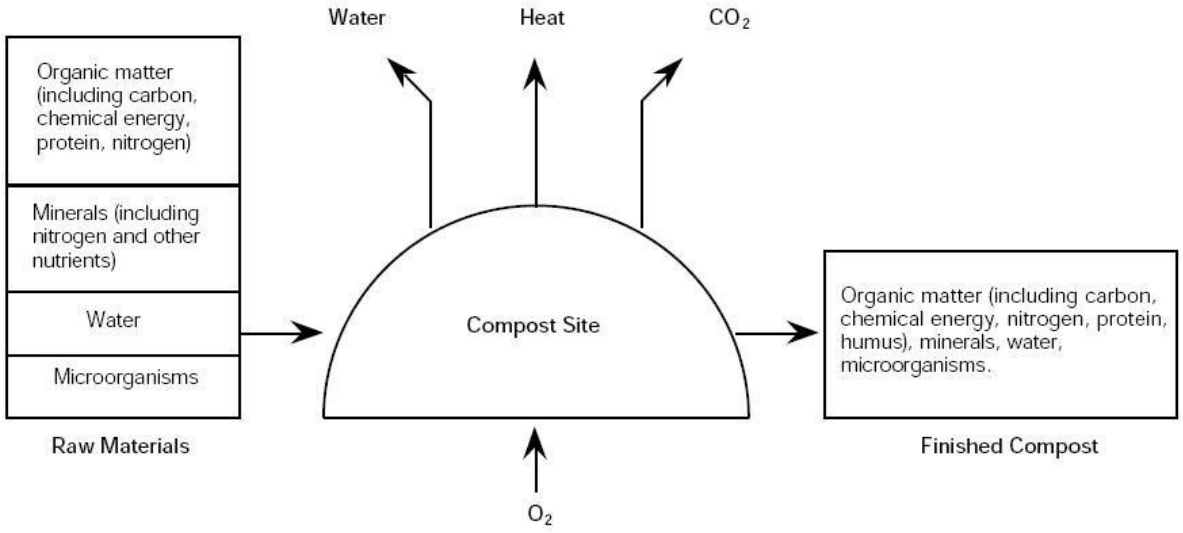

Figure 7: The composting process

Source: Rynk, et al., 1992[7]

Technology Characteristics

Three composting techniques available are windrow, aerated static pile, and in-vessel composting. Supporting techniques include sorting, screening and curing also. Each technique varies in procedures and equipment needs. Other variations between the technologies are issues such as air supply, temperature control, mixing, and the time required for composting. Moreover, their capital and operating costs also differ widely.

In-vessel composting: It occurs within a contained vessel, thus nullifying the effects of weather, resulting in a product of more consistent. In addition, due to the lesser man power and smaller space requirement, in-vessel technology is more suitable in suburban and urban technologies compared to the other composting technologies. Also, the in-vessel system allows for detailed containment and treatment of air to remove odours before release.

However, this technique is comparatively more costly than the other methods. The higher level of mechanization with this technique also results in more maintenance requirements which increase operational costs.

Windrow composting: Windrow composting often requires large tracts of land, sturdy equipment, a continual supply of labour. In this technique, segregated organic waste is placed into rows of long piles (pile height-4 to 8 feet, width- 12-16 feet) called windrows and exposed to air by turning the pile periodically by either manual or mechanical methods. This height allows for a pile large enough to generate sufficient heat yet small enough to allow oxygen to flow to the windrow's core.

[7] In ClimateTechWiki, available at http://climatetechwiki.org/technology/jiqweb-abt-0, accessed on 6 August 2012

The technique is suitable for large quantities such as that generated by entire communities and collected by local governments and high volume food-processing businesses. Windrow composting can work in both warm, arid climates and in cold climates. Rainy seasons sometimes require adjustment of the shape of the pile to ensure that the water runs off the top of the pile rather than being absorbed into the pile. In cold climates, the pile might freeze at the outside, but will remain warm in the core.

It is important to collect and treat the leachate that is released during the composting process, else it might contaminate local ground-water and surface-water supplies.

Aerated static pile (EPA, 2000): Aerated static pile composting involves mixing organic waste together in one large pile instead of rows. To ensure adequate flow of oxygen throughout the pile, layers of loosely piled bulking agents such as wood chips are added so that air can pass from the bottom to the top of the pile. Oxygen may also be delivered mechanically into the pile with the use of air blowers and a network of pipes which are placed into the piles.

This technology is applicable for a relatively homogenous mix of organic waste and works well for larger quantity generators of yard trimmings and compostable municipal solid waste, hence suitable for local governments, farms or landscapers.

Sometimes, aerated static piles are placed indoor with proper ventilation to exclude climate or seasonal influences. Since the technique doesn't use physical turning of the pile it is essential to carefully monitor the pile to ensure that the outside of the pile heats up as much as the core. The technique requires equipment such as blowers, pipes, sensors and fans. The use of this equipment might cause significant costs and require technical assistance. The advantage of the technique is that it requires less land than the windrow method. Additionally, the method has a high production rate – it only takes about 3 to 6 months to produce compost.

Country specific applicability and potential

In view of the high organic content (>50%) of the municipal solid waste, there is opportunity to convert this into good compost. Composting will help to reduce the waste volume. The Waste Prevention and Management Act 2009 and the subsequent Waste Prevention and Management Regulation 2012 also emphasizes on the importance of composting in the country. The Waste Prevention and Management Regulation 2012 calls it a preferred method for organic waste management

Status of technology in country

The country has a single composting plant in Serbithang, set up by the Thimphu City Corporation. The plant is however facing barriers in terms of low waste availability, high transportation cost and operational and technical inefficiencies leading to high cost of composting.

Benefits to economic / social and environmental development

Economic benefits

Composting programs launched by small communities can provide benefits to the local community in the form of increased local employment and reduced costs for waste removal.

Producing compost is found to be a profitable business in many parts of the world if implemented in public private partnerships models and right choice of centralized and decentralized composting units.

Compost application in farm fields also results in economic benefits by enhancing the availability of nutrients in the soil to crops and improving the effectiveness of other fertilizers.

Social benefits

Composting done by utilizing municipal solid waste generated from the cities/municipalities can result in effective management of waste thereby assisting local authorities in providing critical waste management services for city dwellers' overall social well being.

The economy of many developing countries is based on the agrarian sector. When the farms utilizes compost, the need to purchase chemical fertilizers is reduced which thereby results in reduction in human and soil health problems.

Composting also provides benefits for waste handling agencies. Composting part of the waste the agency receives increases the landfill lifetime and provides the waste handling agency with a marketable product in the form of compost.

The technology is applicable for both small scale and large scale applications. Either of these will support local employment generation.

Environmental

Composting directly leads to avoidance of methane emissions thereby improving the air quality.

Composting results in a reduced waste volume going into landfills.

The leachate from conventional waste management practices in developing countries can be addressed through the implementation of composting technology.

Composts directly replace the application of chemical fertilizers in farm lands thereby resulting in reduction of chemical effects on soil and water.

Climate change mitigation benefits

Composting of waste reduces the amount of waste to be disposed of in landfills. This directly prevents the emissions of methane (which is 25 times a more potent GHG than CO_2) that would have occurred from waste disposal on land.

Costs

Composting requires equipment, labour, and management, cost of which may be very high if the waste generation scale is very low. Also, the cost of composting increases with high cost of transportation of waste materials to the composting sites which are generally far from the cities. A 70 TPD (tons per day) compost plant in Uganda has an investment cost of $ 421,344 with operating cost of $47,525 per annum[8]. While large scale centralized commercial composting may not be economical if revenue from compost is not significant, it could be more economical to set up decentralized small scale composting systems if amount of waste generated is low in cities of country like Bhutan.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment and Technology Action Plans For Climate Change Mitigation– Bhutan. You can access the complete report from the TNA project website http://tech-action.org/**