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MUNICIPAL SOLID WASTE COMPOSTING AND THEIR HEALTH HAZARDS

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Abstract

Modernization and progress had its share of disadvantages and one of the main aspects of concern is the pollution it is causing to the earth – be it land, air, and water. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. This waste is ultimately thrown into municipal waste collection centers from where it is collected by the area municipalities to be further thrown into the landfills and dumps. However, either due to resource crunch or inefficient infrastructure, not all of this waste gets collected and transported to the final dumpsites. If at this stage the management and disposal is improperly done, it can cause serious impacts on health and problems to the surrounding environment.

Keywords: *Municipal solid waste, discarded materials, garbage, dumpsites,*

Introduction:

Solid waste may be defined as garbage from homes, waste resulting from commercial and industrial activities, and waste substances created by agriculture, mining and water purification plants. Every kind of unusable, undesirable or discarded material produced in the course of daily human activities and not soft enough to be regarded as liquid waste falls in to the category of solid waste. There are a number of concepts about waste management which vary in their usage

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between counties or regions. Some the most general, widely- used concept include:

Waste hierarchy

The waste hierarchy refers to the "3R's" reduce, reuse and recycle, which classify waste management strategies according to their desire ability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum particles benefits from products and to generate minimum amount of waste.

Extended producer responsibility-

Extended producer responsibility (EPR) is a strategy designed to promote the integration of all costs associated with products through out their life cycle (including end –of–life disposal costs) in to the market price of the product.

Polluter pays principle

The polluter pays principle is a principle where the polluting party pays for the impact caused to the environment.

Objectives

This paper makes an attempt to assess the health impacts and suggest methodologies, which could be adopted for setting of solid waste composting facilities.

Sources of municipal solid waste (MSW)

Major sources of municipal solid waste come from the following

1.Domestic waste including household waste
2. Shops
3. Offices
4. Restaurants
5. Hospitals
6. Educational institutions
7.Small scale industries

Health hazards

The health hazards associated with the municipal solid wastes can be classified as-

1. ON- SITE health hazards:

Variety of primary pathogens are present in MSW, however, composting kills most of them. Therefore, exposure- related infection and diseases from primary pathogens are not expected. Pathogens in fungi and other micro organisms produced during composting are, however of great concern. A variety of symptoms ranging from red and irritated eyes to running nose and nausea are expected due to dust borne bacterial and fungal spores

and endotoxins from organisms present in MSW and growing in the compost.

The most serious health threat is expected from secondary pathogens, the heat tolerant fungus, *Aspergillus fumigatus* and several related fungi which cause Aspergillosis. This fungi is well known product of silage and manure compost and grows well on decaying vegetable matter at temperature above 45^{0}C. It survives most of the composting process. Infection of susceptible individuals may be severely de bilitating and even fatal.

The flammable nature of unprocessed MSW clearly poses risk to workers from sharps i.e. broken glass, metal edges etc

The allergens and endotoxins released by the breakdown of microbes or vegetable matter on which they are growing can evoke local inflammation and congestion. A full blown serious response is expected in sensitive individuals. However, such sensitization may be overcome by repeated exposure.

Long term exposure of workers to low levels of persistent organic chemicals and innumerable other chemicals common in MSW because of house hold use, has not been studied in detail. Concern about such chemicals has been expressed as they have not been sufficiently evaluated to assess the dangers of long term low level exposure particularly in regard to immune system suppression or activation, and reproductive or nervous system effects.

In such cases where exposure is expected but not well described and predictable, the environment needs to be monitored to enable use of simple mathematical models to simulate the nature of occupational exposure of workers and population residing in downwind locations.

2. OFF-SITE health hazards:

Off – site health hazards are due to the odorous gases emanating from such MSW composting facility and transport of MSW to the facility. Besides the aesthetics associated with the odour, health hazards are also expected, table 1 gives the occupational health and safety association (OSHA), National institute of occupational safety and health (NIOSH) recommended values for short term exposure limit and TLV_s for some gases expected from a composting facility.

Table.1: exposure limits

Offensive odours may be generated during active stage of composting. The intensity of odour increases if composting conditions are not controlled within narrow tolerance limits from the ideal. Odour is also generated if unprocessed feedstock containing putrescrible materials has been stored for an extended period. The degree of odour control depends to large extent on the facility's proximity to residential, commercial, school and sensitive areas. Besides odour higher level of gaseous emissions are also harmful to health. Thus setting of such facilities is a key issue in successful operation on the compost facility.

Safe distances of such a facility from residential and sensitive areas can be computed using mathematical model for specific capacity and meteorology

A rough indicative estimate of maximum distances of health and odour impact is computed using Gaussian distribution model for area source with wind speed in the range of calm to 3 km/sec and maximum minimum temperature as 27^0c to 33^0c in winter respectively. The maximum mixing height has been assumed to be 1500m and minimum mixing height as 450m. Since formaldehyde has lowest value of TLV and odour threshold, safe distances in terms of health impact and odour impact have been computed, based on actual values observed at MSW composting plant, considering formaldehyde emission of 0.2g/secm^2. Composting in open windows occupying an area of 0.1km^2 for 1000MT processing capacity has been assumed. Linear dependence of processing capacity with windows area has been assumed. The results have been summarized in Table 2 for different processing capacities.

Results indicate that for a 1000MTD plant the safe distance will be about 2km from the facility in terms of odour impact, however, health impact shall be felt with in 1km distance. These results suggest that in a city, where such distance are difficult to maintain, smaller capacity plants should planned to minimize the health and odour impact.

Conclusions

- Municipal solid waste composting in India should be adopted with care and strict measures for safety of on-site workers.
- The siting of the facility should also be based on computation of safe distances from residential and sensitive areas.

➢ Proper maintenance of operational parameters should be ensured to minimize the health effect due to various gaseous emissions.

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Table.1: Exposure limits

parameters	TLV mg/m^3 (ppm)	STEL mg/m^3 (ppm)	IDLH mg/m^3 (ppm)	REL mg/m^3 (ppm)	O.T.H.V mg/m^3 (ppm)
Hydrogen	14	21	140	14	0.011
Sulphide	(10)	(15)	(100)	(10)	(0.0081)
Ammonia	17 (25)	24 (35)	220 (300)	17 (25)	3.54 (5.2)
Formaldehyde	0.93 (0.3)	2.46 (2)	24.6 (20)	0.049 (0.016)	2.54 (0.83)

TLV : Threshold level values eight hour average
STEL : Short term exposure limit fifteen-minute average
IDLH : Immediately dangerous to life and health
REL : Recommend exposure limits eight hour average
O.T.H.V : Odour threshold value

Table- 2 Capcities

Capacity (MT/day	impact distances in kms			
	Summer		Winter	
	Odour impact	Health impact	Odour impact	Health impact
1000	2(0.5)	1.1(0.6)	2.2(0.5)	1.1(0.6)
800	1.5(0.5)	0.9(0.6)	1.6(0.5)	0.9(0.6)
600	1.2(0.5)	0.75(0.6)	1.2(0.05)	0.75(0.5)
400	1.0(0.6)	0.6(0.5)	1.0(0.5)	0.7(0.5)
200	0.8(0.6)	0.5(0.5)	0.7(0.5)	0.5(0.5)