

# Treatment of Solid Waste

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## Landfills

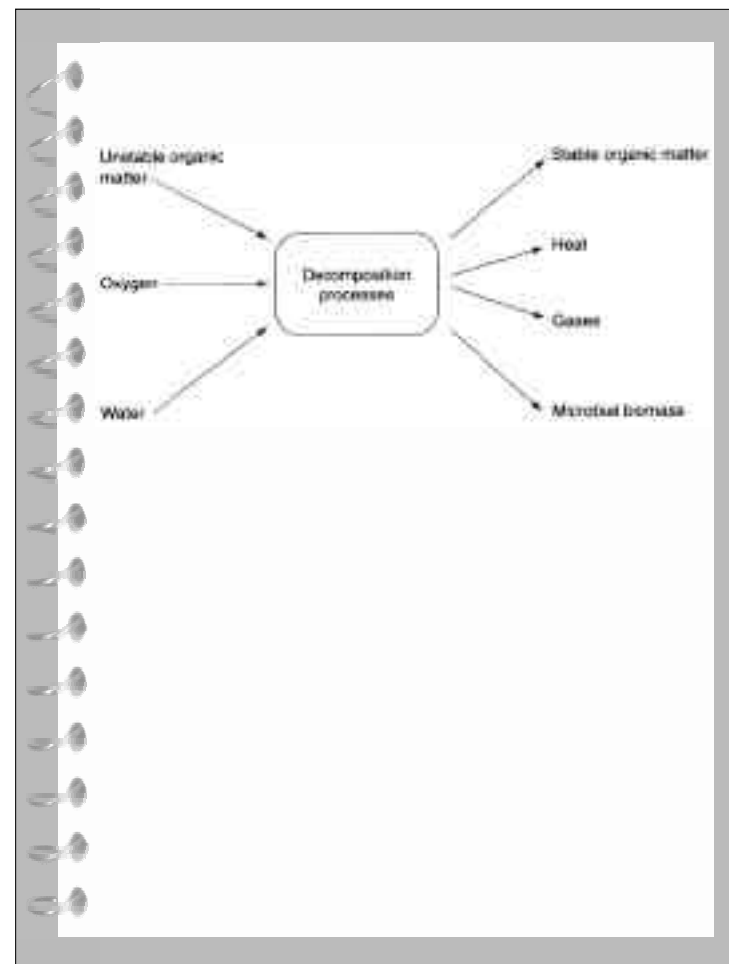
## Composting

Haug. 1993. The Practical Handbook of Compost Engineering. Lewis.

Sylvia et al. 1998. Composting of Organic Wastes. In Principles and Applications of Solid Microbiology. Prentice Hall



“Composting is the biological decomposition and stabilization of organic substrates, under conditions that allow development of thermophilic temperatures as a result of biologically produced heat, to produce a final product that is stable, free of pathogens and plant seeds, and can be beneficially applied to land.”



## **Compostable Wastes**

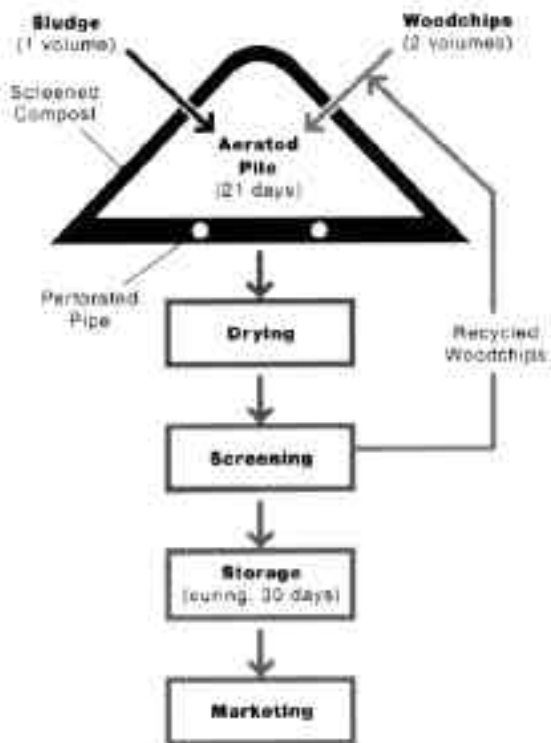
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- ✓ Agricultural crops and food wastes
- ✓ Manure
- ✓ Urban refuse
- ✓ Logging and wood-manufacturing residues
- ✓ Miscellaneous organic wastes
- ✓ Industrial wastes
- ✓ Municipal sewage solids

## **Composting Systems**

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- ✓ Windrow (long rows aerated by convective air movement and diffusion)
- ✓ Static pile (forced-aeration)
- ✓ In-vessel (enclosed reactor)



## Composting components

- ✓ Feed conditioning
- ✓ Amendments

*Structural or drying amendment* – an organic or inorganic material added to reduce bulk weight and increase air voids allowing for proper aeration.

*Energy or fuel amendment* – an organic material added to increase the quantity of biodegradable organics in the mixture and, thereby, increase the energy content of the mixture.

## Critical parameters

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- ✓ Chemical & physical properties: pH; relative quantity of C, N, P, S, and micronutrients (C/N = 25–35 [ $>35$ , ammonia volatilization while  $<25$  biological limitations]; nature of organics (eg. cellulose vs. glucose) and inorganics (eg. heavy metals); water content (40–60% w/w); oxygen content; temperature; particle sizes (oxygen diffusion).
- ✓ Biological characteristics: mesophilic stage (20–40°C); thermophilic stage ( $>40^\circ\text{C}$ ); cooling period; stabilization of curing stage.

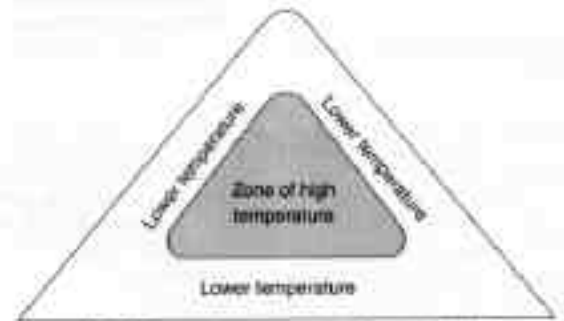
## High temperatures for pathogen removal:

- Temperatures maintained above 53°C for 3 days are sufficient to eliminate enteric pathogens including *Ascaris* eggs.

**Table 22-3 Microorganisms commonly associated with compost piles.**

	Bacteria	Fungi
<b>Mesophiles</b>	<i>Pseudomonas</i> spp. <i>Achromobacter</i> spp. <i>Bacillus</i> spp. <i>Flavobacterium</i> spp. <i>Clostridium</i> spp. <i>Streptococcus</i> spp.	<i>Aspergillus</i> spp. <i>Cladosporium</i> spp. <i>Trichoderma</i> spp. <i>Mucor</i> spp. <i>Penicillium</i> spp. <i>Fusarium</i> spp.
<b>Thermophiles</b>	<i>Bacillus</i> spp. <i>Streptococcus</i> spp. <i>Thermococcus</i> spp. <i>Thermoplasma</i> spp. <i>Thermotoga</i> spp. <i>Thermoplasma</i> spp.	<i>Aspergillus fumigatus</i> <i>Mucor pusillus</i> <i>Chaetomium thermophilum</i> <i>Thermaria longissima</i> <i>Thielavia</i> spp. <i>Trichoderma thermophilum</i> <i>Trichoderma reesei</i> (parent) <i>Thermomyces dubautii</i>

Adapted from Cheng and Hinton (1987) and Olson (1992).



**Figure 22-3** Temperature zones in a static compost pile.