

Composting Principals

**Southern New England Chapter of the Soil &
Water Conservation Society**

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Bear Path Farm (Whately, MA)
and UMass Amherst

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Agresource Inc.

Since 1984, providing organic waste management services to municipal and corporate clients

- Land application of biosolids, wastewater and water treatment residuals from municipal and industrial sources.
- Operation of regional composting facility in Ipswich MA
- Compost marketing services for municipal and private facilities



Compost as the Product

Compost vs. the Process: Composting

- Composting is the process of recycling organic residues (wastes) into a product: Compost
- Compost is more readily usable and has a higher value.
- Convert raw organic matter to a more stable form, reduce pathogens and weed seeds.



What is Compost?

Compost is a soil amendment that:

- Provides organic matter
- Supplies nutrients
- Stimulates microbial activity

Compost added to soil changes:

- Soil physical properties
- Soil chemistry
- Microbial activity



Composting

A process for converting and recycling “wastes” that includes:

- Temperatures favoring the growth of thermophilic microbes (35 to 60 C or 105 to 160 F).
- Under aerobic (the presence of oxygen) conditions.
- Controlled process.



Putting organic matter in a pile and letting it decay is not composting



Composting Temperatures

- Temperatures are high enough and for long enough time to kill pathogens and destroy weed seeds (55 C for 3 days).
- Not too high as to slow microbial growth or generate fires.

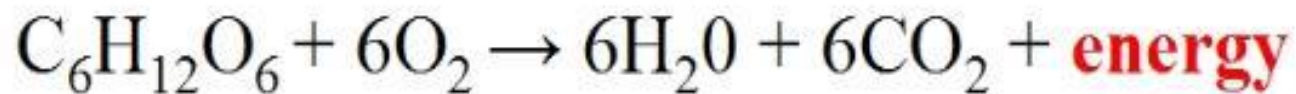


Aerobic Conditions

- Adequate oxygen to favor aerobic over anaerobic metabolism.
- Carbon oxidized to carbon dioxide not organic acids or methane.



Aerobic Respiration



(glucose + oxygen → water + carbon dioxide + energy)



Composting Process Control

Control temperatures (cool down piles) and provide oxygen by introducing air.

- Turning piles.
- Aerating piles (forced aeration) with blowers.



Different Ways to Make Compost



Composting Methods

- **Windrow**

Simplest approach with least process control and largest land requirement

- **Aerated Static Pile**

Moderately simple requirements for equipment and space with moderate level of process control

- **In-Vessel**

Typically mechanized with process control and containment and treatment of odors



Composting Steps

- Preparation of the input mix
- Active composting phase
- Curing phase
- Screening and product preparation
- Compost storage



Composting

- Adequate bulking agent to absorb moisture and insure pile has adequate porosity
- Piles turned and mixed to insure exposure to microbial activity and break open particles and expose all portions to high temperatures.

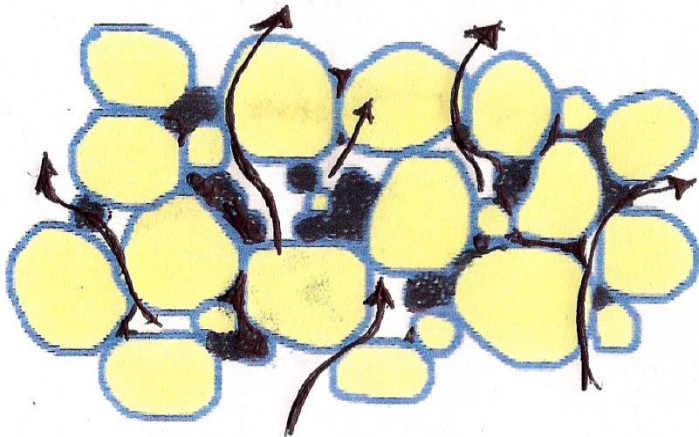


Bulking Agent

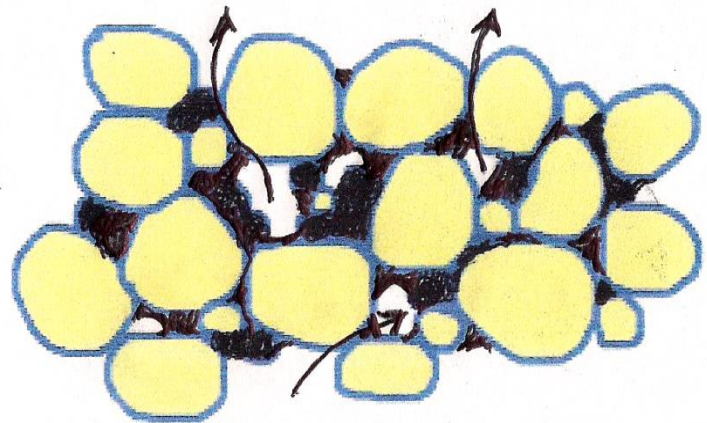
- Provides “structure” and porosity
- Allows air movement
- Source of carbon
- Absorbs excess moisture



Air Filled Pore Space



Good Air- Filled Pore Space



Poor Air-Filled Pore Space

Active Composting

- High rate of microbial activity requiring oxygen to maintain aerobic conditions and aeration to cool piles
- Aeration requirements dependent on rate of biodegradation and microbial activity
- The amount of air needed to supply oxygen is less than that needed to remove heat and maintain temperatures
- Active piles will have temperature gradients



Curing

- Curing follows the active composting stage and allows time for further degradation of materials
- Curing may not require forced aeration as degradation rates are lower
- During curing temperatures may remain at thermophilic conditions
- Curing may be associated with further drying



Screening

- Large pieces of bulking agent may remain largely intact even after curing
- Removal of both un-compostable debris and bulking agent using with $\frac{1}{2}$ or $\frac{3}{4}$ inch screen improves acceptance of the product
- Oversized pieces (screenings) can be recycled to supplement supplies of bulking agent
- Screening can be performed prior to curing



Storage

- Storage is required to account for the variability in demand for product
- Compost in storage should be protected from run-off and run-on
- Area should allow oldest material to be removed first
- Prior to distribution from storage areas compost should be tested



Source Separated Food Wastes

Food wastes received and mixed using front end loader with leaves.



Food Wastes Characteristics

- High Moisture Content
- Contaminated (Comingled) with Plastics
- Highly Putrescible and Potentially Odorous



Contamination



Source Separated Food Wastes



Source Separated Food Wastes



Conclusions

Multiple approaches to making compost

Successful operations require:

- Understanding and selecting appropriate feedstocks
- Making the compost mixture
- Managing the process to produce a consistent product

