

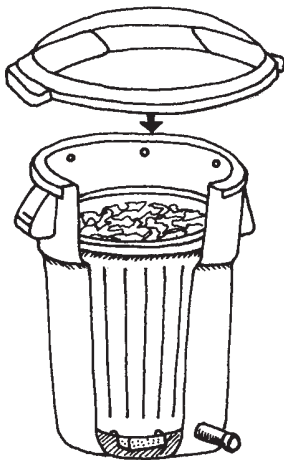
TWO-CAN BIOREACTORS

PURPOSE

Two-can composters consist of a 20-gallon garbage can containing organic wastes placed inside a 32-gallon garbage can. Although many classrooms have successfully composted with a single container, placing the can that holds wastes inside another container helps alleviate any odor and fly problems that may arise. The outside container can also be used to collect leachate.

Two-can units are designed to be used for small-scale indoor composting, and as an educational tool in the classroom. A 20-gallon can holds only about 10% of the cubic meter volume commonly recommended for thermophilic composting. Thermophilic composting is possible in these smaller systems, but careful attention needs to be paid to C:N ratios, moisture content, and aeration.

A system using a 10-gallon plastic garbage can inside a 20-gallon can may be substituted if space is a problem. The smaller system may operate at lower temperatures, thereby lengthening the time for decomposition. Or students may want to experiment with various aeration and insulation systems to see if they can come up with a 10-gallon system that achieves temperatures as high as those in a larger system.



MATERIALS

- 32-gal plastic garbage can
- 20-gal plastic garbage can
- drill
- brick
- spigot (optional—see Step 3, below)
- insulation (optional—see Step 5, below)
- duct tape (optional—see Step 5, below)
- 6 pieces of nylon window screen (each about 5 cm²)
- dial thermometer with stem at least 60 cm long
- peat moss or finished compost to make 5-cm layer in outer can
- compost ingredients, including high-carbon materials such as wood chips and high-nitrogen materials such as food scraps (see Step 8, below)

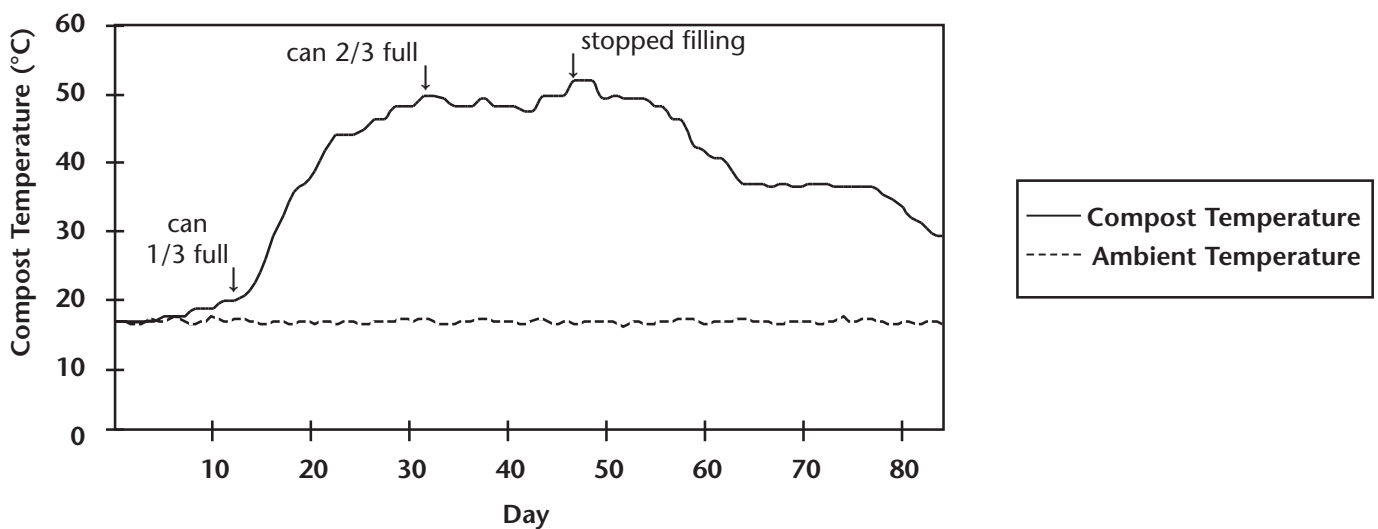
CONSTRUCTION

1. Using a drill, make 15 to 20 holes (1–2.5 cm diameter) through the bottom of the 20-gal can.
2. Drill five 1–2.5 cm holes just below the rim of the larger garbage can, and cover them on the inside with pieces of nylon window screen.
3. Design and build a spigot at the bottom of the larger can for draining leachate. One way to do this is to fit a piece of pipe into a hole at the bottom edge of the outer can, sealing around the edges with waterproof tape or sealant. Close the outer end of the pipe with a tight-fitting cork or stopper that can be removed to drain the accumu-

lated leachate, and cover the inner end with a piece of nylon screening to block the flow of solid particles.

4. Place a brick or some other object in the bottom of the 32-gal can. This is to separate the two cans, leaving space for leachate to collect. (Students may want to measure the leachate and add it back into the compost.)
5. If you are composting in a cold area, you may want to attach insulation to the outer barrel and lid with duct tape, making sure not to block aeration holes.
6. To reduce potential odors, line the bottom of the outer can with several centimeters of absorbent material such as peat moss or finished compost. Periodically drain the leachate to avoid anaerobic conditions that may cause odors. The leachate can be poured back in the top if the compost appears to be drying out. Otherwise, dispose of it outside or down the drain, but do not use it for watering plants. (This leachate is not the “compost tea” prized by gardeners, and it could harm vegetation unless diluted. Compost tea is made by soaking mature compost, after decomposition is completed.)
7. Fill the reactor, starting with a 5–10 cm layer of “brown” material such as wood chips, finished compost, or twigs and branches. Loading can take place all at once (called “batch composting”) or in periodic increments. With batch composting, you are more likely to achieve high temperatures quickly, but you will need to have all organic material ready to add at one time. If you are going to add layers of materials over a period of time rather than all at once, the material probably won’t begin to get hot until the can is at least 1/3 full (Figure 2–1).

Figure 2–1. A Typical Temperature Profile for Two-Can Composting with Continuous Loading.



Whether you fill the reactor all at once or in batches, remember to keep the ingredients loose and fluffy. Although they will become more compact during composting, never pack them down yourself because the air spaces are needed for maintaining aerobic conditions. Another important rule is to keep the mixture in the inner can covered at all times with a layer of high-carbon material such as finished compost, sawdust, straw, or wood shavings. This minimizes the chance of odor or insect problems.

8. To achieve thermophilic composting, you will need to provide the ingredients within the target ranges for moisture, carbon, and nitrogen. For moisture, the ideal mixture is 50–60% water by weight. You can calculate this by using the procedure described in Chapter 3 (pp. 47–48), or use the rule of thumb that the ingredient mix should feel about as damp as a wrung-out sponge. For carbon and nitrogen, the mixture should contain approximately 30 times as much available carbon as nitrogen (or a C:N ratio of 30:1). Using a specified quantity of one ingredient, you can calculate how much of the other you will need to achieve this ratio (see Chapter 3, pp. 48–50). Or, you can simply make a mixture of high-carbon and high-nitrogen materials. Organic materials that are high in carbon include wood chips or shavings, shredded newspaper, paper egg cartons, and brown leaves. Those high in nitrogen include food scraps, green grass or yard trimmings, coffee grounds, and manure. (Do not use feces from cats or meat-eating animals because of the potential for spreading disease organisms.)

You are now ready to begin monitoring the composting process using the methods outlined in Chapter 4. The composting process should take two to three months after the can is filled. At the end of this period, you can either leave the compost in the can or transfer it into other containers or an outdoor pile for the curing phase.