Sewage Sludge Composting
From Waste to Resource

WAYS MUST BE found to dispose of vast quantities of sewage sludge. Disposal alternatives include dumping it in waterways, incineration, landfilling and landspreading. Landspreading is the only alternative which does not waste a potential soil-building material. Moreover, it is the only alternative possible for disposing of the 550 tons of sludge generated daily at the Blue Plains Wastewater Treatment Plant, Washington, D.C. Other communities face similar problems.

The research demonstration project at Beltsville, Md., is being conducted to show that composting can solve three major sewage sludge problems involved with landspreading: it can stabilize excessive quantities of nitrogen that might get into streams or underground drinking water, it can kill disease-causing organisms, and it can eliminate objectionable odors associated with conventional anaerobic digestion of sludge.

The demonstration project also shows that costs for composting 550 tons of sewage sludge per day will be less than for incineration. In addition, the studies established that composted sludge is safer to dispose of than is raw or digested sludge. In short, composting transforms sewage sludge into a product acceptable to the public.

Composting: What and How?

Composting is the natural, biological decomposition of solid organic matter. The method of composting being used at Beltsville is the windrow process. Heat produced by aerobic microorganisms warms air within the windrow. Convective forces move air through the windrow, supplying oxygen to the microorganisms.

Improper management of the composting process will result in an improper oxygen supply. For example, if the windrow is too dense, there will be no air movement. Anaerobic organisms would then take over the process, producing obnoxious odors. On the other hand, if the windrow is too porous, the air will remove heat as fast as it is produced by the microorganisms so that the compost will stay near air temperature slowing the process.

In the demonstration project, the rate of air exchange is regulated by controlling the porosity and the size of the windrow. Wood chips are used as a bulking material to increase air flow. The chips are needed because the sludge produced at Blue Plains is in a semi-fluid state (75 to 80 percent moisture). A semi-fluid sludge would not permit air movement needed for effective composting.

Composting Procedure

Wood chips are placed in a strip 12 inches deep by 15 feet wide. Sludge is distributed over the chips to an average depth of four inches. The chips and sludge are mechanically blended and formed into a windrow, which is turned over daily for 10 days. Then it is spread out to a uniform depth 20 feet wide and cultivated to air dry it for two or three days. When the moisture content has decreased to about 35 percent, fresh sludge is added and windrowed for another two weeks. The windrow is then dried again and screened to remove the chips for reuse. The screened sludge is stockpiled for an additional 30 days before it is ready for use as a soil conditioner and low grade fertilizer.

Compost as a Soil Conditioner

Organic matter improves the physical properties of the soil. Compost, which is a stabilized, partly decomposed organic matter, improves the soil structure. Like a sponge, compost will hold more water than does soil. Adding compost to a light, sandy soil increases the water holding capacity of the soil. Plants grown on these soils are better able to survive drought.

Heavy soils are generally compact, and thus have inadequate air space available for good root growth. Moreover, the compacted soil does not allow water to infiltrate, resulting in runoff and less water available for plant growth. Compost can make a heavy soil friable and loose. Water and air can move into the soil, and undesirable gases, such as carbon dioxide; move out. The loose, friable soil does not restrict root movement as compared with a compacted soil.

Thus composted sewage sludge improves soil conditions, providing a desirable environment for plant growth.

Compost as a Fertilizer

Composted sewage sludge has a fertilizer rating of about 0.9 percent nitrogen, 2.3 percent phosphoric acid and 0.2 percent potash. This means that it will take five to 10 times as much composted sludge to supply the same plant nutrients as an ordinary 5-10-5 chemical fertilizer. Because the potash level in composted sludge is very low, supplemental potash fertilization will probably be necessary. Beltsville studies show that nitrogen in composted sludge will likely be unavailable to plants unless the sludge is completely cured — that is, unless organic cellulose is screened out or decomposed.

Heavy Metals in Compost

Adding composted sludge to soil simultaneously adds appreciable amounts of heavy metals, such as zinc, copper, nickel, cadmium and lead. These metals fertilize lawns, gardens and farms.

Zinc is one of the essential trace elements needed in diets, and useful amounts of this metal are taken up by plants. Because many people would benefit from increased dietary zinc, adding composted sludge to soils would be a significant benefit.

The sludges from some cities are polluted with certain industrial metals that are toxic to crops. Crops differ widely in sensitivity to metal toxicity; vegetables are sensitive, while grasses are quite tolerant of excess amounts of zinc, copper and nitrogen.

Further, if cadmium content is high in the sludge, crops may contain enough of this metal to be hazardous for use as food or animal feed.

The Blue Plains composted sludge contains approximately 1,000 parts per million (ppm) zinc, 250 ppm copper, 9 ppm cadmium and

(continued on page 65)

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SEWAGE *(from page 43)*

320 ppm lead. These levels are low compared with most other metropolitan areas, and can be further reduced by eliminating industrial effluents of these heavy metals.

Pathogen Destruction

Numerous studies have shown that temperatures generated in properly conducted composting processes are capable of killing the cysts of amoebic dysentery-causing protozoans, the ova of parasitic worms and most pathogenic bacteria. Killing temperatures are not reached, however, throughout all parts of the compost at any one time. All the material will be eventually subjected to the higher interior temperatures when the compost windrows are turned a number of times during the course of several weeks. Salmonellosis (food poisoning) is capable of growing in the cooler parts of the compost. When the compost is turned, the sterile interior materials become inoculated.

Survival of these organisms in sufficient quantities to constitute a health hazard seems unlikely for two reasons: (1) as composting continues, the material appears to become increasingly less capable of supporting their growth, and (2) storage for 30 days in the largest compost piles, wherein heating continues, should reduce their numbers to insignificant quantities. □

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