G79-464 Composting Municipal Sewage Sludge Slurry

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Municipalities can save operating expenses, eliminate pollution problems and increase the convenience of their waste management program by recycling their sewage sludge slurry in agricultural soils. Sewage sludge slurries have from 2 to 10-percent solids depending on the treatment plant design and operation procedures. Sewage slurries with more than 8 percent solids are difficult to pump because of high friction in the pipe lines and pump mechanism. Sewage slurries can be applied to agricultural fields by gravity flow and sprinkler irrigation systems, as well as by tank trucks that either broadcast spray on, or inject the slurry into, the soil. The direct application of sewage involves the handling or transportation of large quantities of water. This is a seasonal activity at best that cannot be carried out during the winter, during rainy periods or when agricultural practices conflict with sludge slurry applications.

Composting sewage sludge slurry before soil application solves many of the problems associated with direct application. Composting is the controlled aerobic, thermophilic (heat loving and generating), microbiological processing and enrichment of solid organic raw materials, such as sewage sludge, plant residues or their mixtures. When composted, these materials have no odor or live seeds, do not attract insects, and are a valuable soil amendment for plant growth. Composted sewage sludge has about 20 percent moisture and can be applied to fields by any pull type broadcast solid fertilizer or lime spreader.

Sludge Slurry Composting Procedures

Equipment

a. A trailer type or truck mounted feed mix wagon modified to discharge the comport mixture in a high pile or windrow, or to load into a dump truck.

b. A front end loader and auger elevator for loading plant residues, such as sawdust or other drying and bulking agents, into the feed mix wagon.

Drying and Bulking Agents

Finely ground plant residues are excellent for absorbing the water in sewage sludge slurries. The smaller the size of the ground material, the more surface is available for holding water, sludge solids and composting microorganisms that are normally present in sewage sludge. Cellulose in the plant residues is a source of energy for these microbes which do the composting. The ground plant residues swell as they absorb the water phase of sludge slurry. This provides a bulky mass that air can diffuse into, supplying the oxygen needs of the compost microbes. The microbes consume the sludge solids and plant residues for nutrients and energy. Heat is generated during this process.

Plant residues that can be used as drying and bulking agents are sawdust, corn cobs, leaves, straw, old hay and stalks. Dry manure, pen wastes from slaughterhouses and sale barns (a mixture of manure and hay), and shredded paper can also be used to mix with sludge slurries as drying and bulking agents.

Procedure

1. Determine the moisture content of the drying and bulking agent, the solids content of the sewage sludge slurry, and the weight of the slurry in pounds/gallon.
2. Using the weight capacity of the mixing wagon as the final batch weight, calculate the amounts of the drying-bulking agent and sludge slurry needed to mix a batch of 60 percent (±5 percent) moisture content (use *Table I* or the AGNET "Compost" computer program at your county Extension office for this purpose). Some mixing units are constructed with self-contained scales that greatly facilitate the measuring process.
3. Using the wagon's blending system, mix the two components until they are blended uniformly. Unload the blended mixture at the composting site in a windrow approximately 8 feet wide at the base and sloping to a peak approximately 15 feet high. These dimensions are suitable for the warm season of April through September. During the cold season, October through March, the windrow should be larger in order to reduce the loss of heat to the atmosphere. The base should then be about 18 feet wide, and the top should be 6 to 9 feet high and 3 to 4 feet wide.
4. Spread a 6 to 12-inch thick layer of the drying-bulking agent over the windrow. This layer insulates the composting mass and helps to reduce heat loss during the winter. During the warm season, this insulation allows the very surface of the composting pile to reach the temperature of pasteurization.
5. Check the temperature of the composting windrow from the surface of the sludge mixture to the center of the pile using a 2.5 to 3 feet long metal stem thermometer. The temperature should be checked at several different locations in the windrow. Disease organisms are killed at the pasteurization temperature range of 140° to 155°F.
6. After 4 weeks of composting at pasteurization temperature, take a weekly composite sample of the windrow and check its moisture content. When the moisture content is reduced to about 40 percent, load the compost into the mix wagon and add the amount of additional sludge slurry needed to bring the final batch mixture back up to 60 percent (±5 percent) moisture content. (See *Table I* or use the AGNET "Compost" computer program.) Repeat *steps 3-6* until the end of September. Terminate these procedures if, after mixing, the compost windrow cools well below the pasteurization range; this indicates that composting is completed.
7. Compost wind rows prepared from October through March should not be disturbed or mixed again during this period to conserve the heat generated during composting.
8. If a reconstituted windrow (see *step 6*) does not increase in temperature and it is necessary to

reactivate the composting process, blend in some additional plant residues to provide an energy source for the microbes. The final mixture, however, should have at least 50 percent moisture.

9. Chemical analyses for carbon and nitrogen content will aid in determining if composting is finished. Composting is completed when the proportion of carbon to nitrogen in the windrow mixture (carbon:nitrogen ratio or C:N ratio) is reduced by the microbes to approximately that of soil humus, 10:1. Straw and cornstalks have a C:N ratio of 90:1, while sawdust has a C:N ratio of 250:1. The reduction in C:N ratio of the compost is also accompanied by a reduction in its water content. When composting is completed, the moisture content of the material will be about 20 percent (±5 percent).
10. Pile the finished compost in large tent-shaped mounds for storage. Stored under a protective cover, the compost will remain dry until applied to agricultural fields or lawns.

Table I. Pounds of sewage sludge slurry, ranging from 1 to 8 percent solids, to be mixed with each 1000 pounds of plant residues or other drying-bulking agents, ranging from 5 to 50 percent in water content, to make a final moisture of 60 percent moisture content.

Plant residues water content percent	**Pounds of sewage sludge slurry to add to have 60 percent moisture in mixture**							
	Slurry solids content, percent							
	1.00	*2.00*	*3.00*	*4.00*	*5.00*	*6.00*	*7.00*	*8.00*
5	1410	1447	1486	1527	1571	1617	1666	1718
10	1282	1315	1351	1388	1428	1470	1515	1562
15	1153	1184	1216	1250	1285	1323	1363	1406
20	1025	1052	1081	1111	1142	1176	1212	1250
25	897	921	945	972	1000	1029	1060	1093
30	769	789	810	833	857	882	909	937
35	641	657	675	694	714	735	757	781
40	512	526	540	555	571	588	606	625
45	384	394	405	416	428	441	454	468
50	256	263	270	277	285	294	303	312

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