Onsite Wastewater Treatment Systems Special Issues Fact Sheet 2

High-Organic-Strength Wastewaters (Including Garbage Grinders)

Description

Because many onsite treatment alternatives are sensitive to organic loading rate, high-strength wastewaters may require additional treatment steps to ultimately meet environmental discharge or reuse goals. Among the individual home options that increase the organic strength of the wastewater (see chapter 3) are water conservation and use of garbage grinders (disposals). Commercial wastewater may also be high in organic concentration and, thus, organic loading. The database on such wastewaters is extremely limited for use in design of OWTSs.

The major concern caused by high organic loadings in the pretreated wastewater is higher organic loadings (e.g., BOD) to the infiltrative surface of the SWIS, which could result in clogging. A certain degree of clogging at the interface of infiltration trenches and the surrounding soil is expected and helps the soil absorption field function properly. The clogging layer, or biomat, which forms at this interface, is composed of organic material, trapped colloidal matter, bacteria, and microorganisms and their by-products. The biomat may slow the infiltrative capacity of the SWIS, but it increases effluent treatment time under unsaturated aerobic conditions (in the vadose zone below the trenches).

Physical clogging occurs when solid material such as grit, organic material, and grease is carried in the effluent beyond the septic tank to the soil adsorption field and deposited on the biomat. Biological clogging generally occurs with excessive organic loading to the biomat, which results in excess microbial growth that restricts the passage of effluent into the soil. Slimes, sugars, ferrous sulfide, and the precipitation of metals such as iron and manganese are additional clogging by-products. Chemical clogging can occur in clayey soils when high concentrations of sodium ions exchange with calcium and magnesium ions in the clay. The soil loses its structure and becomes tighter and more impervious.

Garbage disposals

Garbage disposals, which have become a standard appliance in many residential kitchens in the United States, contribute excessive organic loadings to the infiltrative field and other system components. Usually installed under the kitchen sink, disposals are basically motorized grinders designed to shred food scraps, vegetable peelings and cuttings, bones, and other food wastes to allow them to flow through drain pipes and into the wastewater treatment system. Disposing of food waste in this manner eliminates the nuisance of an odor of food wastes decaying in a trashcan by moving this waste to the wastewater stream. Many states accommodate these appliances by prescribing additional septic tank volume, service requirements, or other stipulations (e.g., septic tank effluent filter, multiple tanks, larger infiltration field) that address higher BOD and TSS loadings.

Table 1 contains reported information that illustrates that in-sink garbage disposal units increase septic tank loadings of BOD by 20 to 65 percent, suspended solids by 40 to 90 percent, and fats, oils, and grease by 70 to 150 percent. For any septic system, the installation of a disposal causes a more rapid buildup of the scum and sludge layers in the septic tank and an increased risk of clogging in the soil adsorption field due to higher concentrations of suspended solids in the effluent. Also, it means that septic tank volumes should be increased or tanks should be pumped more frequently.

Table 1. Increase in pollutant loading caused by addition of garbage disposal

Parameter	Increase in pollutant loading (%)
Suspended solids	40–90
Biochemical oxygen demand	20–65
Total nitrogen	3–10
Total phosphorus	2–3
Fats, oils, and grease	70–150

Sources: Hazeltine, 1951; Rawn, 1951; Univ. of Wisconsin, 1978; USEPA, 1992.

Eliminating the use of garbage disposals will significantly reduce the amount of grease, suspended solids, and BOD in wastewater (see table 1). Elimination of garbage disposal use reduces the rate of sludge and scum accumulation in the septic tank, thus reducing the frequency of required pumping. All of these can improve wastewater system performance.

For system owners who choose to use garbage grinders, manufacturers recommend grinding wastes with a moderate flow of cold water. No research data representing claims of enhanced performance of garbage grinders equipped with septic system additive injectors are available. Additives are not required nor recommended for onsite system operation, and some might actually interfere with treatment, damage the drainfield, or contaminate ground water below the drainfield. (See Special Issues Fact Sheet 1.)

The most common unsewered commercial sources that exhibit high organic strength are restaurants, although a variety of commercial sources produce such wastewaters. These include other facilities with food service capability and dairy product/processing plants. The preprocessing required to remove the source of excessive organic strength is a function of (1) the fractionation of the organic content (settleable, supra-colloidal, colloidal, or soluble); (2) the site characteristics; and (3) the final steps in OWTS processing and the environmental introduction method.

Typical Applications

Additional pretreatment is typically required before discharge to a SWIS or surface water. There are some proprietary aerobic units that are designed to accept high organic loads, and greatly increase the potential for odors and, where concrete structures are employed, corrosion. Therefore, odor protection becomes a major issue for the designer in these situations. These units are usually a combination of suspended growth/fixed growth or enhanced Continuous-Flow, Suspended Growth Aerobic Systems (CFSGAS; see Technology Fact Sheet 1). Alternatively, anaerobic upflow filters (UAFs) and other anaerobic proprietary and nonproprietary systems can also “thin” excess organics to permit normal loading to these final processing steps.

The Safe Drinking Water Act (SDWA) underground injection systems (UIC) Title V Rule, which is discussed in chapter 1, is designed to eliminate some of these problem wastewater sources of potential ground water contamination (e.g., auto repair facilities) from further consideration for SWIS disposal.

Design

For domestic systems the additional organic and oil/grease concentrations resulting from use of a garbage grinder usually does not in itself cause the wastewater to require additional processing as described above, but the designer should at least calculate any potential design changes that might be required by the increased strength. For example, for a sandy soil, the bottom area hydraulic loading rate could be crosschecked against the limiting organic loading rate limits cited in table 4-2. Most state codes require a septic tank size increase to account for the additional volume of sludge and scum accumulating in a septic tank but offer no advice as to any increasing field size.

For restaurants, facilities with food preparation, and other producers of high-organic wastewaters, the designer must evaluate alternative pretreatment schemes that can reduce the excess organics (and sometimes other constituents) to levels that allow subsequent processes to function normally and achieve surface water effluent discharge or reuse standards, if applicable.

An analysis of organic waste sources and waste characteristics (particulate/soluble fractions) is required to determine the best pretreatment approach. On the latter issue, if the majority was coming from a highly concentrated, low-volume source in the facility, a holding tank/hauling solution may be most cost-effective choice. The fraction that contains the majority of the excess contaminants might be readily removable by a specific process (e.g., soluble and biodegradable (aerobic unit) versus supracolloidal and removable by flocculation/sedimentation (vegetated submerged bed or anaerobic upflow filter).

Performance

The performance of these pretreatment devices is discussed in other fact sheets. Influent concentrations which still exceed normal loading rates can be accommodated by increasing the size or other key basis of computing loading rate or by investigating and implementating pollution prevention measures to reduce the source concentration of the constituent of concern (e.g., BOD).

The reliability of anaerobic processes is highly temperature-dependent, thus requiring heating in northern climates. However short-term anaerobic upflow filters and vegetated submerged beds are less sensitive because of their primary reliance on physical processes. Aerobic treatment processes are also temperature-sensitive, but less so than anaerobic processes.

There is little documented, quality-assured information on the performance of small alternative systems that treat high-organic strength wastewater. However, well-managed aerobic units, upflow filters, and vegetated submerged beds are known to perform reliably.

Management needs

Management needs are the same as those noted in the unit process fact sheets.

Risk management issues

Depending on the sequence of processes chosen, the impacts of flow variation, toxic shocks, extreme temperatures, and power outages may cause significant variations from expected treatment performance. However, high-strength wastewaters greatly increase the potential for odors and, where concrete structures are employed, corrosion. Therefore, protection from odor becomes a major issue for the designer in these situations.

Costs

Costs of treatment trains for high-organic-strength wastewaters can be estimated from the costs of the unit process components.

References

Andress, S., and C. Jordan. 1998. *Onsite Sewage Systems.* Virginia Polytechnic Institute and State University, Department of Civil Engineering, Blacksburg, VA.

Hazeltine, T.R. 1951. Addition of garbage to sewage. *Water & Sewage Works*, pp. 151-154. Annual compilation, 1951.

Jensen, P.D., and R.L. Siegrist. 1991. Integrated Loading Rate Determination for Wastewater Infiltration System Sizing. In *Proceedings of Sixth Onsite Wastewater Treatment Symposium*. American Society of Agricultural Engineers, St. Joseph, MI.

Mancl, K.M. 1998. *Septic Tank Maintenance.* Ohio State University Extension publication AEX-740-98. Ohio State University, Food, Agricultural and Biological Engineering, Columbus, OH

Rawn, A.M. 1951. Some effects of home garbage grinding upon domestic sewage. *American City*, March, pp.110-111.

Siegrist, R.L. 1987. Hydraulic Loading Rates for Soil Absorption Systems Based on Wastewater Quality. In *Proceedings of the Fifth Onsite Wastewater Treatment Symposium*. American Society of Agricultural Engineers, St. Joseph, MI.

Siegrist, R.L., D.L. Anderson, and J.C. Convene. 1984. *Commercial Wastewater Onsite Treatment Symposium*. American Society of Agricultural Engineers, St. Joseph, MI.

Stuth, W.L. 1992. Treating Commercial High-Strength Waste. In *Proceedings of Seventh Northwest On-Site Wastewater Treatment Short Course*. University of Washington, Seattle, WA.

Tyler, E.J., and J.C. Converse. 1994. Soil Acceptance of Onsite Wastewater as Affected by Soil Morphology and Wastewater Quality. In *Proceedings of Seventh Onsite Wastewater Treatment Symposium*. American Society of Agricultural Engineers, St. Joseph, MI.

University of Wisconsin. 1978. Management of Small Waste Flows. USEPA 600/2-78-73. September, 1978. U.S. Environmental Protection Agency, Office of Research and Development, Cincinnati, OH.