Trickling Filter

A trickling filter may be used following a primary settling tank, a septic tank, or an Imhoff tank to provide secondary treatment of the sewage. Habitation should not be closer than 400 ft. Some odors and filter flies can be expected with a standard rate filter. Filter flies can be controlled by weekly chlorination (1 mg/l in effluent for 4 to 8 hours), flooding (24 hours), increased hydraulic loading, and insecticide treatment. A receiving stream providing adequate dilution and supervision over operation is required. Seeding of the filter stone and development of a gelatinous film of aerobic microorganisms is necessary before good results can be produced. High BOD reduction is obtained within 7 days of starting a trickling filter, but as long as 3 months may be required to obtain equilibrium, including high nitrification.[128] Nitrification is an aerobic process in which the ammonia from sewage is acted upon by the oxygen in the air to form nitrate and carbon dioxide. Continuous operation, particularly during cold months of the year, is necessary to maintain nitrification efficiency. High nitrification is important in reducing the nitrogenous oxygen demand downstream in a body of receiving water.

Small standard-rate trickling filters are usually 6 ft deep and designed for a dosage of 200,000 to 300,00 gpd/acre-ft, or not more than 1,800,000 gal for a 6-ft deep filter. Filter loading is also expressed, with greater accuracy, in terms of 5-day BOD in the sewage applied to the filter. It is usually assumed that 35 percent of the BOD in a raw sewage is removed by the primary settling unit. Standard-rate trickling filters are dosed at 200 to 600 lb of BOD/acre-ft/day. Average loading are 400 lb in northern states and 600 lb in southern states. Since dosage must be controlled, dosing siphons or tipping trays may be used for very small filter and dosing tanks with siphons or pumps containing revolving distributors or stationary spray nozzles on the usual filter. Periodic dosing with interim resting usually produces a better effluent than continuous dosing. Continuous dosage at a higher rate, with recirculation of part of the effluent, may be suitable where good supervision is available and operation can be controlled to produce the intended results. Lower-rate dosage results in a higher quality effluent. Filter flies are reduced with recirculation. Good natural or forced ventilation of the filter is necessary.

A trickling filter should be followed by a secondary settling or humus tank to remove the biological growths sloughed off the filter stone; this unit will require the removal of sludge at least twice a day. The sludge is removed by pumping or by gravity flow if possible, usually to the sludge digester or Imhoff tank, depending on the plant design. The discharge of the raw sludge to a sand drying bed is not advisable, as sludge drying will be slow and odors will result.

For odor control or disinfection of the sewage effluent for bacterial reduction, chlorination of the final effluent is an additional and often required treatment. Trickling-filter treatment can be supplemented by sand filtration, oxidation pond, solids contact basin, flocculator-clarifiers, or chemical coagulation and settling where a higher quality effluent is necessary. Variations of the standard-rate trickling filter include the high-rate filter with recirculation; the biological tower (20 to 30 ft), which uses a plastic media; biological aerated filter, which uses a submerged media and forced air; and rotating biological contractors.

Flow diagrams including trickling filters are illustrated in Figure 4-34. A typical design of an Imhoff tank standard-rate trickling filter plant is shown under Typical Designs of Small Plants, and Design for a Small Community, this chapter. Other combinations are used.

[126]David Kirkwold, "Disinfecting with Ultraviolet Radiation," *Civil Engineering*, ASCE, December 1984

[127]Kerwin L. Rakness, et al., "Design, start-up and operation of an ozone disinfection unit," *J. Water Pollut. Control Fed.*, November 1984, pp. 1152-1159

[128]G. R. Grantham and J. G. Seeger, Jr., "Progress of Purification During the Starting of a Trickling Filter," *Sewage Ind. Wastes*, December 1951, pp. 1486-1492.

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