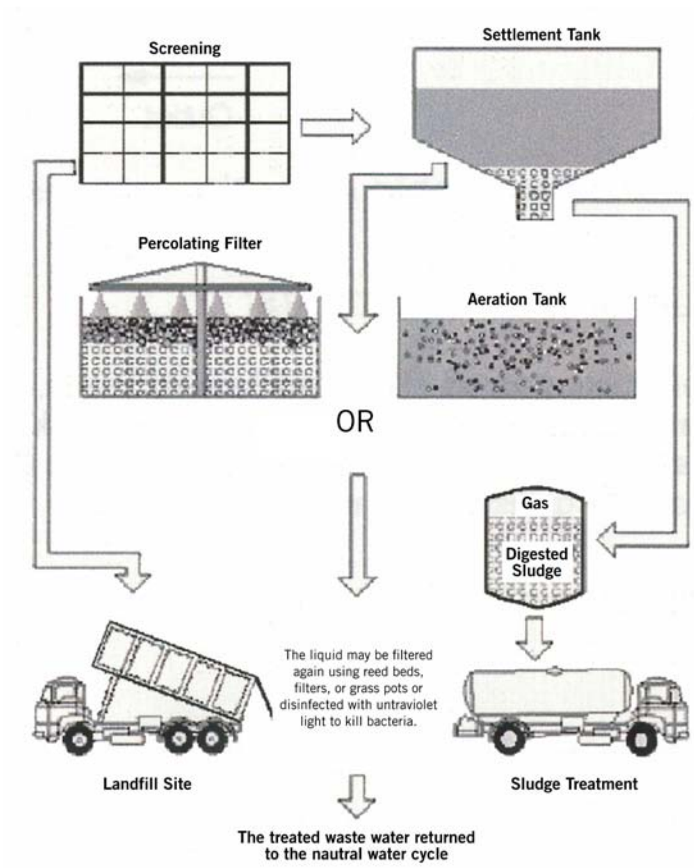
Anaerobic Digestion of Municipal Waste

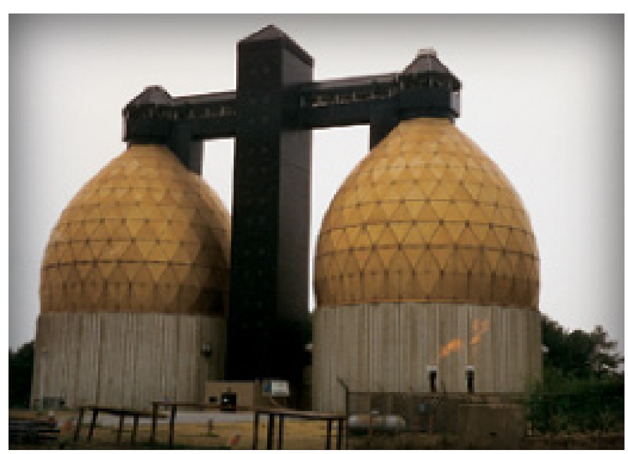
Municipalities generally have two water systems. Sewer and Waste. Sewers comprise all water that is primarily a result of rain or runoff from streams or rivers. This water is not treated and is returned to the natural water system through a dedicated piping network. Waste streams are generally made up of all residential and industrial systems in which organic or inorganic waste is discharged. This effluent cannot be discharged directly to the area water supply for a number of reasons. These include the potential of toxins being present in the waste, the increased biological oxygen demand (BOD) of any organics' that will be acted on by bacteria in the lake, river or stream, and the unpleasant odors and solids that are undesirable near populated areas.

The goal of municipal waste treatment is to return clean water to the local water supply. This involves removing any solids that are in the waste stream, and killing any microorganisms that may be present. A secondary goal is to reduce the amount of solids volume that must be sent to a landfill.



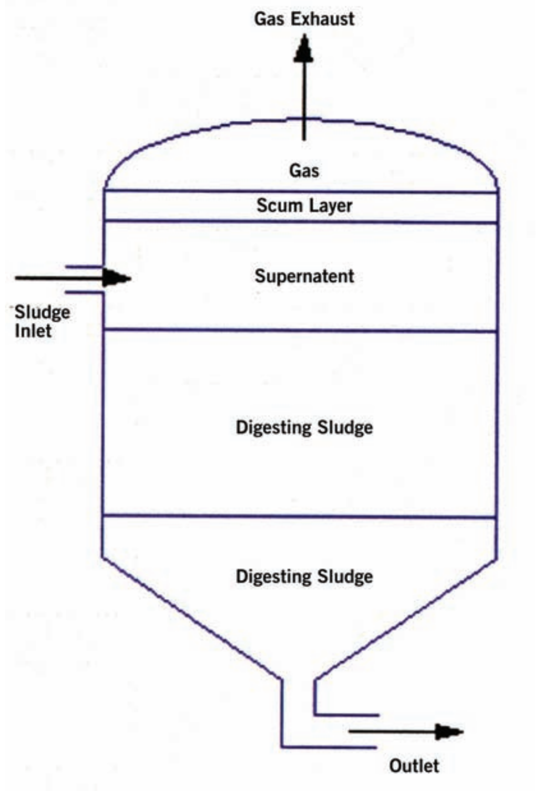
The treatment process begins by screening, settling and filtering inorganic solids from the waste, and percolating the remaining waste in aerated tanks or ponds to allow bacteria to reduce a significant quantity of the organic material. The remaining organic material is known as sludge. This sludge is further broken down by bacteria in equipment known as digesters. The digestion process is either aerobic or anaerobic. Aerobic digestion is generally more expensive to run than anaerobic, but is much less capitol extensive. As such, it is usually performed by smaller municipalities treating less than 500,000 gal/d of raw wastewater. This generally correlates to a municipality of about 50,000 people. Larger municipalities usually find it cost effective to run an anaerobic process. Anaerobic digestion takes 10-22 days to completely break down the organic material. This process produces methane, a potentially explosive gas which must be extracted from the area. The digesters are run continuously, with new waste added to the top of the digester. The volume of organic waste is generally reduced by about 50% in the digester.

The remaining solids are sold as a fertilizer. The liquid waste is agitated, and circulated to maintain a uniform temperature. The process is very temperature sensitive. Optimum biological action occurs at 95-98°F. The liquid waste stream into the digester is generally a 5% slurry by weight ofwaste in water. It is a very light, water-like liquid stream. Aerobic digestion, by contrast, is relatively insensitive to temperature, although in northern climates there can be benefits to heating the wastewater to improve biological activity.



Anaerobic digesters, City of Baltimore

Anaerobic digesters may be any large vessel, but are often egg shaped, oriented vertically. The digester could have internal volumes from 0.5 million gallons to 5 million gallons depending upon the waste stream requirements. The methane gas produced by the digestion is removed at the top of the tank. Digested waste is removed from the bottom of the digester.

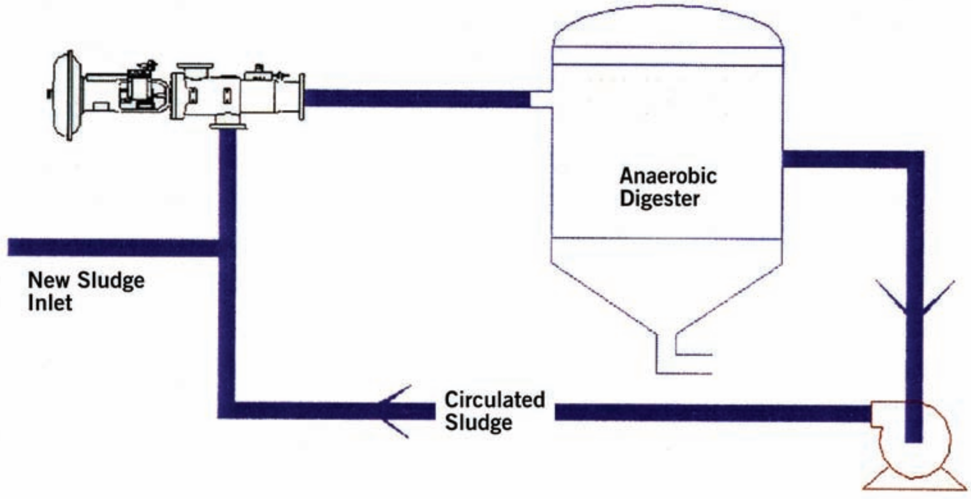


Because of the long time required to digest the material, heat is added to the tank to keep it at optimum temperature (95°F). This is usually accomplished by taking a portion of the liquid in the tank and circulating it through a heater. This heater may be a heat exchanger, or direct steam heater. Heat exchangers and sparging nozzles are not desirable because of the tendency of the solids in the waste stream to plug or foul the heat exchanger surfaces or the sparger holes. Circulation and fill rates into the digester will range from 100 to 1000 gpm depending on the size of the vessel.

Hydroheater Solution

The Hydroheater is an ideal instrument for heating and maintaining the sludge temperature in the digester. The heaters are relatively small compared to a heat exchanger, and operate continuously without plugging or fouling. In addition they may be placed in the sludge piping network where convenient, without requiring floor mounting. One or two Hydroheaters may be employed for each digester. In a two heater system, one Hydroheater heats the initial influent up to the optimum digestion temperature, while a second heater heats the sludge stream on a circulation loop from the digester to make up for any heat losses to atmosphere. In a one Hydroheater installation, a single larger heater is employed to heat the combined inflow and circulation streams to the desired temperature. In either case, the digester temperature can be maintained precisely (+1-0.5°F) with adequate instrumentation, allowing the digestion process to be fine tuned for optimum results.

By maintaining a tight temperature band and eliminating hot or cold spots in the digester, an increase in biological activity will be seen. In addition, less digestion time is possible because the sludge will digest consistently throughout the digester. Energy costs are reduced due to the high efficiency of the Hydroheater as compared to a heat exchanger.



Key Hydroheater Benefits:

- Tighter process control
- Reduced bacteria usage
- Shorter digestion times
- Low installation costs
- Reduced maintenance costs & downtime
- Small installed size
- Reduced energy usage
- No ancillary discharge

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