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Decentralized Systems Technology Fact Sheet
Types of Filters

DESCRIPTION

The primary purpose of improving the quality of the effluent from a septic tank system is to provide a cleaner effluent and in some cases, to improve treatment to address local environmental conditions. This may be necessary due to site constraints, regulations, or other limiting factors. Sand filters in various configurations are one of many traditional technologies applied to decentralized systems. These filters are located at the effluent side of the septic tank in order to remove solids.

Research on alternate filtration media, particularly recycled materials, has expanded the options available for improving effluent quality. This Fact Sheet summarizes the research on several alternate media materials, including crushed glass, recycled textiles, synthetic foam, and peat.

In a traditional sand filter application, physical, chemical, and biological transformations facilitate the enhanced treatment of effluent. Suspended solids are removed by mechanical straining, through chance contact, and by sedimentation. Aerobic conditions must be maintained to maintain a high performance level,. Intermittent application and venting of underdrains helps maintain aerobic conditions within the filter.

The alternate media discussed in this Fact Sheet generally operate in the same way as sand filters. They provide the same treatment of wastewater and, in some cases, enhance the treatment efficiency of the filter. The loading rate achieved in some alternate media filters is twice that of traditional sand filters. The filters discussed in this Fact Sheet are single pass filters, where wastewater passes through the filter only once before being discharged.

APPLICATION

Applications for alternate media filters are emerging, with the technology still largely in the research phase. Filtration is widely used in conjunction with drainfield systems for septic tanks which require enhanced effluent quality. Alternate filter media provide an option beyond a conventional septic tank drainfield, which consists of several trenches with gravel beds and perforated plastic pipes. Alternate media filters may allow a higher soil loading rate, use less space, and use material that is easy to obtain. For example, the Waterloo biofilter (developed at the University of Waterloo, Ontario, Canada) uses absorbent plastic foam cubes as its medium. Loading rates with this porous synthetic medium are four times higher than which use a recirculating sand filter. These biofilters may be followed by disinfection.

These higher loading rate filters may perform more effectively than traditional gravel drainfields and sand filters, especially when the drainfield must be located on a steep slope. Alternate media filters are suitable for lots with sizing constraints or where water tables or bedrock limit the depth of the drainfield. States may offer a sizing reduction allowance for alternate media filters because of their high loading. They are also easy to install and repair.

DESIGN CRITERIA

Peat

Peat is a permeable, absorbent medium used as a filter medium for onsite wastewater treatment. Much research has been conducted in the Northeast where peat is widely available. Peat filters used for onsite wastewater treatment remove 60 to 90 percent of BOD_5, but no long term data yet exist. Because peat is a natural material, significant variations in composition have been noted. Several manufacturers enclose the peat in fiberglass housing.

Foam

The foam cube filter is similar in performance to an intermittent sand filter, but has been tested at 10 times the loading rate. The filter is housed in a 1.8 meter by 1.8 meter by 1.5 meter (six foot by six foot by five foot) container, with 1.2 meters (four feet) of media. Wastewater is sprayed on top of the media and withdrawn from the base of the unit. Alternatively, filter cubes installed in pre-assembled cylinders can be placed in a tank.

Crushed Glass

A pilot project was conducted for the City of Roslyn, Washington, to evaluate the feasibility of using crushed, recycled glass as a filtration medium in slow sand filters. The study used a 38 centimeter (15 inch) PVC pipe as the media container and three types of sand and crushed glass. The media were washed so that less than 0.10 percent by weight passed a #200 mesh sieve. Wastewater was added to the filter at a loading rate of 0.002 cubic meters/minute/square meter (0.06 gallon/minute/square foot). The removal of bacteriological contaminants demonstrated that the glass filter media obtained an activity level typical of slow rate sand filtration. The results suggest that slow rate filtration may be an effective treatment process for Roslyn's raw water source with the addition of a roughing filter. All three filters had similar removal efficiencies, although it was hard to draw conclusions for other geographical areas.

Textile

This medium consists of textile chips known as "coupons". The medium is placed in a filter housing similar to a sand filter, with wastewater applied by spraying it at the top of the filter. The loading rate was reported at 400 liters/square meter/day (10 gallons/square foot/day). A modification of this design uses layers of textile material with a break between layers, allowing greater loading rates, up to 600 liters/square meter/day (15 gallons/square foot/day), producing an effluent quality that meets or exceeds advanced treatment standards.

ADVANTAGES AND DISADVANTAGES

Advantages

Alternate media filters are moderately inexpensive, have low energy requirements and do not require highly skilled personnel. They generally produce high quality effluent. The process is stable and requires limited intervention by operating personnel. The media may be able to withstand higher loading rates than traditional sand filters due to increased surface area. These filters may provide a suitable treatment option for degraded or failed septic systems if it is shown that they can operate over an extended period of time at the demonstrated efficiencies.

Disadvantages

Alternate media filters are not proven technologies and no long term operating data for the crushed glass and textile media are available. The cost to operate and maintain the systems has not been standardized. Odors from open, single pass filters treating septic tank effluent may be a problem. The filter medium is unique, and may not be readily available when it must be replaced. The media may not be consistent from supplier to supplier or batch to batch and may require additional monitoring costs to confirm performance across batches.

The recent arrival and continuing research into alternate filter media do not provide a potential user with the same performance track record as conventional sand filters. Filter surfaces and disinfection equipment require periodic maintenance, pumping and some disinfection units require power and facilities must have state or federal discharge permits, along with sampling and monitoring.

Filters using alternate media have performed well in the laboratory but have seen limited use in the field. Frequent inspection and monitoring are required to obtain proper functioning of filtration units and to determine cleaning cycles.

PERFORMANCE

Effluent quality data from long term use of peat, crushed glass, and textile media as on-site filtration systems are not available, yet experimental filter systems show greater treatment efficiencies at higher loading rates than standard sand filters.

OPERATION AND MAINTENANCE

Alternate media filters require more initial operational control and maintenance due to the lack of long term operational data. Primary Operation and Maintenance (O&M) tasks include filter surface maintenance, dosing equipment servicing, and influent and effluent monitoring. With continued use, filter surfaces become clogged with organic biomass and solids. Once operating, infiltration rates may fall below the hydraulic loading rate and permanent ponding of the filter surface may occur. If this occurs, the filter should be taken off-line for rest or media removal and replacement. Buried filters are designed to operate without maintenance for their design life. Filters exposed to sunlight may develop algae mats controlled by surface shading. For community systems, disinfection is required prior to discharge, but disinfectant quantity requirements are low due to the high quality of the effluent.

COSTS

Detailed cost information is not available because most systems are still under study. Alternate media materials are not common to wastewater treatment applications, and long term costs are difficult to estimate. In areas where the filter materials are commonly found (peat is easily obtained in Maine, Minnesota, and Wisconsin) the cost of filter media is expected to be nominal. The cost of peat in other areas is significantly higher. One manufacturer reports that 30 bags of peat, each weighing 30 pounds, are needed for one filter. A research paper on crushed glass filters estimates that 10 to 20 cubic yards per installation would be necessary. Foam, crushed glass, and textile material are all subject to availability and transportation cost sensitivity.

REFERENCES

Other Related Fact Sheets

Intermittent Sand Filters
EPA 832-F-99-067
September 1999

Recirculating Sand Filters
EPA 832-F-99-079
September 1999

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

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3. Falling Spring Technologies, no date. Ecoflo. Internet site at http://www.ecoflopa.com/ecofaqdesignerinstaller.html, accessed February 2000.

4. Jowett, E. Craig. August 1997. *Field Performance of the Waterloo Biofilter with Different Wastewaters* National Small Flows Clearinghouse.

ADDITIONAL INFORMATION

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