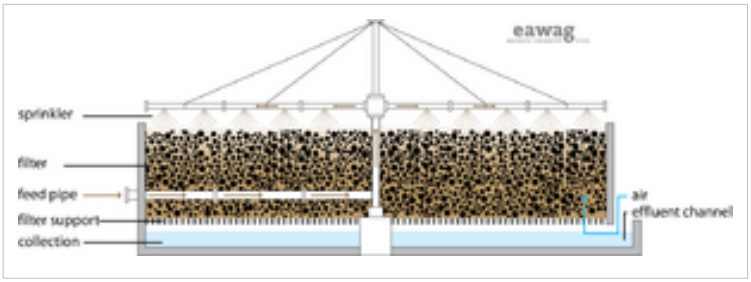
Trickling_Filter

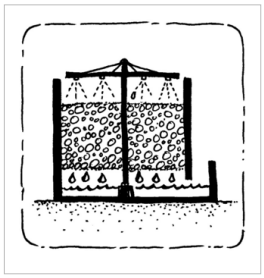
Application level		Management level	
Household		Household	
Neighbourhood	X	Shared	
City	XX	Public	XX



Applicable to systems:	Languages / langues / idiomas
1, 5 , 6 , 7 , 8	

Inputs: Blackwater , Greywater

Outputs: Effluent , Sludge



A Trickling Filter is a fixed bed, biological filter that operates under (mostly) aerobic conditions. Pre-settled wastewater is 'trickled' or sprayed over the filter. As the water migrates through the pores of the filter, organics are degraded by the biomass covering the filter material.

The Trickling Filter is filled with a high specific surface-area material such as rocks, gravel, shredded PVC bottles, or special pre-formed filter-material. A material with a specific surface area between 30 and 900m2/m3 is desirable. Pre-treatment is essential to prevent clogging and to ensure efficient treatment. The pre-treated wastewater is 'trickled' over the surface of the filter. Organisms that grow in a thin bio-film over the surface of the media oxidize the organic load in the wastewater to carbon dioxide and water while generating new biomass.

The incoming wastewater is sprayed over the filter with the use of a rotating sprinkler. In this way, the filter media goes through cycles of being dosed and exposed to air. However, oxygen is depleted within the biomass and the inner layers may be anoxic or anaerobic.

The filter is usually 1 to 3m deep but filters packed with lighter plastic filling can be up to 12m deep. The ideal filter material has a high surface to volume ratio, is light, durable and allows air to circulate. Whenever it is available, crushed rock or gravel is the cheapest option. The particles should be uniform such that 95% of the particles have a diameter between 7 and 10cm. Both ends of the filter are ventilated to allow oxygen to travel the length of the filter. A perforated slab that allows the effluent and excess sludge to be collected supports the bottom of the filter.

With time, the biomass will grow thick and the attached layer will be deprived of oxygen; it will enter an endogenous state, will lose its ability to stay attached and will slough off. High-rate loading conditions will also cause sloughing. The collected effluent should be clarified in a settling tank to remove any biomass that may have dislodged from the filter. The hydraulic and nutrient loading rate (i.e. how much wastewater can be applied to the filter) is determined based on the characteristics of the wastewater, the type of filter media, the ambient temperature, and the discharge requirements.

Advantages	Disadvantages/limitations

- Can be operated at a range of organic and hydraulic loading rates. - Small land area required compared to Constructed Wetlands.	- High capital costs and moderate operating costs - Requires expert design and construction. - Requires constant source of electricity and constant wastewater flow. - Flies and odours are often problematic. - Not all parts and materials may be available locally. - Pre-treatment is required to prevent clogging. - Dosing system requires more complex engineering.

Adequacy

This technology can only be used following primary clarification since high solids loading will cause the filter to clog. A skilled operator is required to monitor and repair the filter and the pump in case of problems. A low-energy (gravity) trickling system can be designed, but in general, a continuous supply of power and wastewater is required.

Compared to other technologies (e.g. WSPs), trickling filters are compact, although they are still are best suited for peri-urban or large, rural settlements. Trickling Filters can be built in almost all environments, although special adaptations for cold climates are required.

Health Aspects/Acceptance

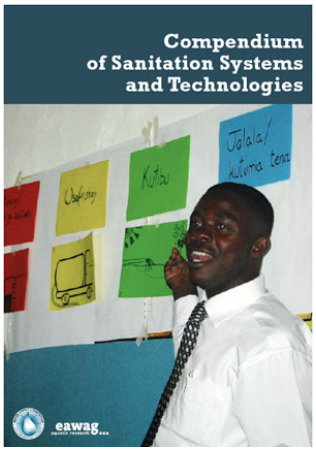
The odour and fly problems require that the filter be built away from homes and businesses. There must be appropriate measures taken for pre-treatment, effluent discharge and solids treatment, all of which can still pose health risks.

Maintenance

The sludge that accumulates on the filter must be periodically washed away to prevent clogging. High hydraulic loading rates can be used to flush the filter. The packing must be kept moist. This may be problematic at night when the water flow is reduced or when there are power failures.

Acknowledgements

The material on this page was adapted from: Tilley, E. et al. (2008). Compendium of Sanitation Systems and Technologies [2], published by Sandec [3], the Department of Water and Sanitation in Developing Countries of Eawag [4], the Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland. The publication is available in English, French, and will be made available in Spanish. Available in the IRC Digital Library [5]



Download the Eawag Compendium of Sanitation Systems and Technologies! [1]

References and external links

- U.S. EPA (2000). Wastewater Technology Fact Sheet- Trickling Filters, 832-F-00-014. US Environmental Protection Agency, Washington. Available: http://www.epa.gov (Design summary including tips for trouble shooting.)
- Sasse, L. (1998). DEWATS: Decentralised Wastewater Treatment in Developing Countries. BORDA, Bremen Overseas Research and Development Association, Bremen, Germany. (Provides a short description of the technology.)

- Tchobanoglous, G., Burton, FL. and Stensel, HD. (2003). Wastewater Engineering: Treatment and Reuse, 4th Edition. Metcalf & Eddy, New York. pp 890–930 . (Detailed description and example calculations.)

References

[1] http://www.eawag.ch/organisation/abteilungen/sandec/publikationen/compendium_e/index_EN
[2] http://www.eawag.ch/organisation/abteilungen/sandec/publikationen/publications_sesp/downloads_sesp/compendium_high.pdf
[3] http://www.eawag.ch/organisation/abteilungen/sandec/index_EN
[4] http://www.eawag.ch/index_EN
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