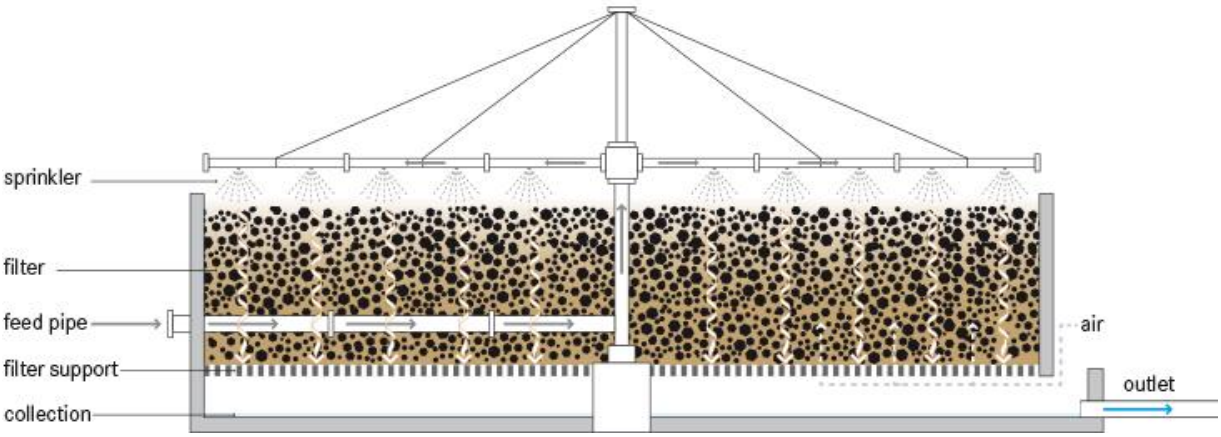
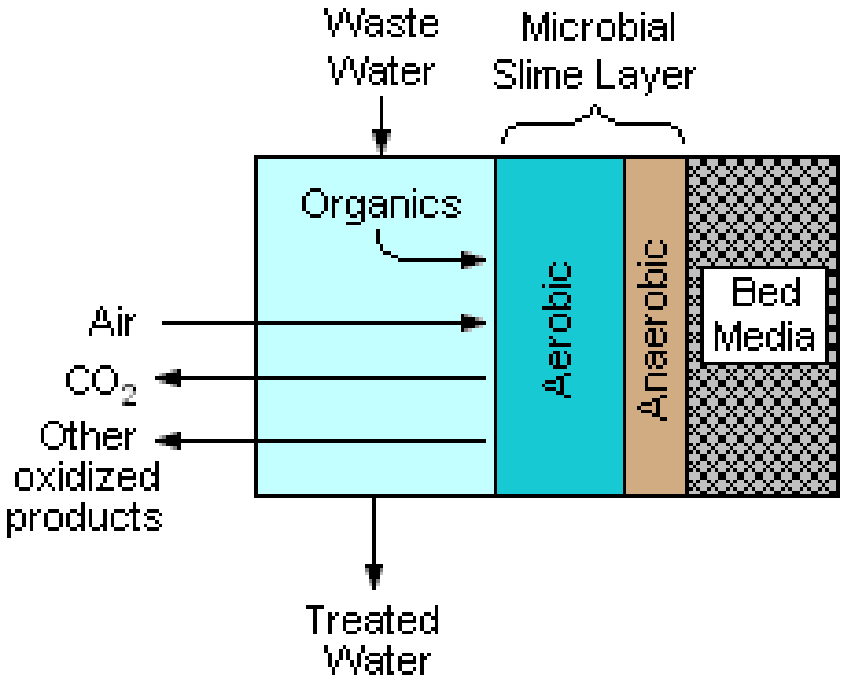
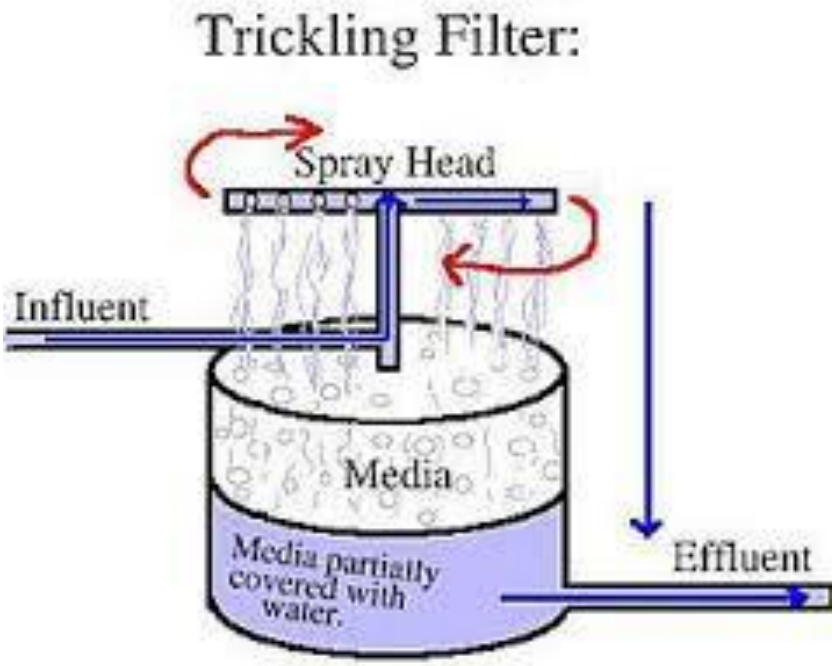
6-Trickling Filter

Trickling filter is a widely used aerobic biological treatment system. Also called a biofilter, it is a downflow packed bed type of reactor. It consists of a fixed bed made up of different inert materials. Biofilm grows on the surface of the inert bed. Different cheap and porous materials such as rocks, , gravel, stone, , ceramic, or plastic media can be used for making the porous bed. Wastewater enters from the top of the fixed bed making use of a rotating arm distributor or static nozzles fed with a variable head feed source. Microbial biofilm grown on the surface of the inert support helps to degrade the waste. Aerobic condition is achieved by active or passive aeration by using either a blower or fan (forced aeration) or natural convection of air due to the temperature difference between the water and ambient air


sprinkler
filter
feed pipe
filter support
collection
air
outlet


Waste Water
Microbial Slime Layer
Organics
Air
CO_2
Other oxidized products
Aerobic
Anaerobic
Bed Media
Treated Water


Trickling Filter:
Spray Head
Influent
Media
Media partially covered with water.
Effluent

7-Rotating Biological Contactor

A series of circular lightweight rotating discs are mounted on a shaft through which wastewater flows. The partially discs rotate through the wastewater slowly. The disks are most commonly made of high-density plastic sheets (e.g. Polyethylene, polystyrene or polyvinylchloride) and are usually ridged, corrugated, or lattice-like to increase the specific surface area The surface of the disks provides an attachment site for bacteria and as the discs rotate, a film of biomass grows on their surfaces This biofilm is alternately exposed to either the air or the wastewater as it rotates. The oxygen necessary for the growth of these microorganisms is obtained by adsorption from the air as the biofilm on the disk is rotated out of the liquid. As the biofilm passes through the liquid phase, nutrients and organic pollutants are taken up. All oxygen, nutrients and organic pollutants are necessary for the growth of the microorganism and the conversion of the organic matter to CO2. Nitrogen is removed by nitrification and subsequent denitrification transforming it to gaseous N2, which is released to the air. The process is optimized by adjusting the speed of rotation and the depth of submergence. In some designs, air is added to the bottom of the tank to provide additional oxygen in case of high-strength influents

The submerging level varies from 40 to 80 % and a usual rotating speed is 1 to 2 rpm The common disc diameter is between 0.6 and 3 m The degradation process is similar to the one in a trickling filter with a high rate of recirculation The higher contact time in RBCs due to rotation allows up to 8 to 10 times higher levels of treatment than in trickling filters Also because the rotation allows both optimum wetting and oxygen supply, RBCs are generally more reliable than other fixed-film processes. Additionally, the disc design is made in such a way that large amounts of biofilm can attach, which means that there is a large amount of biological mass present to degrade the pollutants The large amount of biomass and the stability of contact also results in an improved stability and a reduced ability to changes in hydraulic or organic loading compared to conventional activated sludge processes
As for all fixed-film processes, primary settling and/or screening is required for the removal of grit, debris, and excessive oil Such primary treatments are typically septic tanks, or anaerobic reactors. To remove sloughing sludge, a post-settling unit (i.e. a clarifier) is also required.