SAND FILTERS

A sand bed filter is a kind of depth filter. Broadly, there are two types of filter for separating particulate solids from fluids:

- Surface filters, where particulates are captured on a permeable surface
- Depth filters, where particulates are captured within a porous body of material.[1]

In addition, there are passive and active devices for causing solid-liquid separation such as settling tanks, self-cleaning screen filters, hydrocyclones and centrifuges.[1]

There are several kinds of depth filter, some employing fibrous material and others employing granular materials. Sand bed filters are an example of a granular loose media depth filter. They are usually used to separate small amounts (<10 parts per million or <10 g per cubic metre) of fine solids (<100 micrometres) from aqueous solutions.[2]:302-303In addition, they are

usually used to purify the fluid rather than capture the solids as a valuable material. Therefore they find most of their uses in liquid effluent (wastewater) treatment.

Sand bed filters work by providing the particulate solids with many opportunities to be captured on the surface of a sand grain. As fluid flows through the porous sand along a tortuous route, the particulates come close to sand grains.

Industrial water treatment can be classified into the following categories:

- Industrial wastewater treatment
- Boiler water treatment
- Cooling water treatment
    - Industrial water treatment seeks to manage four main problem areas: scaling, corrosion, microbiological activity and disposal of residual wastewater. Boilers do not have many problems with microbes as the high temperatures prevent their growth.
    - Scaling occurs when the chemistry and temperature conditions are such that the dissolved mineral salts in the water are caused to precipitate and form solid deposits. These can be mobile, like a fine silt, or can build up in layers on the metal surfaces of the systems. Scale is a problem because it insulates and heat exchange becomes less efficient as the scale thickens, which wastes energy. Scale also narrows pipe widths and therefore increases the energy used in pumping the water through the pipes.

- Corrosion occurs when the parent metal oxidises (as iron rusts, for example) and gradually the integrity of the plant equipment is compromised. The corrosion products can cause similar problems to scale, but corrosion can also lead to leaks, which in a pressurised system can lead to catastrophic failures.
- Microbes can thrive in untreated cooling water, which is warm and sometimes full of organic nutrients as wet cooling towers are very efficient air scrubbers. Dust, flies, grass, fungal spores, and others collect in the water and create a sort of "microbial soup" if not treated with biocides. Most outbreaks of the deadly Legionnaires' Disease have been traced to unmanaged cooling towers, and the UK has had stringent Health & Safety guidelines concerning cooling tower operations for many years as have had governmental agencies in other countries.

Activated sludge refers to a mass of microorganisms cultivated in the treatment process to break down organic matter into carbon dioxide, water, and other inorganic compounds. The activated sludge process has three basic components: 1) a reactor in which the microorganisms are kept in suspension, aerated, and in contact with the waste they are treating; 2) liquid-solid separation; and 3) a sludge recycling system for returning activated sludge back to the beginning of the process. There are many variants of activated sludge processes, including variations in the aeration method and the way the sludge is returned to the process.

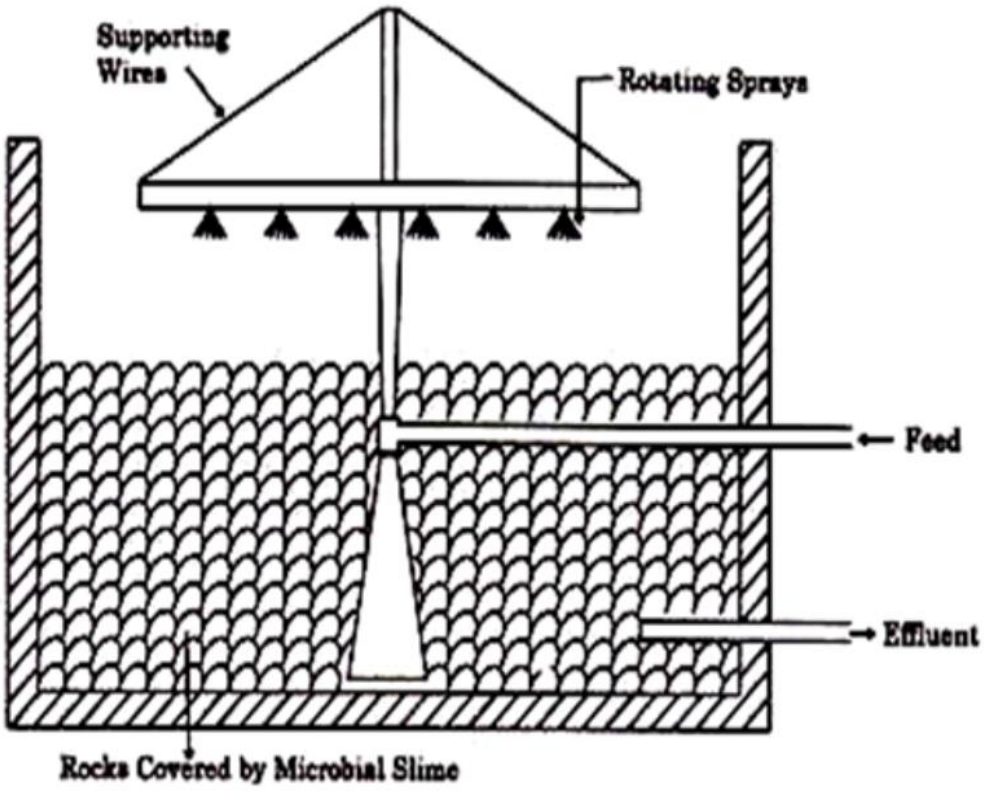
Advantages: Efficient removal of BOD, COD and nutrients when designed and professionally operated according to local requirements. The process itself has flexibility and numerous modifications can be tailored to meet specific requirements (e.g. for nitrogen removal). Activated sludge is the best documented and most widely used form of secondary wastewater treatment.

Disadvantages: Expensive in terms of both capital and O&M costs, requires a constant energy supply, needs trained operators who can monitor the system and react to changes immediately, and the availability of spare parts and chemicals may be an obstacle. The track record of activated sludge plants in the developing world is very poor, and few operate as designed or intended.

Trickling Filter Bed

A trickling filter is a type of wastewater treatment system first used by Dibden and Clowes · It consists of a fixed bed of rocks,lava, coke, gravel, slag, polyurethane foam, sphagnum peat moss, ceramic, or plastic media over which sewage or otherwastewater flows downward and causes a layer of microbial slime (biofilm) to grow, covering the bed of media. Aerobic conditions are maintained by splashing, diffusion, and either by forced-air flowing through the bed or natural convection of air if the filter medium is porous.

The terms trickle filter, trickling biofilter, biofilter, biological filter and biological trickling filter are often used to refer to atrickling filter. These systems have also been described as roughing filters, intermittent filters, packed media bed filters, alternative septic systems, percolating filters, attached growth processes, and fixed film processes.



Trickling filter bed

WATER POLLUTION EFFECT ON MAN,PLANT AND ANIMAL

Effects of Water Pollution on Man

a. Waterborne diseases caused by polluted drinking water:
• Typhoid
• Amoebiasis
• Giardiasis
• Ascariasis
• Hookworm
b. Waterborne diseases caused by polluted beach water:
• Rashes, ear ache, pink eye
• Respiratory infections
• Hepatitis, encephalitis, gastroenteritis, diarrhoea, vomiting, and stomach aches
c. Conditions related to water polluted by chemicals (such as pesticides, hydrocarbons, persistent organic pollutants, heavy metals etc):
• Cancer, incl. prostate cancer and non-Hodgkin's lymphoma
• Hormonal problems that can disrupt reproductive and developmental processes
• Damage to the nervous system
• Liver and kidney damage
• Damage to the DNA
• Exposure to mercury (heavy metal):
• *In the womb:* may cause neurological problems including slower reflexes, learning deficits, delayed or incomplete mental development, autism and brain damage
• *In adults:* Parkinson's disease, multiple sclerosis, Alzheimer's disease, heart disease, and even death
d. Other effects:
• Water pollution may also result from interactions between water and contaminated soil, as well as from deposition of air contaminants (such as acid rain)
• Damage to people may be caused by fish foods coming from polluted water (a well known example is high mercury levels in fish)
• Damage to people may be caused by vegetable crops grown / washed with polluted water

Effects of Water Pollution on Animals

• *Nutrient pollution* (nitrogen, phosphates etc) causes overgrowth of toxic algae eaten by other aquatic animals, and may cause death; nutrient pollution can also cause outbreaks of fish diseases

Oil Coated Duck

• *Chemical contamination* can cause declines in frog biodiversity and tadpole mass

• *Oil pollution* (as part of chemical contamination) can negatively affect development of marine organisms, increase susceptibility to disease and affect reproductive processes; can also cause gastrointestinal irritation, liver and kidney damage, and damage to the nervous system
• *Mercury* in water can cause abnormal behavior, slower growth and development, reduced reproduction, and death
• *Persistent organic pollutants* (POPs) may cause declines, deformities and death of fish life
• Too much sodium chloride (ordinary salt) in water may kill animals
• We also assume that some higher forms of non-aquatic animals may have similar effects from water pollution as those experienced by humans, as described above

Effects of Water Pollution on Plants

• May disrupt photosynthesis in aquatic plants and thus affecting ecosystems that depend on these plants
• Terrestrial and aquatic plants may absorb pollutants from water (as their main nutrient source) and pass them up the food chain to consumer animals and humans
• Plants may be killed by too much sodium chloride (ordinary slat) in water
• Plants may be killed by mud from construction sites as well as bits of wood and leaves, clay and other similar materials
• Plants may be killed by herbicides in water; herbicides are chemicals which are most harmful to plants.