

Aquatic microbiology

- Sewage treatment
- Drinking water microbiology

Sewage / waste water Treatment

- Waste water, that is water after being used, is called sewage. Household water, toilet wastes, industrial wastes and rain water.

Water Treatment

- Drinking water : Held in a holding tank settling the suspended matter.
- Colloidal materials such as clay are removed from water by using flocculant chemicals
- Water is treated by filtration : through beds of sand or diatomaceous earth.
- Disinfected with chlorine to kill remaining pathogenic bacteria.

Primary Treatment

- Removal of solid matter called sludge 40 ~ 60% of suspended solids are removed in sedimentation tanks. Flocculating chemicals are added to remove more solids.
- Primary treatment removes 25% to 35% of the biochemical oxygen demand (BOD)

Secondary Treatment

- Secondary treatment is biological degradation. sewage is aerated vigorously to encourage growth of aerobic bacteria
 - oxidize the dissolved organic matter to CO_2 and water.Activated sludge systems and trickling filters.
- Activated sludge system consists of aeration tank- some of the sludge from a previous batch is added - large number of metabolizing bacteria, yeasts, molds and protozoa.
- Species of Zoogloea are important they form flocculant masses in the tank and oxidizes the organic matter.
- These flocs settle out organic matter.
- Settled sludge is removed for treatment in an anaerobic sludge digester.
- Effluent is sent on for final treatment.
- Activated sludge systems remove 75% to 95% of the BOD from sewage.

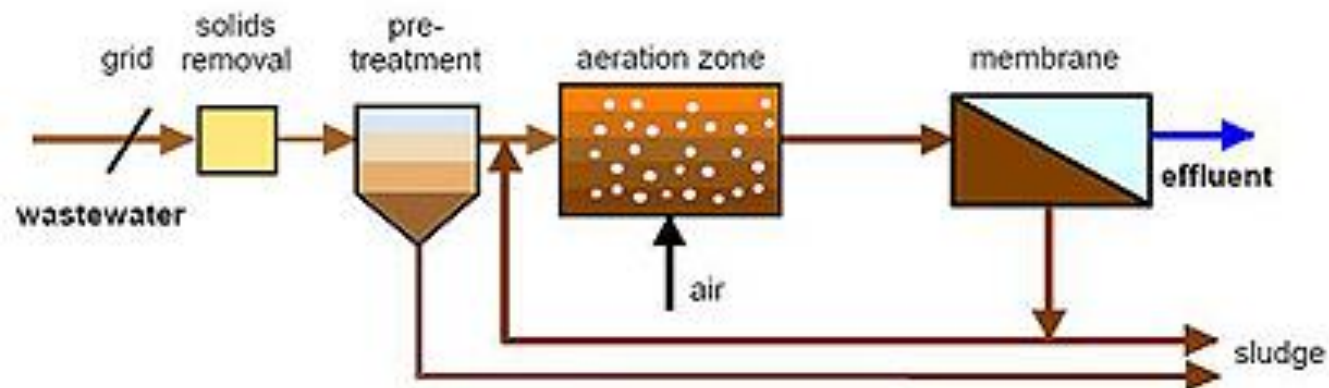
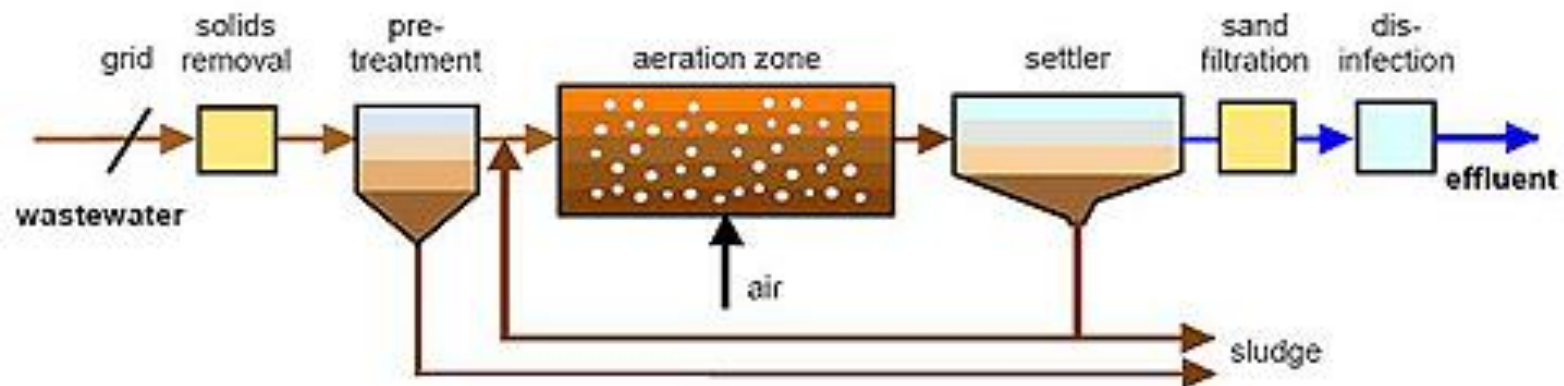
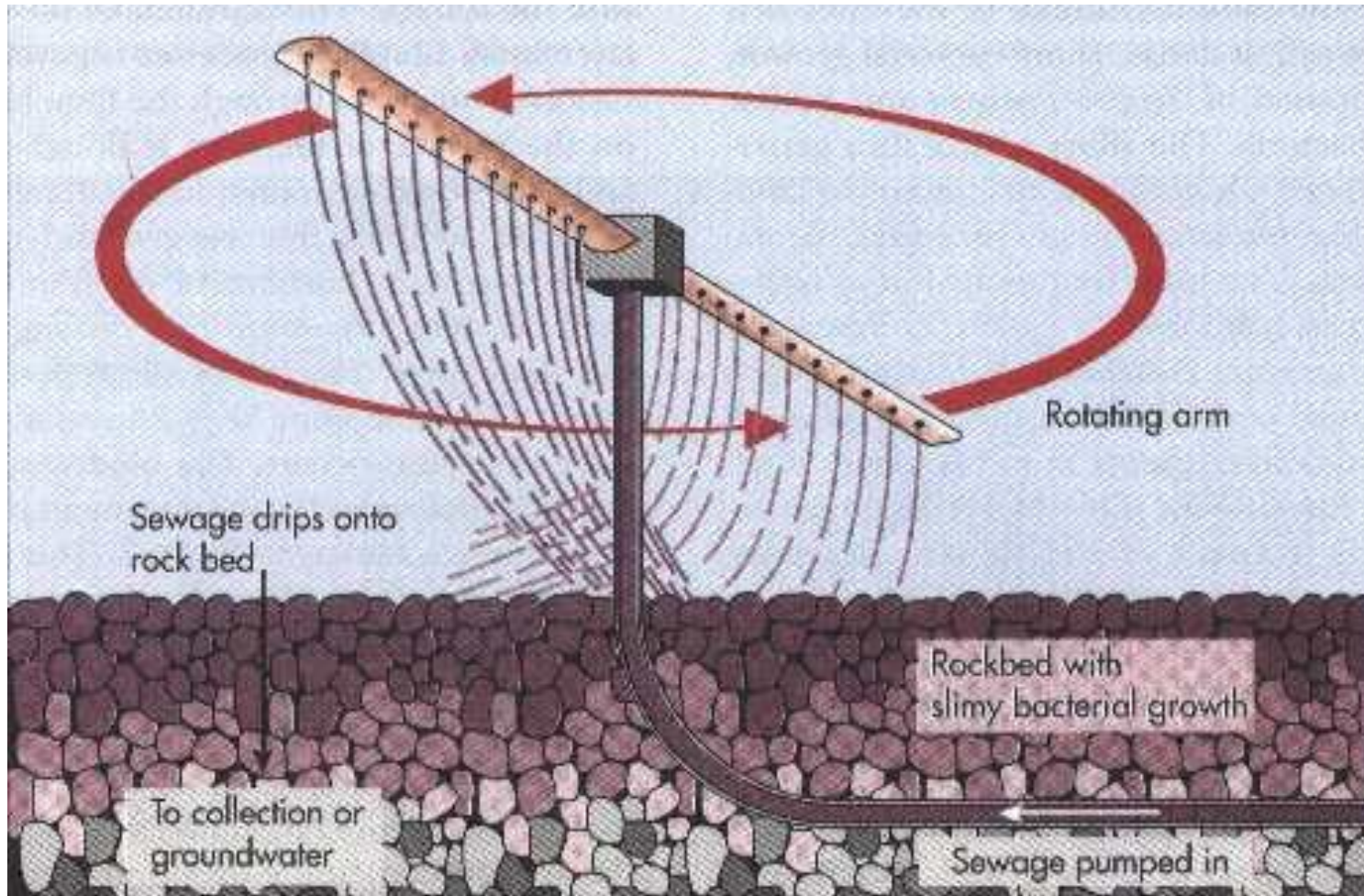


Image courtesy of <http://en.wikipedia.org>

Trickling filters

- Sewage is sprayed over a bed of rocks or molded plastic. The rocks provide enough surface area for microbial activity space air to the bottom.
- Slimy gelatinous film of aerobic microorganisms grow - metabolize the organic matter.
- Trickling filters remove 80 to 85% of BOD.

Trickling filter



Final Treatment

- Effluent from secondary treatment is disinfected and discharged on to land or into water.
- It is subjected to tertiary treatment.
- Tertiary treatment uses physical filtration and chemical precipitation to remove all the BOD, nitrogen and phosphorus from water.
- Tertiary treatment provides drinkable water, whereas secondary treatment provides water for irrigation.
- Sludge is further digested in an anaerobic sludge digester. Bacteria degrade organic matter and produce methane and CO₂.
- First stage of anaerobic sludge digestion, production of CO₂ and organic acids
- Next stage organic acids are metabolized to form hydrogen and CO₂.
- Third stage there are converted into methane by methane producing bacteria



(acetic acid)

Drinking water microbiology

- Drinking or potable water is water that is free from pathogens and chemicals that are dangerous to human health.
- Any taste, odor and color must be absent from the water to be palatable.
- Raw water may contain many contaminants derived from sewage and nearby industries.
- Many enteric pathogens are water borne.
- Therefore water is treated and disinfected to remove chemicals and pathogens respectively.

- Determining whether a water supply is fecally polluted is to test for the presence of normal fecal organism.
- Testing for normal fecal organisms as indicators of fecal pollution is a reliable way of determining whether water is bacteriologically safe to drink.
- A single laboratory examination of any water does not justify the conclusion that the supply is safe for drinking so bacteriologic analysis of water should be performed at regular intervals.
- This analysis is used in companies that manufactured water supplies like water bottles, the ones we get on fast food restaurants and stores.
- Namely: Nature Spring, Wilkins, Absolute, Summit etc.

- With this analysis, one can be sure that the water we drink is safe and free from microorganisms.
- So, one can also prevent getting diseases from microbes that can live on water especially the fecal coliforms.
- An important aspect of Water Microbiology is numerous disease causing microorganisms spread through water.
- Many bacteria, viruses, fungi and protozoa are responsible for waterborne diseases.
- The recurrence of waterborne illness has led to the improvement in water purification.

Typical water quality standards

- **Drinking Water:**
 - No coliforms contamination acceptable
- **Recreational water:**
 - 200 faecal coliforms /100 ml
- **Fish and wildlife habitat:**
 - 5000 faecal coliforms/100 ml
- **Shellfish:**
 - 14 faecal coliforms/100 ml

Indicator Organisms

- **General coliforms –**
 - indicate water in contact with plant or animal life (universally present).
- **Fecal coliforms –**
 - mammal or bird feces in water.
- **Enterococcus bacteria** (type of fecal streptococci)–
 - feces from warm blooded animals in water