Online Lecture 1

Water Pollution

- The addition of various organic and inorganic substances that change the physical and chemical properties of water thereby leading to detrimental effects on living organisms and reducing water usability is termed as water pollution.

Causes of Water Pollution

- Natural Causes-
  - Soil erosion due to rain, floods, high speed wind.
  - Deposition of dead and decaying remains of plants and animals.
- Man-made Causes-
  - Sewage and other wastes: Includes papers, cloth, soap, detergents, waste.
  - Industrial waste: effluents such as oil, grease, plastic, metals, acids and other toxic chemicals.
  - Agricultural waste: fertilizers, pesticides.
  - Human activities: bathing, washing clothes (use of synthetic detergents).
  - Customs and traditions: disposal of dead bodies, immersion of idols of gods.

Sources of water pollutants

- Point sources
  - Pollutants enter the water at a single point. Examples: sewage treatment plant and factories. These can be regulated through law.
- Non point source
  - pollutants enter the water over large areas. Examples: Surface run off, mining wastes, municipal wastes, acid rain and soil erosion

Water Pollutants and its effects

- Sediments: Excessive amounts of soil particles carried by flowing water, when there is severe soil erosion. Sediments cloud the water and reduces photosynthesis, destroys feeding ground of fishes, clogs reservoirs and channels.
- Oxygen-demanding wastes (BOD and COD): Organic waste such as animal manure and plant debris that are decomposed by bacteria, from sewage, animal feedlots, paper mills, and food processing facilities. These bacteria deplete the oxygen and causes death of fish.
- Infectious microorganisms (Pathogens): Parasitic worms, viruses and bacteria from infected organisms as well as human and animal wastes. They are responsible for water borne diseases.
- Synthetic chemicals: Synthetic chemicals from industrial effluents, surface runoff, and cleaning agents. These chemicals causes health problems for humans and harm fishes.

Water Pollutants and its effects

- Inorganic nutrients: Substances like nitrogen and phosphorus from animal waste, plant residues, and fertilizer runoff. These nutrients causes eutrophication.
- Radioactive substances: Wastes from nuclear power plants, nuclear weapons production, mining and refining uranium and other ores. Such substances causes cancer and birth defects.
- Thermal pollution: Hot water from industrial processes. Heat lowers oxygen demand and makes aquatic life more vulnerable to diseases, parasites. Thermal shock in aquatic organisms.

Effects of Water Pollution

- Effect on human health
  - Infectious diseases can be spread through contaminated water. These water-borne diseases are caused by bacteria (Typhoid, Cholera, diarrhoea etc.) or by viruses (Infectious Hepatitis)
  - Pesticides – can damage the nervous system and cause cancer.
  - Mercury – Minamata disease
  - Chlorides can cause reproductive and endocrinal damage.
  - Nitrates – are especially dangerous to babies that drink formula milk. It restricts the amount of oxygen in the brain and cause the "blue baby" syndrome.
  - Lead – can accumulate in the body and damage the central nervous system.
  - Arsenic – causes liver damage, skin cancer and vascular diseases
  - Flourides - in excessive amounts can make your teeth yellow and cause damage to the spinal cord.

Effects of Water Pollution

- Effects on animals
  - Loss of aquatic biodiversity: Harmful chemicals and pollutants in water effect survival of aquatic organisms
- Effects on plants
  - Eutrophication of water bodies: Nitrate and phosphate fertilizer used to increase nitrogen and phosphate content of soil goes in water and increases the growth of certain plants on surface of water body.
  - Polluted water contains high concentration of heavy metals becomes toxic for plants.

Pollution of Groundwater

- Excessive extraction of groundwater leads to the natural pollution of groundwater. Examples are fluoride and arsenic contamination.
- Groundwater receives pollutants from septic tanks, landfills, hazardous waste dumps, and underground tanks containing petrol, oil, chemicals, etc.

Eutrophication

- Enrichment of a standing water body by nutrients, such as phosphorus and nitrogen.
- Increased photosynthetic activity.
- Excessive algae die, they fall to the bottom and gets decomposed. This process requires dissolved oxygen, some fish species die.

Biomagnification

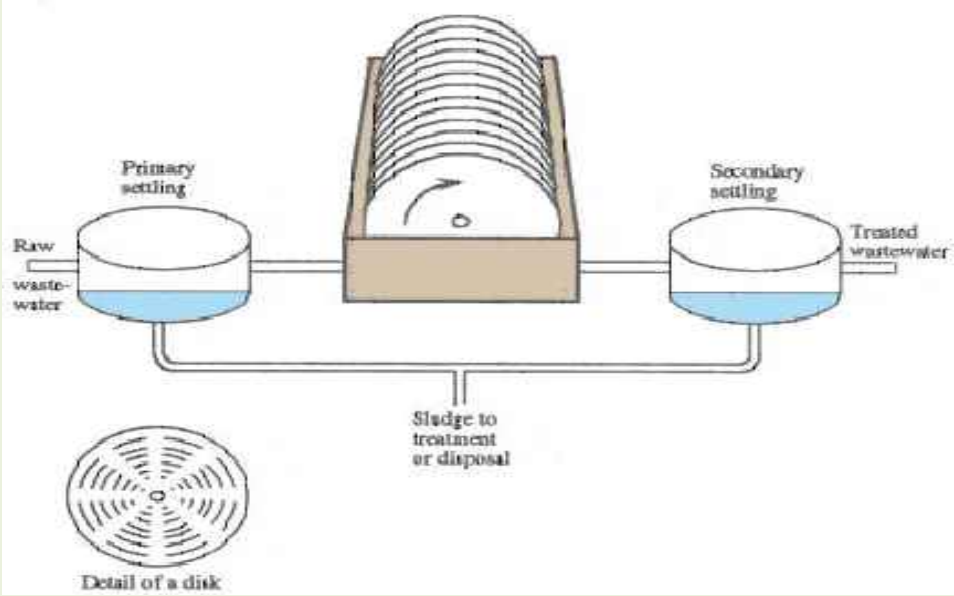
- Biomagnification is the increase in concentration of a substance, such as the pesticide, that occurs in a food chain. The pollutant enters the first organism in a food chain. When the second organism in the chain consumes the first one, the pollutant too moves into the second organism.
- As we go up the levels of the ecological pyramid, there is energy loss. Hence, at each succeeding level, the predator consumes more of the prey. As a result, the organisms at higher levels have greater concentrations of the pollutant.

Control of Water Pollution

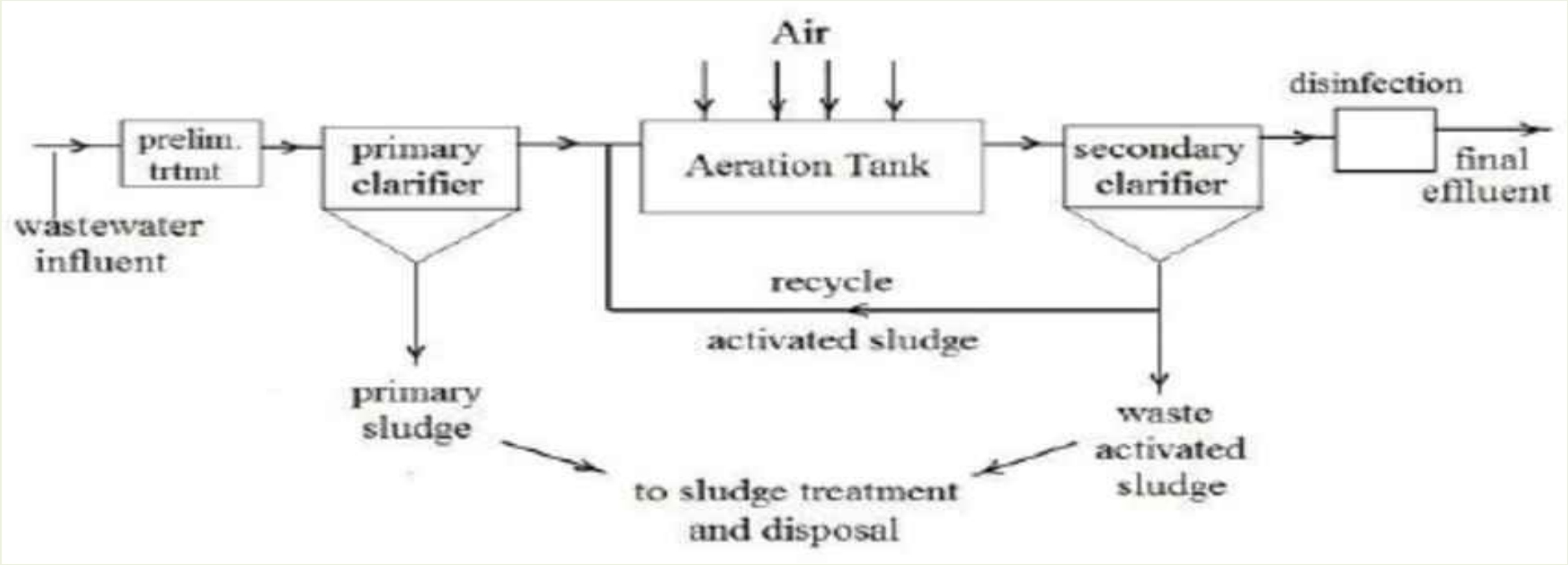
- Treatment of domestic and industrial waste in order to reduce toxicity.
- Control on excess use of fertilizers and pesticides in agriculture
- Human activities such as bathing, washing ; throwing dead bodies should be stopped.
- Non- biodegradable waste material such as plastic should not be disposed in water bodies.
- Strict enforcement of rules
- Public awareness

Waste water treatment

- Primary treatment
  - Grit removal
  - Sedimentation
  - Floatation
- Secondary treatment
  - Trickling filters
  - Activated sludge process
  - Rotating biological contactor
- Tertiary treatment
  - Chlorination
  - Anaerobic treatment: Up-flow Anaerobic Sludge Blanket (UASB) Reactor
    - Hydrolysis, Acidogenesis, Acetogenesis, Methanogenesis



This PPT should be used as reference only. Reading books (mentioned in syllabus) is mandatory for the preparation of the examinations.



This PPT should be used as reference only. Reading books (mentioned in syllabus) is mandatory for the preparation of the examinations.