UNIT 3.Water Pollution

Water Pollution – Sources –Industrial effluents- agriculture discharge - oil spills, heavy metal -pesticides-biomagnifications and bioaccumulations, Dissolved oxygen in water, chemical oxygen demand (COD) and biochemical Oxygen demand(BOD)(Definition only)- control of water pollution- ISI/BIS standards of drinking water

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Water pollution is the contamination of water bodies as a result of human activities. Water bodies include lakes, rivers, oceans and groundwater. Water pollution results when contaminants are introduced into the natural environment. Water pollution is the leading worldwide cause of death and disease, e.g. due to water-borne diseases.

Water pollution can be **surface water pollution and marine pollution**. Sources of water pollution are either **point sources** or **non-point sources**. Point sources have one identifiable cause of the pollution, such as a storm drain, wastewater etc. Non-point sources are more diffuse, such as agricultural runoff.

The causes of water pollution include a wide range of chemicals and pathogens as well as physical parameters. Contaminants may include organic and inorganic substances.

Sources:

Industrial effluent: Sewage is another name for waste water from domestic and industrial processes. These include C, N, S and P compounds. These compounds are converted in to methane, amines, hydrogen sulphide etc. which leads to the bad odour of water and also decrease the dissolved oxygen of water. This results in the death of fish and other aquatic living beings.

Agricultural discharge: Agricultural processes such as uncontrolled spreading of slurries and manure, use of pesticides and fertilizers can cause water pollution.

Oil spills: Oil spillages affect water quality in a number of ways. Oil can make drinking water unsafe. A substantial amount of oil released into oceans and seas will destroy life and the ecosystem. Oil spills also reduce oxygen supplies within the water environment. The main causes are: loss from storage facilities, spillage during delivery and deliberate disposal of waste oil to drainage systems.

Heavy metals: Metals are introduced in aquatic systems as a result of the weathering of soils and rocks, from volcanic eruptions, and from a variety of human activities involving the mining, processing, or use of metals substances that contain metal pollutants. The most common heavy metal pollutants are arsenic, cadmium, chromium, copper, nickel, lead and mercury. The most common metal pollution in freshwater comes from mining companies. They use acid to release heavy metals from ores. After the process, they disperse the acid solution in the groundwater, containing high levels of metals. This will also leads to the decrease of pH of water.

Pesticides: These are chemicals used to kill or control pests. Pesticides are used to protect crops against insects, weeds, fungi, and other pests. They also play a significant role in food production. They protect or increase yields. This includes herbicides (weeds), insecticides (insects), fungicides (fungi), nematocides (nematodes), and rodenticides (vertebrate poisons).

Pesticides are potentially toxic to humans and can have both acute and chronic health effects, depending on the quantity and the ways in which a person is exposed. Some of the older, cheaper pesticides can remain in the soil and water for years. They have been banned in most of the countries. There are more than 1,000 pesticides used around the world. During the rainfall pesticides and residues dissolved in water can be quickly transported to contaminate ground water and freshwater supplies.

	Biomagnification	**Bioaccumulation**
Definition	An increased concentration of a toxic chemicals or pesticides, in higher animals of food chain.	Accumulation of a toxic chemical in the tissue of a particular organism.
Causes	An increase in the concentration as one moves higher in the food chain.	An increase in the concentration of a substance inside an organism
Food Chain	Biomagnification takes place between two given trophic levels.	Bioaccumulation takes place or occurs within a given trophic level
Example	The transfer of pollutants and other absorbed toxins from the microscopic aquatic organisms into the small fish, which are later consumed by the larger fish and other aquatic animals.	Buildup or accumulation of mercury in fishes and other aquatic animals.

The increase in the concentration of substances can occur as a result of:

- Persistence – where the substance cannot be broken down by environmental processes.
- Food chain energetics – where the substance's concentration increases progressively as it moves up a food chain.
- Low rate of internal degradation or excretion of the substance – mainly due to water-insolubility.

Dissolved oxygen (DO) is a measure of the quantity of free oxygen molecules in water. The concentration of DO is an important indicator of the health of an aquatic ecosystem because oxygen is essential for almost all forms of life. Low DO in a water body will harm most aquatic life, because there will not be enough O to sustain life and too much oxygen in water can also be dangerous.
Dissolved oxygen in water comes from two main sources: the atmosphere and photosynthesis. The concentration of DO is affected by numerous variables, including water temperature (colder water holds more oxygen than warmer water), salinity (freshwater holds more oxygen than saltwater) and atmospheric pressure (the amount of DO absorbed in water decreases as altitude increases).

Chemical oxygen demand (**COD**) is an indicative measure of the amount of oxygen that can be consumed by reactions in a measured solution. It is commonly expressed in mass of oxygen consumed over volume of solution which in SI units is milligrams per litre (mg/L). The most common application of COD is in quantifying the amount of oxidizable pollutants found in surface water or wastewater. COD is useful in terms of water quality.

Biochemical Oxygen Demand (**BOD**) is the amount of dissolved oxygen needed by microorganisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 °C.

Control of water pollution

- Bringing awareness in people: People must be against of dumping waste and sewage into fresh water. They must force the Government to go for an alternate way like treating this before dumping and people who dumped waste must be penalized.

- Leakage from drainage in pipeline must be avoided
- Industrial waste water must be treated before passing in to river or lake
- Ships must transport oil only when the weather conditions are good. During Storms ships may wreck which might result in oil spills
- Dispose of toxic chemicals properly: many household chemicals bleach, paint, paint thinner, can be recycled.
- Do not pour cooking oil, fat and grease down the drain
- Use phosphate-free detergent and dish cleaner
- Dispose of medical waste properly
- Report water polluters
- Support environmental charities
- Try to avoid plastic containers
- Cut down on the chemicals fertilizers and pesticides
- Plant some trees

The **Bureau of Indian Standards** (**BIS**) is the national Standards Body of India working under the Ministry of Consumer Affairs, Food & Public Distribution, Government of India. It is established by the Bureau of Indian Standards Act, 1986 which came into effect on 23 December 1986. The Minister in charge of the Ministry or Department having administrative control of the BIS is the ex-officio President of the BIS. The organisation was formerly the **Indian Standards Institution** (**ISI**).

As a corporate body, it has 25 members drawn from Central or State Governments, industry, scientific and research institutions, and consumer organizations. Its headquarters are in New Delhi, with regional offices in Eastern Region at Kolkata, southern Region at Chennai, Western Region at Mumbai, Northern Region at Chandigarh and Central Region at Delhi and 20 branch offices.

According to BIS 1500-2012 the acceptable limit of bacteria and other major contamination of water are as follows:

Test parameter	**Acceptable limit**	**Permissible limit**
pH value	6.5-8.5	No relaxation
Turbidity	1	5
Total hardness as $CaCO_3$, mg/l	200	600
E.coli presence/absence	Shall not be detectable in any 100ml sample	Shall not be detectable in any 100ml sample
Total iron as Fe, mg/l	0.3	No relaxation
Taste	Agreeable	Agreeable
Odour	Agreeable	Agreeable