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((Environmental Pollution))

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LEC- ((5))

Water pollution

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Water pollution

We live on a planet that is dominated by water. More than 70% of the Earth's surface is covered with this simple molecule. Scientists estimate that the hydrosphere contains about 1.36 billion cubic kilometers of this substance mostly in the form of a **liquid** (water). The second most common form of the water molecule on our planet is **ice**. If all our planet's ice melted, sea-level would rise by about 70 meters.

Water is also essential for life. It is the major constituent of almost all life forms. Most animals and plants contain more than 60% water by volume.

Water quality

Water quality refers to the chemical, physical, biological, and radiological characteristics of water. When water quality is poor, **it affects not only aquatic life but the surrounding ecosystem as well.**

These sections detail all of the parameters that affect the quality of water in the environment. Physical properties of water quality include temperature and turbidity. Chemical characteristics involve parameters such as pH and dissolved oxygen. Biological indicators of water quality include algae and phytoplankton. These parameters are relevant not only to surface water studies of the ocean, lakes and rivers, but to groundwater and industrial processes as well.

1- Water temperature

The temperature of water is an important physical parameter affecting other water quality parameters. **Water temperature affects** the ability of water to hold oxygen, the rate of photosynthesis by aquatic plants and the metabolic rates of



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aquatic organisms. Living organisms differs in their ability to tolerant the temperature , the species have a wide range ability of tolerance called **Eurythermic** , but called **stenothermic** organisms when it be with low wide of tolerance.

2- Color

Water may become **cloudy** or **discolored** (green , yellow ,brown or red) **as a result of pollutants** , so it called polluted water ,while the pure - clean water appear to **be colorless**.

3- Turbidity

Turbidity in water is caused by suspended material such as **clay, silt, finely divided organic and inorganic matter, soluble colored compounds and plankton and microscopic organisms**. Turbidity is an expression of the optical properties that cause light to be scattered and absorbed rather than transmitted in a straight line through the water. Standard units for turbidity are "**nephelometric turbidity units**" (**NTU**) .

4- Electrical conductivity and total dissolved solids (TDS)

Conductivity is a measure of the capacity of an aqueous solution to carry an electrical current, and depends on the presence of ions. Conductivity is commonly used to determine salinity and is mostly reported in **micro-Siemens per centimeter** ($\mu\text{S}/\text{cm}$) at a standard reference temperature of 25 degrees Celsius. While, total dissolved solids (TDS) are a measure of all inorganic and organic constituents dissolved in water.

5- Salinity



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The salinity is the quantity of dissolved salt content of the water. Salts are compounds like sodium chloride, magnesium sulfate, potassium nitrate, and sodium bicarbonate which dissolve into ions. The concentration of dissolved chloride ions is sometimes referred to as chlorinity.

Thus, water can be classified into the following depending on the content of salt

1- Euhaline water : salinity about 15-35% , EX: oceans , seas and gulfs.

2- Brackish water : it divided to ,

a- **Polyhaline** : salinity about 18-30 % , EX: Shatt Al-Arab near Fao region.

b- **Mesohaline** : salinity about 5-18 % , EX: the southern part of Shatt Al-Arab .

c- **Oligohaline** : salinity about 0.5-5% , EX: the upper part of Shatt Al-Arab .

3- Fresh water : salinity less than 0.5 % , EX: Tigris and Euphrates rivers.

6- Dissolved Oxygen (DO)

The most important measure of water quality is the dissolved oxygen (DO). Oxygen, although poorly soluble in water, is fundamental to aquatic life. Without free DO, streams and lakes become uninhabitable to gill-breathing aquatic organisms. Dissolved oxygen is **inversely proportional** to temperature, and the maximum oxygen that can be dissolved in water at most ambient



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temperatures is about **10 mg/L**. In general, rapidly moving water contains more dissolved oxygen than slow or stagnant water. The decomposition of organic matter through microbial activity also consumes oxygen and can be evident at nutrient enriched sites.

7- pH

The pH of the aquatic systems is an important indicator of the water quality. Water (H₂O) contains both hydrogen (H⁺) and hydroxyl (OH⁻) ions. The pH of water is a measurement of the concentration of H⁺ ions, using a scale that ranges from 0 to 14. A pH of 7 is considered "**neutral**", since concentrations of H⁺ and OH⁻ ions are **equal**. Liquids or substances with pH measurements below 7 are considered "**acidic**", and contain more H⁺ ions than OH⁻ ions. **Since pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically.** pH is reported in "logarithmic units". Each number represents a 10-fold change in the acidity/basicness of the water. Water with a pH of five is ten times more acidic than water having a pH of six. Natural water usually has a pH between 6.5 and 8.5. **The pH of water determines the solubility** (amount that can be dissolved in the water) **and biological availability** (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (lead, copper, cadmium, etc.).

Water pollutants

Water pollution happens when toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them,



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lying suspended in the water or depositing on the bed. This degrades the quality of water.

Water pollution can be defined as "*any biological, chemical, or physical change in water quality that has a harmful effect on living organisms or makes water unsuitable for desired uses.*"

Sources of water pollution

Water pollution can come from a number of different sources. If the pollution comes from a single source, such as an oil spill, it is called **point-source pollution**. Water pollutants are categorized as **point source** if these pollutants enter watercourses through pipes or channels.

Point source pollution comes mainly from industrial facilities and municipal wastewater treatment plants.

Nonpoint source (NPS) generally results from land runoff, precipitation, atmospheric deposition and drainage. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.