



L.E. COLLEGE, MORBI

VISION

To provide quality engineering education and transforming students into professionally competent and socially responsible human beings.

MISSION

- To provide a platform for basic and advanced engineering knowledge to meet global challenges.
- To impart state-of-art know-how with managerial and technical skills.
- To create a sustainable society through ethical and accountable engineering practices.

CO1: UNIT 2 ENVIRONMENT POLLUTION

Types of Environmental Pollution:

- *Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution: Industrial ,Agricultural, Municipal; Classification of water pollutants, Effects of water pollutants, Eutrophication*

TYPES OF POLLUTION

Types of Environmental Pollution:

- (1) Water Pollution
- (2) Land Pollution
- (3) Marine Pollution
- (4) Air Pollution
- (5) Noise Pollution
- (6) Thermal Pollution

❖ Water Pollution

- Introduction
 - Water Quality Standards,
 - Sources of Water Pollution: Industrial ,Agricultural, Municipal;
 - Classification of water pollutants,
 - Effects of water pollutants,
 - Eutrophication
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➤ Introduction:

Water is one of the basic need to sustain a life on earth. Life can not exist without water. even two third of our body is made of water whereas about three fourth part of our mother earth is covered by a water.

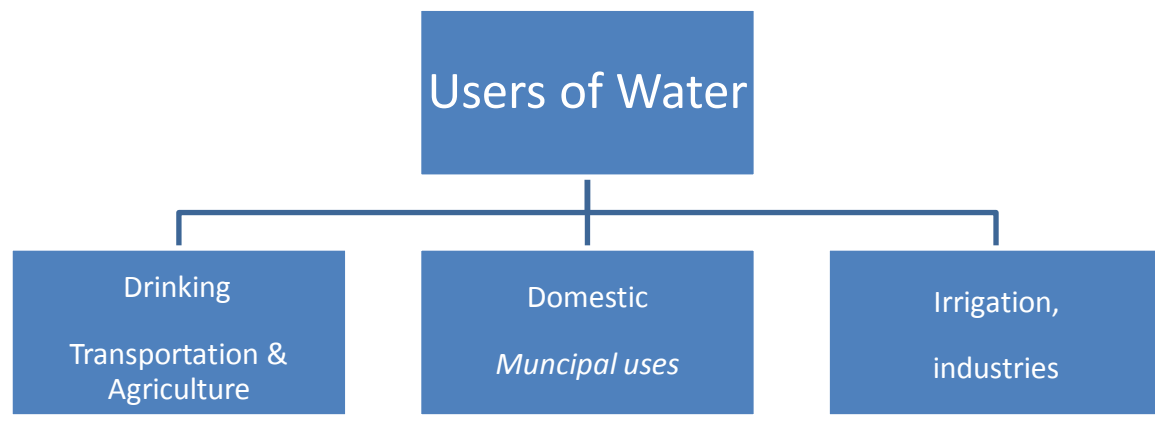
Only less than 1% of water is available for human uses, remaining 97% is in oceans and 2% is locked as ice and glaciers

Because of human disturbance in environment it leads to various types of pollution and water pollution is one of them.

“water pollution is defined as Alteration in physical, chemical or biological characteristics of water through natural or human activities making it unusable ”

Or

“Presence of some foreign substances or impurities (Organic, inorganic, biological, radiological) in such quantity that its lower the quality of water is known as water pollution”



➤ Signs of polluted water

- *Bad Taste*
- *Bad odours(smell)*
- *Decrease in number of fish in fresh water and sea water*
- *Growth of aquatic weeds**
- *Oily substance on the surface of water.*

**A wild plant growing where it is not wanted and in competition with cultivated plants*

Water Quality Standards

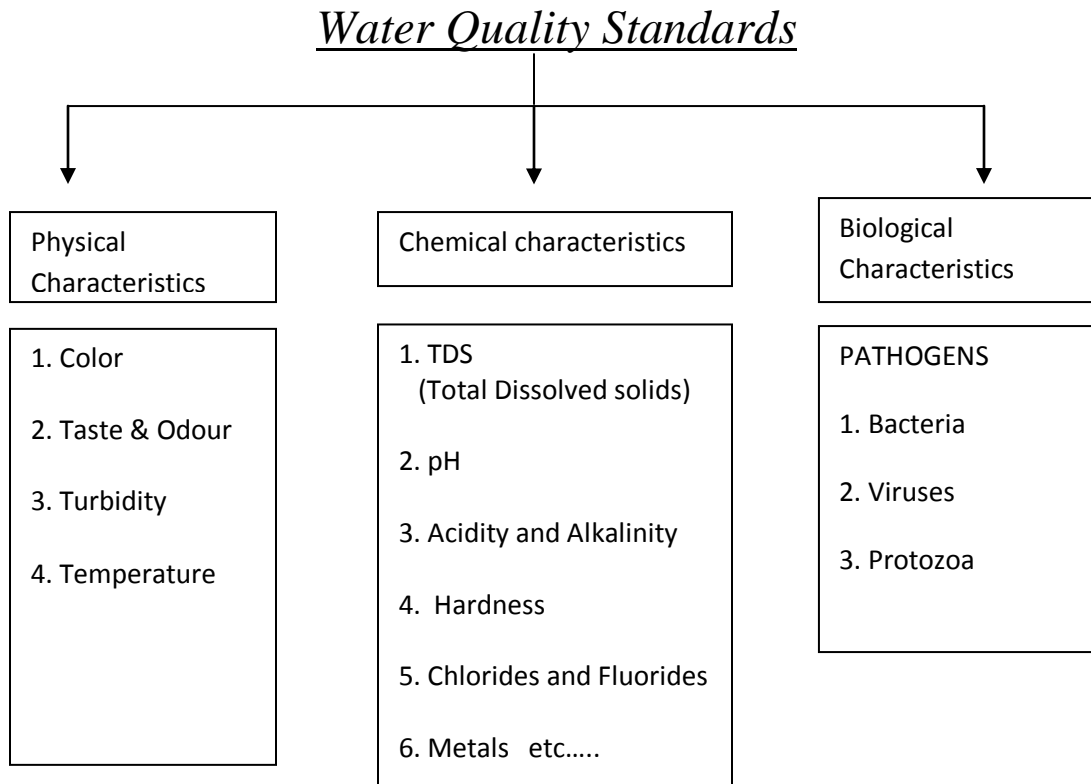
Water quality Standards depends on the use of the water which may be a human consumption or it may be for industries, irrigation, etc.

For different filed quality of water is different. For the purpose of drinking water quality of water must be of higher level.

In india water quality standards is controlled by government organization known as “Bureau of Indian Standards”

Water quality standard can be divided in three categories

- (1) Physical
- (2) Chemical
- (3) Microbiological



- **PHYSICAL CHARATERSTICS**

1. **COLOUR**

- Water is colourless in pure form, but impurities give a change in colour of water.

- *Organic matter(Woods, Weeds, Leaves etc.), Suspended solids, industrial wastes may change the colour of pure water*
- *The sources of colour in water should always be investigated before the water is used*
- *Accurate Measurement of colour can be done by spectrophotometer*

2. *Taste and Odour*

- *Good water shouldn't have any particular taste and should be odourless. natural water has some taste and odour due to the contact of various substance like minerals, metals and salts from the soil and Biological reactions.*
- *Taste and odour may also develop during storage and distribution*
- *Growth of algae micro-organisms hydrogen sulphide an ammonia give and bad odour to water making it unfit for use.*

3. *Turbidity*

- *Turbidity is the cloudiness (haziness) of a water caused by suspended solids that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.*
- *Turbidity is measurement of how light is passed from the water, where suspended solids may abosorbed or scattered the light depending upon its properties*
- *Turbidity in open water may be caused by growth of [*phytoplankton](#). Human activities that disturb land, such as [construction](#), [mining](#) and [agriculture](#),*
- *Turbidity is measured in Turbidity meter and its unit is Nephelometric Turbidity Units(NTU)*

4. *Temprature*

- *Water with higher temperature is unacceptable, whereas normal water with normal temperature is more acceptable to consume.*
- *Higher temperature of water leads to growth of micro-organisms in the water and may increase taste, odour and corrosion problems*
- *Common methods used for measuring temperature are also useful to measure the temperature of water*

5. Suspended Solids

- *Suspended solids are any particles that are neither dissolved nor settled in the water.*

● CHEMICAL CHARACTERISTICS

1. TDS (Total Dissolved Solids)

- *TDS are the Total Amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of a water.*
- *Its expressed in units of mg per unit volume of water i.e. mg/l OR “ppm”*
- *Dissolved solids refer to any minerals, salts, metals cations, or anions dissolved in water*
- *TDS can be controlled by Reverse Osmosis (RO), Electro dialysis, Carbon Filtration (Charcoal).*
- *Desire value of TDS in india is approx near to 500 ppm*

2. pH

- *pH is the negative logarithm of Hydrogen ions concentration in water, it's a measure of degree of acidity or alkalinity (Basicity)*
- *pH of pure water is about 7 at 25°C. which varies with temperature*
- *for value of pH = 7 water is neutral*
 - pH = 0 to 7 water is acidic*
 - pH = 7 to 14 water is alkaline*
- *equation for pH is*

$$pH = - \log_{10}[H^+]$$

Acidity and Alkalinity

- *Capacity of substance to neutralize basics is known as Acidity where as a capacity of substance to neutralize Acids is known as Alalinity.*
- *Acidity is due to presence of minerals and dissolution of carbon dioxide() whereas Alkalinity is due to Bicarbonates, Carbonates, and Hydroxides (- HCO_3^- , CO_3^{2-} , OH^-)*
- *Acidity used to soft hard water, presence of it causes the corrosion of melts and pipelines, presences of alkalinity results a bitter taste of water.*

Hardness

- *It's a soap destroying property of water*
- *It is of two types*
 - (a) *Temporary Hardness*

Temporary Hardness is developed due to presence () (of CO_3^{2-} and HCO_3^- of Calcium and Magnesium). By Boiling or adding lime in such water it can be removed.

- (b) *Permanent Hardness*

P.H. is due to the presence of sulphates, chlorides, nitrates of calcium and magnesium, to remove it soda lime process is requires Ground water is harder than surface water. Permissible value of it is near 75 to 115 ppm.

Chlorides

- *Chlorides is raised due to mixture of sea water, brine, industrial and domestic waste in to water sources.*
- *Its presents in form of CaCl_2 , NaCl , MgCl_2*
- *Over level of it leads to salty taste of drinking water, Which also indicate the pollution of water*

Fluorides

- *Adequate value of fluorides in water is required, Higher level of it behaves as a toxic.*
- *Fluoride in water less than 1.0 mg/l can cause dental cavities in childrens and more than 1.5 mg/l may cause dental or skeletal fluorosis.*

Metals

- *All metals soluble to some level in water, whereas higher amount of nay metal can produce health problems*
- *Metals can be mixed up with natural water due to natural process like rain water and by domestic industrial or agriculture discharge of waste in water*

● *Biological Characteristics of Water.*

- *The presence of micro-orgnaisms like Bacteria and Virus make the water contaminated.*
- *All micro-organisms are not harmful for human being but pathogenic micro organisms causes water Bourne diseases*
- *Pathogens : Organisms capable for infection or transmitting diseases to humans called pathogens*
- *Diseases caused by virus are Hepatitis-A, Hepatitis-E, Rotavirus Diarrhea*
- *Diseases caused by Bacteria are Typhoid, Cholera, E-Coli, Diarrhea.*

SOURCES OF WATER POLLUTANTS

Sources of water pollutants can be classified in two categories

(1) Point Sources (2) Diffuse Sources

Total wastes add in water body is a sum of all point and non-point sources

(1) Point Sources

- *Those sources which are producing pollution and can be identified as a single location are known as point sources.*
- *e.g. Industrial plants, power plants, sewage discharge etc.*
- *Its possible to minimize the water pollution from the point sources, cause it is producing from a limited locations.*
- *Due to the rapid growth of urban population municipal and industrial zone are producing a higher level of pollution, sewage and fertilizers*
Oil sippage ,various metals are producing bad effect.

(2) Diffuse Sources or Non-point Sources

- *Those sources which are producing pollution and cannot be identified from a single location are known as non-point sources pollutant.*
These sources are scattered, so they are uncontrollable
- *E.g.*
 - small overflowing drains.*
 - Surface runoff from agriculture fields.*
 - Air pollution which degrades rain water quality.*
 - Small scattered and unauthorized industries*
 - Domestic level.*

- *Agriculture is one of the example of this source, heavy uses of fertilizers and pesticides are mix up with water, and it's not in a limited area so cumulative effect of it can damage more*

CLASSIFICATION OF WATER POLLUTANTS

CLASSIFICATION OF WATER POLLUTANTS

The various types of water pollutants can be classified in to following categories:

- (1) Organic pollutants,*
- (2) Pathogens,*
- (3) Nutrients,*
- (4) Suspended solids*
- (5) Thermal Pollution*
- (6) Radioactive pollutants*
- (7) Fluorides*

(1) ORGANIC POLLUTANTS

Organic pollutants can be further divided in to following categories:

a) Oxygen Demanding wastes:

- *The wastewaters such as, domestic and municipal sewage, wastewater from industries have considerable concentration of biodegradable organic compounds either in suspended, colloidal or dissolved form.*
- *These wastes undergo degradation and decomposition by bacterial activity. Which leads to higher demand of B.O.D. ,results in lower quality of water*

b) Synthetic Organic Compounds

- *Synthetic organic compounds are also likely to enter the ecosystem through various Man made activities such as production of these compounds, spillage during transportation, and their uses in different applications.*
- *These include synthetic pesticides, synthetic detergents, food additives, pharmaceuticals, insecticides, paints, synthetic fibers, plastics, Most of these compounds are toxic and they are resistant to microbial degradation.*

(c) Oil

- *Oil enters in to water through oil spills, leak from oil pipes, and wastewater from production and refineries.*
- *Being lighter than water it spreads over the surface of water, separating the contact of water with air, hence resulting in reduction of DO.*
- *This pollutant is also responsible for risk of water birds and coastal plants due to coating of oils It also reducing the photosynthetic activity of the aquatic plants.*

(2) PATHOGENS

- *The pathogenic microorganisms enter in to water body through sewage discharge as a major source or through the wastewater from industries .*
- *Viruses and bacteria can cause water borne diseases, such as cholera, typhoid, dysentery, polio, hepatitis in human.*

(3) NUTRIENTS

- *The agriculture run-off, wastewater from fertilizer industry and sewage contains high concentration of nutrients like nitrogen and phosphorous in water, which results in rapid growth of algae and other aquatic weeds.*

- *Thus, the value of the water body is degraded, In long run, water body reduces DO, leads to eutrophication and ends up as a dead pool of water.*
- *People swimming in eutrophic waters containing blue-green algae can have skin and eye irritation, *gastroenteritis and vomiting.*

(4) SUSPENDED SOLIDS

- *Suspended solids are any particles that are neither dissolved nor settled in the water like Silt, sand and minerals, they are mixed up in the water through the surface runoff during rainy season and through municipal sewers. This can lead to the *siltation, reduces storage capacities of reservoirs.*
- *Presence of suspended solids can block the sunlight penetration in the water, which is required for the photosynthesis by bottom vegetation affect the diversity of the aquatic ecosystem.*
- *Finer suspended solids such as silt and coal dust may injure the gills of fishes*

(5) THERMAL POLLUTION

- *The heat in water body is regarded as a pollutant which damage the quality of water*
- *Discharge of hot water from thermal power plants, nuclear power plants, and industries where water is used as coolant , because of it the temperature of water body increases, Which reduces the DO of the water and affect the aquatic life.*

(6) RADIOACTIVE POLLUTANTS

- *During the mining of the Uranium, Thorium the Radioactive pollutants enters in the human body through water and food, which leads to critical illness and deaths.*

(7) Fluorides

- *Excess amount of fluorides consumption causes dental and skeletal fluorosis,*

EFFECTS OF WATER POLLUTANTS (MAY 2013)

- *Water is one of the basic requirement of living beings, when such substance degrades the quality of water, it effects the health of living beings as well as on environment.*
- *Effect caused by water pollutant on environment are as under.*

(a) Because of Industries

- *Toxic chemicals such as Mercury (Hg), Cadmium(Cd), Arsenic (As), Lead (Pb),cobalt(Co) mixed up in water can cause the diseases*
- *By a food chain they can enter in a body of aquatic life and human body can produce bad health effects.*

(b) Because of Fertilizers and Detergents

- *They increase the concentration of nutrients which results in a grow of algae, which consumes D.O. and increase then demand of B.O.D. Which leads to poor quality of water and damage the aquatic life.*

(c) Because of Oil

- *Due to oil transportation and slippage of various form of oil by industries, Oil gets spread over the water, and covers water surface, which leads to death of water birds and aquatic animals, fishes*

(d) Because of Radio Active Pollutants

- *During the mining of the Uranium, Thorium the Radioactive pollutants enters in the human body through water and food, which leads to critical illness and deaths*

(e) Because of Fluorides

- *Excess amount of fluorides consumption causes dental and skeletal fluorosis*

In general consumption of polluted water generates the diseases like Typhoid, Cholera.

EUTROPHICATION

- *“The process by which body of water get a concentration of nutrients, especially phosphates and nitrates”, which increases the growth of algae*
- *“Enrichment of the nutrients is called Eutrophication”*
- *Eutrophication can take place in small ponds, lakes, rivers or even in the oceans.*
- *Word Eutro is originated from greek words where ‘Eu’ means well and ‘trophes’ means feed. Thus Eutrophication is “well feed”*
- *Presence of nutrients is must for growth of organisms, but if this presence of nutrients is excessive act as Pollutants, because it growth the aquatic plants like algae.*
- *If the concentration of nutrients is of poor level its known as “Oligotrophic” means low production of Aquatic plants, If the concentration of nutrients is of moderate level its known as “Mesotrophic” means average production of Aquatic plants, If the concentration of nutrients is of high level its known as “Eutrophic” means high production of Aquatic plants*
- *Newly formed water body (natural or man made) do not support aquatic life, cause of poor nutrient supply, Gradually these water bodies become rich in nutrient through deposit of Domestic, agriculture and industrial waste such as Phosphorous and Nitrogen in water*
- *This nutrients help to grow small floating aqua-plants, as they cover the surface of water and penetration of the sun light becomes difficult which results in death of aquatic animals and BOD increases.*

- *Photosynthesis activity is blocked which effect the food chain of aqua ecosystem*
- *Flow of water is reduced, which can cause flood in rain season. May effect the tourism and long way lakes or pond may disappear*

USEFULL WORDS

** Synthetic Organic Compounds are those organic compounds that have been created by man in laboratories eg. soap, detergents, chemical dyes and other industrial chemicals and their waste*

** Natural Organic compounds are those organic compounds that exit naturally in nature eg. Natural Gas ,Coal,Diamond....*

** Industries : food processing industries, canning industries, paper mills, tanneries, distilleries, etc.)*

** Silt : A sedimentary material consisting of very fine particles intermediate in size between sand and clay*

** Gastroenteritis is an infection of the stomach and bowel (large intestine), caused by bacteria or viruses. Symptoms include vomiting and diarrhoea.*

Siltation is a process by which water becomes dirty as a result of fine mineral particles in the water

D.O. or O.D. Oxygen is measured in its dissolved form as dissolved oxygen (DO). If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken, or die.

B.O.D is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water

Nutrients: *elements essential for animal and human growth.*

Phytoplankton : are microscopic plants that grow in the upper regions of the ocean where sunlight is plentiful.