

PHYSICAL, CHEMICAL & BACTERIOLOGICAL CONTAMINATION OF WATER AND WATER QUALITY STANDARDS

Distribution of water on earth:-

- Ocean and sea - 97%
- Snow and ice caps - 2%
- Rivers, lakes, Ground water - 1%

Universal Solvent

Contamination:

- Geological
- Human activities
 - . Organic waste
 - Industrial waste

Safe Drinking water :

- Free from pathogenic organisms
- Clear
- Not saline
- Free from offensive taste or smell
- Free from compounds that may have adverse effect on human health
- Free from chemicals that cause corrosion of water supply systems

Water quality Parameters:

- Physical parameters
- Chemical
- Bacteriological

Colour

- May be due to the Presence of organic matter,metals(iron, manganese) or highly coloured industrial waste
- Aesthetically displeasing
- Desirable that drinking water be colorless
- Desirable limit, 5 Hazen unit
- Permissible limit 25 Hazen Unit

Taste & Odour

- Mainly due to organic substances, ,Biological activity, industrial pollution
- Taste buds in the oral cavity specially detect inorganic compounds of metals like magnesium, calcium, sodium, copper, iron and zinc
- Water should be free from objectionable taste and odour.

Turbidity

- Caused by suspended matter
- High level turbidity shield and protect bacteria from the action of disinfecting agents
- Disirable limit-5NTU

should be below 1 NTU when disinfection is practiced

Permissible limit-10NTU

PH

- It is the measure of hydrogen ion concentration
- Neutral water pH-7
- Acidic water has pH below 7
- Basic water has pH above 7
- Desirable limit 6.5-8.5 Beyond this limit the water will affect the mucous membrane and water supply system

Substances that change pH of water

<ul style="list-style-type: none">■ <u>Acidic Industries</u>■ Sugar - 5 – 6■ Distillery 3 - 4■ Electro-Plating unit 2.5-4■ Pickle 2 - 3	<ul style="list-style-type: none">■ <u>Basic</u>■ Paper 8 – 10■ Textile 8.5-11■ Fertiliser 6.5- 9■ Oil Refine-ries 6.5-9.5
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HARDNESS

- Capacity of water for reducing and destroying the lather of soap
- It is total concentration of calcium and magnesium ions
- Temporary hardness – Bicarbonates of Calcium and Magnesium
- Permanent hardness – Sulphates, chlorides and nitrates of calcium and magnesium
- 0 – 50 mg/l - soft

- 50 – 150 mg/l - moderately hard
- 150 – 300 mg/l - hard
- 300 above - very hard
- Surface water is softer than ground water
- Causes encrustations in water supply structures

Alkalinity

- Capacity to neutralize acid
- Presence of carbonates, bi-carbonates and hydroxide compounds of Ca, Mg, Na and K
- Alkalinity = hardness, Ca and Mg salts
- Alkalinity > hardness - presence of basic salts, Na, K along with Ca and Mg
- Alkalinity < hardness – neutral salts of Ca & Mg present

Iron

- One of the earth's most plentiful resource
- High iron causes brown or yellow staining of laundry, household fixtures
- Metallic taste, offensive odour, poor tasting coffee
- Cause iron bacteria
- Acceptable limit – 0.3 mg / l

Chloride

- Causes
- Dissolution of salt deposit
- Discharge of effluents
- Intrusion of sea water
- Not harmful to human beings
- Regarding irrigation – most troublesome anion
- Acceptable limit - 250 mg/l

Nitrate

- Increasing level of nitrate is due to
- Agricultural fertilizers, manure, animal dung, nitrogenous material ,sewage pollution
- (blue baby diseases to infants)

- Maximum permissible limit 45 mg / l

Fluoride

- Occurs naturally
- Long term consumption above permissible level can cause –
- dental fluorosis (mottling of teeth)
- Skeletal fluorosis
- Acceptable limit – 1 mg / l
- Maximum permissible limit – 1.5 mg / l
- Remedy – 1) Defluoridation
 - 2) Mixing Fluoride free water
 - 3) Intake of vitamin C,D, calcium, antioxidants

Fluoride causes

Three types of Fluorosis

1. Dental Fluorosis
2. Skeletal Fluorosis
3. Non-skeletal Fluorosis

Arsenic

- Occur in ground water from arseniferous belt
- Industrial waste, agricultural insecticide
- High arsenic causes 1) various type of dermatological lesions, muscular weakness, paralysis of lower limbs, can also cause skin and lung cancer
- Acceptable limit – 0.05 mg / l

Heavy Metals

- Present as mineral in soil and rocks of earth
- Human activities

Battery – Lead & Nickel

Textile - Copper

Photography – Silver

Steel production – Iron

Pesticides

- Cancer
- Birth defects
- Blood disorder
- Nervous disorder
- Genetic damage

Essential bacteriological Standards

Characteristic	Number/100ml
Treated water in distribution system	Feacal coliform zero Total coliform not more than 10 Total coliform should not be detectible in two consecutive samples

Residual Chlorine

- Chlorine added to water forms hypochlorite ions and hypochlorite acids
- Chlorine demand – Quantity required for killing micro organisms and reacting with ammonia, organic compounds etc.
- Free residual chlorine – To take care of post contamination
- Desirable – 0.2 mg / liter

Common problems contd:-

Visible effect	Reason
water turns black, smell	Waste water
Acidic taste	Low PH
Alkaline taste	High PH
Boiled Rice hard and yellow	High alkalinity
White deposits on boiling	hardness
Iron taste, change in colour after exposure to atmosphere, change in colour of cloths, utensils Oily appearance on top of water body	Iron
Soap not lathering	hardness
Brownish black streaks on teeth	Fluoride
Growth of Algae	Nitrate

	phosphate
Fish kills	Low PH Less Do
Salty taste	Chloride