

## HEALTH EFFECTS OF CHEMICAL PARAMETERS

Parameter	BIS Guideline value (maximum allowable)	General & Health effect
Total dissolved solids	2000 mg/L	Undesirable taste; gastro intestinal irritations; corrosion or incrustation
PH	6.5-8.5	Affects mucous membrane; bitter taste; corrosion; affects aquatic life
Alkalinity	600 mg/L	Boiled rice turns yellowish
Hardness	600 mg/L	Poor lathering with soap; deterioration of the quality of clothes; scale forming; skin irritation; boiled meat and food become poor in quality
Calcium	200	Poor lathering and deterioration of the quality of clothes; incrustation in pipes; scale formation
Magnesium	100	Poor lathering and deterioration of clothes; with sulfate laxative
Iron	1.0	Poor or sometimes bitter taste, color and turbidity; staining of clothes materials; iron bacteria causing slime
Manganese	0.3	Poor taste, color and turbidity; staining; black slime
Aluminum	0.2	Neurological disorders; Alzheimer's disease
Copper	1.5	Liver damage; mucosal irritation, renal damage and depression; restricts growth of aquatic plants
Zinc	15	Astringent taste; opalescence in water; gastro intestinal irritation; vomiting, dehydration, abdominal pain, nausea and dizziness
Ammonia	-	Indicates pollution; growth of algae
Nitrite	-	Forms nitrosoamines which are carcinogenic
Nitrate	100	Blue baby disease (methemoglobineamia); algal growth
Sulfate	400	Taste affected; laxative effect; gastro intestinal irritation
Chloride	1000	Taste affected; corrosive
Fluoride	1.5	Dental and skeletal fluorosis; non-skeletal manifestations
Phosphate	-	Algal growth
Arsenic	0.05	Toxic; bio-accumulation; central nervous system affected; carcinogenic
Mercury	0.001	Highly toxic; causes 'minamata' disease-neurological impairment and renal disturbances; mutagenic
Cadmium	0.01	Highly toxic; causes 'itai-itai' disease-painful rheumatic condition; cardio vascular system affected; gastro intestinal upsets and hyper tension
Lead	0.05	Causes plumbism-tiredness, lassitudes, abdominal discomfort, irritability, anaemia; bio-accumulation; impaired neurological and motor development, and damage to kidneys

Chromium	0.05	Carcinogenic; ulcerations, respiratory problems and skin complaints
Pesticide	0.001	Affects central nervous system
Detergent	-	Undesirable foaming

## **CLASSIFICATION OF INEFFECTIVE DISEASES IN RELATION TO WATER SUPPLIES**

1) Water borne diseases (fecal-oral)

(A) by Bacterial organisms Cholera, Typhoid, Paratyphoid, Dysentery, Diarrhea, Weil's disease (Leptospirosis), Tuberculosis

(b) by Phage virus or Bacteriophages Infectious hepatitis, Jaundice, Poliomyelitis

(C) by Protozoan Amoebic dysentery, Ascariasis, Amoebic meningo cephalitis (fatal encephalitis usually acquired while swimming in ponds)

**Preventive measures: Improve quality of drinking water. Prevent causal use of the unhygienic sources**

2) Water washed diseases Scabies, Skin diseases, Typhus fever, Leprosy, Trachoma, Conjunctivitis, Bacillary dysentery

**Preventive measures: Increase water quantity for (washing/cleaning) use. Improve accessibility and reliability of domestic water supply**

3) Water based diseases Schistosomiasis (Liver fluke), Dracunculosis (Guinea worm disease)

**Preventive measures: Control snail populations; filter the water through a fine mesh cloth to remove larvae/cyclops/snail. Disinfect contaminated water.**

4) Water related diseases (by vector organisms) Malaria, Filariasis, Dengue fever, Sleeping sickness (African sleeping sickness)

**Preventive measures: Destroy breeding sites of insects. Decrease need to visit breeding sites. Use mosquito nets.**

By boiling or addition of bleaching powder, the disease causing bacteria and other organisms can be killed and the water can be made safe.

## **PUBLIC WATER TREATMENT SYSTEMS**

The water supplied to big cities is derived from surface water sources like lakes, rivers, dams, reservoirs etc. The water from these sources will be turbid and will have high bacterial contamination. The turbidity is removed by coagulation with

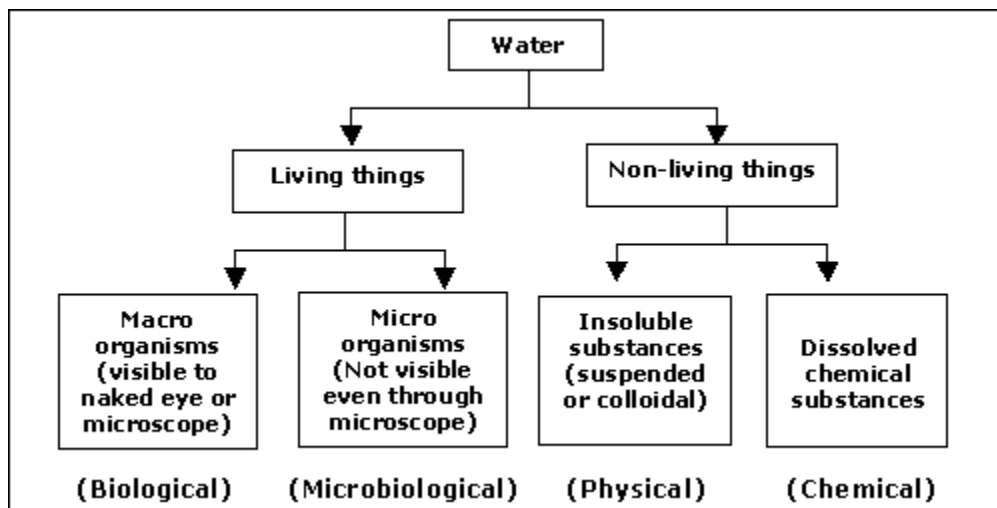
alum. This is done in a mechanical unit called clariflocculator. The water is then filtered through filter beds; it is disinfected and supplied to the public.

### Simple treatment for water containing turbidity and iron

Water containing iron will be turbid and brownish. On standing, the turbidity settles within 2 to 12 hrs depending on the form in which iron is present (inorganic or organic iron). The water after settling can be filtered and directly used. Addition of bleaching powder and alum (at a dosage level of 20 g and 30 g respectively per 1000 liters) can quicken the settling of iron and the water can become clear within 1 to 2 hrs.

Source: [http://www.twadboard.com/main\\_public\\_tnrwssp.html](http://www.twadboard.com/main_public_tnrwssp.html)

### WATER-WHAT ITS CONTAINS



### SUBSTANCES DISSOLVED IN WATER

#### Substances dissolved in water

1. About 1200 chemical contaminants have been so far found in water
2. Water may naturally contain about 10 to 15 parameters only.
3. 'Total dissolved solids (TDS)' is the sum of all dissolved chemicals present in water.

#### Total dissolved solids (TDS)

4. The permissible limit for TDS is 500 mg/L. However in the absence of better alternative source, it could be relaxed up to 2000 mg/L.

5. About 97-99% of TDS in natural water is contributed by only six major ions i.e. Calcium, magnesium, sodium, bicarbonate, chloride and sulfate.
6. The balance TDS is contributed by a variety of contaminants like iron, manganese, potassium, ammonia, nitrite, nitrate, fluoride, phosphate, trace metals and organic substances.

### **Total dissolved solids for some typical waters**

• Rain water	1-50 mg/L
• Surface water in hills	10-100 mg/L
• Surface water in plain	100-1000 mg/L
• Ground water	500-5000 mg/L
• Ground water polluted by tannery	10000 mg/L
• Sea water	35000 mg/L
• Bottled (mineral) water	100-300 mg/L
• Permissible limit	500 mg/L
• Maximum allowable limit	2000 mg/L

### **YOUR DOUBTS CLEARED**

1. Water is saltish- Chlorides give water a salty taste, but the intensity of the taste depends upon the ionic composition. Thus in some waters the salty taste is detected at about 200 mg Cl/L, but if the water contains high concentrations of calcium and magnesium, the salty taste is not noticed even at 1000 mg/L.
2. Water on standing becomes turbid and brownish yellow-Normally some ground water may contain ferrous iron in the form of its bicarbonate, which is in solution. On exposure to air, ferrous iron is oxidized to insoluble ferric iron hydroxide and is seen in the form of brownish yellow precipitate.
3. Soap is not lathering-This is due to the property of excessive hardness in water. Hardness is mainly contributed by calcium and magnesium.
4. Boiled rice is hard and yellow in color-This is due to the property of high alkalinity in water.
5. Dhal becomes hard on cooking-This is due to high alkalinity in water.

6. Nuisance of algae-Trace levels of phosphorus and nitrogen aid for algae growth. Sunlight or stray light can help this process.
7. White deposits in vessels used for boiling of water-The scales are due to precipitation of calcium carbonate from water.  
Scale formation is notable when the water has temporary hardness. The water after filtration can be used without any harm.
8. Oily suspensions noted on the surface of water in wells -This is also due to precipitation of calcium carbonate from water.
9. White deposits blocking the PVC pipes-This is due to deposition of calcium carbonate scales. This is found particularly when compressor pumps are used.
10. Horizontal brownish or brownish-black streaks in teeth: This is caused in children due to excess fluoride in water. The horizontal streaks formed are permanent and cannot be treated or removed.
11. Rotten egg smell from water-In the absence of sufficient air and under anaerobic conditions, hydrogen sulfide is formed due to putrefaction of organic matter in water. This causes rotten egg smell in water.
12. Brownish or brownish black slimes in water conveying pipes-May be due to growth of iron bacteria in water.
13. Death of infants due to blue baby disease-High nitrate in water causes blue baby disease. The blood of the children affected by the disease turns blue and the children die of asphyxiation. The disease affects only infants below six months age. Adults are not affected. Breast fed children are not affected by this disease.
14. Clothes lose their shining and become dirty after some washings-This is due to presence of high hardness and iron in water used for washing. Good lathering can occur with detergents but the cleaning action in hard water will not be satisfactory.
15. Slime formation in classets in toilets and in the floors of bathroom-This happens due to growth of microorganisms under wet conditions.
16. Diseases like cholera, jaundice, diarrhoea, dysentery etc.-These are caused due to presence of disease causing microorganisms (called pathogens) in water.

### **PROTECTION OF PUBLIC DRINKING WATER SYSTEMS**

- Drinking water sources should be fenced and well protected.
- No defaecation should be permitted near these sources.

- Pollution from domestic, industrial and agricultural wastes should not find access to these sources.
- Drainage carrying sewage and other liquid wastes should be diverted away from drinking water sources.
- Solid wastes should not be dumped near these sources.
- Formation of cesspools, allowing the cattle to graze near the drinking water source, tying cattle around the water structure etc. should be prevented.
- Bathing, washing etc. should not be practiced near wells, hand pumps and other drinking water sources.
- Ponds and lakes used as drinking water sources should not be used for bathing or washing of cattle and vehicles.
- Open wells and hand pumps should have platforms. The wastewater should be drained out into soak pits located away from the sources.
- Leakage and bursts in pipelines should be attended to immediately.
- Pit taps should not be permitted in the distribution.
- Sand quarrying in river beds near the infiltration wells should be prevented.
- It is the duty of every citizen to extend necessary help for the protection of public drinking water systems in their neighbourhood.

### **PROTECTION OF DOMESTIC WATER SOURCES**

1. Open wells and storage tanks in the houses should be provided with cover slabs and kept in closed condition.
2. Over head tanks and sumps should be periodically cleaned. After cleaning, the inner walls may be coated with lime to prevent algal growth.
3. Open wells may be scoured periodically to remove silt.
4. Culturing some local varieties of fish (like katla katla) in wells can avoid breeding of insects and larvae like mosquito.
5. Bleaching powder at a dosage level of 2-4 g/1000 liters of water may be added daily to overhead tanks. When fish is not cultured, the same dosage level may be applied to wells once in a day.

6. The best method of disinfection is to boil, cool and filter the water. This has to be followed particularly during rainy seasons.
7. Water filters (reliable brands) available in the market may be used; however proper maintenance and cleaning is necessary. The filters will be useful for removal of turbidity and suspended matter. The units available in the filter have the following functions:

Silver / iodine/ UV light - disinfection  
Micro filters / candles - removal of suspended matter  
Activated carbon - removal of odor and taste

**Above all good hygienic practices should be followed by every individual.**

#### **Abstraction rate and water quality**

Water quality can be improved by reduced rate of pumping and increased pumping period. Smaller capacity pump, which is operated more continuously rather than a larger pump operated at infrequent intervals, can help for improvement of water quality. By this practice incrustation in pipes can also be minimized.

#### **Dual usage of water - a need of the hour**

- The public should know about the details of the quality of water, which they use.
- Depending on the quality, the source should be used either for drinking or for only other domestic purposes.

#### **RAIN WATER HARVESTING AND QUALITY IMPROVEMENT**

Due to over abstraction of water, water quality deteriorates and the quantity also depletes. It is necessary that all private and public buildings including individual houses should be provided with rainwater harvesting structures. Rainwater harvesting can be done either by roof water harvesting or harvesting of surface run off. The roof-harvested rainwater may be directly collected or may be used to recharge the wells/borewells. The cost of rainwater harvesting structure for a house may come to about Rs. 1000/= to Rs. 2500/= only.

- Recharging of water source by rainwater harvesting can improve the quality of water.
- Quality of rainwater will not deteriorate on standing.
- Rainwater may be blended with ordinary water (4 parts rain water + 1 part ordinary water) and used for drinking after disinfection.

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