

There is now global awakening on pollution control by recovering reusable matter from waste products. **Salvaging**, *i.e.*, recovery of useful materials and byproducts could contribute by saving the expenditure and controlling the pollution, within the industry. Reuse of waste water would help in minimisation of fresh water requirement and also reduce waste water economy.

WATER QUALITY PARAMETERS AND STANDARDS

The standards are based on the water quality in the streams and specify its suitability for different purposes such as drinking, irrigation, industry, public health and environmental safety. **Indian Standard Institution (ISI)** has the principal role in specifying the norms for various effluents so that the ambient water quality standards are maintained.

Types of standards are :

1. Drinking water standards.
2. Stream standards.
3. Irrigation standards.
4. Bacteriological standards.
5. Effluent standards.

1. Drinking (or Potable) Water Standards. National and international authorities have laid down various standards for domestic use of drinking water. The main agencies include ISI, Indian Council of Medical Research (ICMR), World Health Organisation (WHO), United States Public Health Standards (USPHS) etc. Parameters for water quality characterisation and standards are illustrated in Table 2.

Table 2. Drinking water standards (Domestic water supplies).

Parameter	USPH standard	ISI standard	Parameter	USPH standard	ISI standard
Colour	Colourless	—	pH	7.0–8.5	6.0–9.0
Odour	Odourless	—			
Taste	Tasteless	—			
Specific conductance	300 $\mu\text{mho cm}^{-1}$	—	Turbidity	25 JTU	25 JTU
Suspended solids	5.0	—	Total dissolved solids	500	—
Chloride	250	600	Sulphate	250	1000
Cyanide	0.05	0.01	Nitrate + nitrite	<10	—
Fluoride	1.5	30	Phosphate	0.1	—
Boron	1.0	—	Calcium	100	—
Magnesium	30	—	Arsenic	0.05	0.2
Chromium VI	0.05	0.05	Copper	1.0	—
Iron	<0.3	—	Lead	<0.05	0.01
Zinc	5.5	—	COD	4.0	—
Carbon CHCl_3 extract	0.15	—	Phenols	0.001	0.005
Pesticides (total)	0.005	—	PAH	0.2 ppb	—
Surfactants	200	—	Dissolved oxygen	4.0–6.0 ppm	—
Gross beta radioactivity	1000 pc / L	—	Radium-226	3 pc/L	<5000
Strontium-90	10 pc / L	<5000	Coliform cells/100 mL	100	—
Total bacteria count/100 mL	1×10^6	—	Detergents	0.1	—

Note. All the units, except otherwise mentioned, are in ppm or mg/L.

2. Stream Standards. The permissible limits of drinking water parameters are 3 to 5 times higher for surface waters. The water quality criteria are classified into different categories by CPCB and SPCB depending on the use of water for irrigation, drinking, industry, power generation and recreation etc.

Surface water should be free from

- (i) materials which impart colour, taste, turbidity (e.g., oils, grease, phenols) and
- (ii) toxic metals, radionuclides, debris and scum etc.

3. Irrigation Standards. The major parameters of concern are :

(i) **Salinity.** Salinity or total dissolved solids is the most important parameter for irrigation water since it controls the availability of water to plants through osmotic pressure regulating mechanisms.

(ii) **Water infiltration rate.** High sodium and low calcium content of water reduces the water infiltration rate so that sufficient water can not reach the crop roots.

(iii) **Specific ion-toxicity.** The presence of toxic metals such as Cu, Cd, As, Hg etc. in water cause crop damage and reduce agricultural yield.

(iv) **Miscellaneous constituents.** Excess of nitrate ion in water causes eutrophication which is injurious for plant growth. Suitability of water with different constituents is shown below.

Class of water	TDS ppm	SO ₄ ²⁻ ppm	Cl ⁻ ppm	B ppm	Na %	EC mS/cm	Suitability for irrigation
I	0-700	0-192	0-142	0-0.5	0-60	0-750	Good for irrigation
II	700-2000	192-480	142-355	0.5-2.0	60-75	750-2250	Suitable for moderate leaching

Class III water is totally unfit for irrigation.

4. Bacteriological Standards. These standards are set by WHO.

(i) **E. coliform bacteria count** in any sample of 100 mL water should be zero.

(ii) Total bacterial count not more than 10/100 mL should be present in any sample of water.

5. Effluent Standards. Effluent standards are related to the quality of waste waters originated from industry, community and agriculture.

Table 3. General standards for discharge of effluents set by CPCB.

Parameter	Standards			
	In land surface water	Public sewers	Land for irrigation	Marine coastal area
pH	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
Suspended solids	100	600	200	100
Dissolved solids	2100	2100	2100	—
BOD (5 days at 20°C)	30	350	100	100
Oil and grease	10	20	10	20

Continued ...

Parameter	Standards			
	In land surface water	Public sewers	Land for irrigation	Marine coastal area
Sulphate	1000	1000	1000	—
Total N	100	—	—	100
NH ₃ -N	50	50	—	50
Chloride	1000	1000	600	—
Fluoride	2.0	15	—	15
Percent Na	—	60	60	—
Phenolic compounds	1.0	5.0	—	5.0
Alpha emitters $\mu\text{C/mL}$	10^{-7}	10^{-7}	10^{-8}	10^{-7}
Beta emitters $\mu\text{C/mL}$	10^{-6}	10^{-6}	10^{-7}	10^{-6}

Note. Maximum limits of parameters are expressed in ppm or mg/L.

WATER POLLUTION LAWS

In India, specific laws have been passed by both Central and State Governments to control water pollution. All these laws are based on standards, a set of parameters used to define water quality.

1. Central Enactments. Acts passed by Government of India are :

- (i) North India Canal and Drainage Act, 1873.
- (ii) Indian Fisheries Act, 1897.
- (iii) Damodar Valley Corporation Regulation Act, 1948.
- (iv) The River Boards Act, 1956.
- (v) The Water (Prevention and Control of Pollution) Act, 1974 (Amended in 1988).
- (vi) The Water (Prevention and Control of Pollution) Cess Act, 1977 (Amended in 1991).
- (vii) The Environment (Protection) Act, 1986.

2. State Enactments. Acts passed by State Governments are :

- (i) The Orissa River Pollution Prevention Act, 1953.
- (ii) The Maharashtra Prevention of Water Pollution Act, 1969.

The Water (Prevention and Control of Pollution) Act, 1974 (Amended in 1988).

- The Act defined terms like pollution, sewage effluent, trade effluent, stream and boards. The Act also assigns the functions to be carried out by the Central and State Boards.
- The **Water Boards** have power to obtain information, to take samples of effluents from any industry and to make survey of any area and gauge and keep record of the volume and other characteristics of any stream or well.
- A person empowered by the Board has the right to enter, inspect and examine any plant, record, register, document or any other material object, or for conducting a