Water quality criteria and Effluent Standards

Contents

- Effect of disposal into natural water courses, Municipal sewers and on land
- River standards and effluent standards.

Disposal in to natural water courses

Effects of disposal in to natural water courses:

1. Acids & Alkalis:

- A & A:discharged by chemical & other industrial plants.
- Make stream unsuitable for:

- Swimming
- Boating
- Propagation of fish
- Other aquatic life
- H_2SO_4- high concentrations: sufficient to lower pH below 7 in absence of free chlorine: cause-
- Eye irritation to swimmers
- rapid corrosion of ship hulls
- accelerated deterioration of fishermen's nets.

Disposal in to natural water courses

- H_2SO_4: toxicity for aquatic life: a function of resulting pH.
- A dose lethal in soft water may be quite harmless in hard or highly buffered water.
- For fish survival: stream pH: must not be less than 4.5 & more than 9.5.
- Stream pH values near industrial sources of pollution: 2 to 11
- Sodium hydroxide: an alkali: highly soluble in water: affects alkalinity & pH.
- NaOH: present in wastes from many industries: soap manufacturing, textile dying, rubber reclaiming, leather tanning.
- Streams containing as little as: 25 parts of NaOH per million: deadly to fish.

Disposal in to natural water courses

- Boiler-feed water: alkali: caustic action: caustic embrittlement of pipes.
- Alkalis: also affect water treatment plants: adversely.
- Ex: WT plants: using alum as a coagulant: often find shock loads of acid or alkali interfering with floc formation.
- Some miscellaneous processes affected by waters of certain pH:

- Rate of industrial fermentation
- quality of dough in baking
- flavor in soft drinks
- yeast activity in brewing of beer
- taste of canned fruits (especially tomatoes)
- cleaning of industrial metals , gelatin & glue manufacture.

Disposal in to natural water courses

- A low pH: may cause corrosion in air-conditioning equipment.
- pH > 9.5: enhances laundering.

2. Organic Matter:

- It exhausts the O_2 resources of rivers & creates:

- Unpleasant tastes
- Odors &
- General septic conditions.

- Fish & most aquatic life: stifled by lack of O_2.
- O_2 level combined with other stream conditions: determines life or death of fish.
- Critical range for fish survival: 3 to 4 parts per million (PPM) of dissolved O_2.

Disposal in to natural water courses

- Some species of fish: may not survive in water containing 3 PPM of dissolved O_2, while other species may not be affected even slightly by same low O_2 level.
- O_2 shortage: caused by organic matter: considered to be the most objectionable single factor in a stream's pollution.
- Certain organic chemicals (ex: phenols): affect taste of domestic water supplies.
- Rivers: containing phenols: permeate nearby wells: cause objectionable medical tastes
- Organic matter: discomfort or diseases.

3. Suspended Solids:

- Settle to bottom or wash up on banks & decompose: causing odors & depleting O_2 in river water.
- Fish: often dies because of sudden lowering of O_2 content of

Disposal in to natural water courses

Of a stream.

- Solids settling to bottom: cover their spawning grounds & inhibit propagation.
- Visible sludge: creates unsightly conditions & destroys river usage for recreational purposes.
- Suspended solids: increase turbidity of water course.

4. Floating Solids & Liquids:

- Oils, greases & other ,materials: float on surface.
- Not only make river unsightly but also obstruct passage of light through the water: retardation of vital plant food growth.

Disposal in to natural water courses

- Some specific objections to oil in streams are that it:
- Interferes with natural reaeration.
- Is toxic to certain species of fish & aquatic life.
- creates a fire hazard when present on water surface in sufficient amounts.
- Destroys vegetation along the shoreline, with consequent erosion.
- Renders boiler-feed & cooling water unusable.
- Causes trouble in conventional water-treatment process by imparting tastes & odors to water & coating filters with a tenacious film.
- Creates an unsightly film on the surface of the water, &
- Lowers recreational potential (e. g. boating).

Disposal in to natural water courses

5. Heated Water:

- Discharge of wastes (condenser waters) in to streams: water temperature increase: various adverse effects.
- Stream waters varying in temp from one hour to next: difficult to process effectively in municipal & industrial water-treatment plants.
- Heated stream waters: are of decreased value for industrial cooling.
- One industry: may so increase the stream temperature that a neighboring industry D/S cannot use water.
- Warm water: lighter than cold: stratification develops: this causes most fish life to retreat to stream bottoms.

Disposal in to natural water courses

- Warm water: less dissolved O_2 than cold: aquatic life suffers: less O_2 available for natural biological degradation of any organic pollution discharged in to these warm surface waters.
- Bacterial action: increases in higher temperatures: accelerated depletion of stream's O_2 resources.

6. Color:

- Color: contributed by: textile & paper mills, tanneries, slaughter houses & other industries: a pollution indicator.
- WW: compounds present: absorb certain wavelengths of light & reflect the remainder: color development in stream.
- Color: interferes with sunlight transmission in to stream: lessens photosynthetic action.

Disposal in to natural water courses

- Visible pollution: often causes more trouble for industry than invisible pollution.
- Unseen pollution not creating a nuisance: often tolerated by state agencies.
- Red & deep-brown colors of slaughterhouse wastes, browns of paper-mill wastes, various intense colors of textile-mill wastes, yellows of plating-mill wastes: focus public indignation directly on those industries.
- Municipal & industrial water plants: have great difficulty & scant success in removing color from raw water.

7. Toxic Chemicals:

- Organic & inorganic chemicals (even in extremely low conc.): may be poisonous to fresh water, fish & other smaller aquatic microorganisms.

Disposal in to natural water courses

- Many compounds: not removed by municipal treatment plants.
- Insecticides: toxaphene, dieldrin, dichlorobenzene: allegedly killed fish in farm ponds & streams.
- Insecticides used in cotton & tobacco dusting: max. effect following heavy rainfalls.
- Insecticides & rodenticides: hard to detect in a stream.
- Newer techniques: electron-capture gas chromatography: can detect chlorinated hydrocarbon pesticides in concentrations of 0.001 micrograms/litre in 1 litre water samples.
- New, highly complex, organic compounds: by chemical industry for textile & other companies: extremely toxic to fish life. Ex: acrylonitrile (raw material in manufacture of synthetic fibres).

Disposal in to natural water courses

- All salts (some even in low conc.): toxic to certain forms of aquatic life.
- Chlorides: reportedly toxic to fresh water fish in 400 ppm concentration.
- accidental or intermittent discharge of certain materials: may go unnoticed: may completely disrupt stream life.
- Building floor & storm water drains: lead directly to stream: may convey contamination because of an upset in an industrial process or ignorance of consequences.
- Ex: flushing of a chemical delivery tank at the uploading dock: may carry dissolved toxic materials into stream through a storm drain.

Disposal in to natural water courses

- Complex inorganic phosphates: such as P_2O_5 @ levels as low as 0.5 ppm, interfere with normal coagulation & sedimentation processes in water-purification plants.
- Phenols in concentrations exceeding 1 part /billion: objectionable in a stream.
- Phenol: reacts with chlorine: gives the residual drinking water a noticeable medical taste.

Water Quality Criteria

- Designated best use classification water quality criteria of surface water

Water Quality Criteria

Designated-Best-Use	Class of water	Criteria
Drinking Water Source Without conventional treatment but after disinfection	A	1.Total Coliforms Organism MPN/100ml shall be 50 or less 2.pH between 6.5 and 8.5 3.Dissolved Oxygen 6mg/l or more 4.Biochemical Oxygen Demand Water Quality Criteria 5 days 20oC 2 mg/l or less
Outdoor bathing (Organised)	B	1.Total Coliforms Organism MPN/100ml shall be 500 or less 2.pH between 6.5 and 8.5 3.Dissolved Oxygen 5mg/l or more 4.Biochemical Oxygen Demand 5 days 20oC 3 mg/l or less

Water Quality Criteria

Designated-Best-Use	Class of water	Criteria
Drinking water source after conventional treatment and disinfection	C	1.Total Coliforms Organism MPN/100ml shall be 5000 or less 2.pH between 6 to 9 3.Dissolved Oxygen 4 mg/l or more 4.Biochemical Oxygen Demand 5 days 20oC 3 mg/l or less
Propagation of Wild life and Fisheries	D	1.pH between 6.5 to 8.5 2.Dissolved Oxygen 4 mg/l or more 3.Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	1.pH betwwn 6.0 to 8.5 2.Electrical Conductivity at 25oC micro mhos/cm Max.2250 3.Sodium absorption Ratio (SAR) Max. 26 4.Boron Max. 2mg/l

Effluent standards

S.No.	Parameter	Standards for disposal of treated effluent in			
		Inland surface water	Public Sewer	Land for irrigation	Marine coastal areas
1.	2.	3.			
		(a)	(b)	(c)	(d)
1.	Colour and odour	See Note-1	---	See Note-1	See Note-1
2.	Suspended Solids, mg/l, Max	100	600	200	(a) For process waste water-100 (b) For cooling water effluent-10 per cent above total suspended matter of influent cooling water.
3.	Particle size of suspended solids	Shall pass 850 micron IS Sieve	---	---	(a) Floatable solids, Max 3 mm (b) Settleable solids Max 850 microns.

1. All efforts should be made to remove colour and unpleasant odour as far as practicable.
2. The standards mentioned in this notification shall apply to all the effluents discharged such as industrial mining and mineral processing activities municipal sewage etc.

4.	Dissolved solids (inorganic), mg/a, mac	2100	2100	2100	---
5.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6.	Temperature °C, Max	Shall not exceed 40 in any section of the stream within 15 meters down stream from the effluent outlet	45 at the point of discharge	---	45 at the point of discharge
7.	Oil and grease, mg/l, max	10	20	10	20
8.	Total residual chlorine, mg/l, Max.	1.0	---	---	1.0

9.	Ammonical nitrogen (as N), mg/l, Max.	50	50	---	50
10.	Total Kjeldahl nitrogen (as N), mg/l, Max.	100	---	---	100
11.	Free Ammonia (as NH_3), mg/l, Max.	5.0	---	---	5.0
12.	Biochemical Oxygen Demand (5 days at 20°C) Max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/l, Max.	250	---	---	250
14.	Arsenic (as As), mg/l, Max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg), mg/l, Max.	0.01	0.01	---	0.01
16.	Lead (as Pb), mg/l, Max.	0.1	1.0	---	1.0
17.	Cadmium (as Cd), mg/l, Max.	2.0	1.0	---	2.0
18.	Hexavalent chromium (as Cr+6) mg/l, Max.	0.1	2.0	---	1.0
19.	Total chromium as (Cr), mg/l, Max.	2.0	2.0	---	2.0
20.	Copper (as Cu), mg/l, Max.	3.0	3.0	---	3.0
21.	Zinc (as Zn), mg/l, Max.	5.0	15	---	15
22.	Selenium (as Se), mg/l, Max.	0.05	0.05	---	0.05
23.	Nickel (as Ni), mg/l, Max.	3.0	3.0	---	5.0
24.	Boron (as B), mg/l, Max.	2.0	2.0	2.0	---
25.	Percent Sodium, Max.	---	60	60	---

26.	Residual sodium carbonate, mg/l, Max.	---	---	5.0	---
27.	Cyanide (as CN), mg/l, Max.	0.2	2.0	0.2	0.2
28.	Chloride (as Cl), mg/l, Max.	1000	1000	600	(a)
29.	Fluoride (as F), mg/l, Max.	2.0	15	---	15
30.	Dissolved Phosphates (as P), mg/l, Max.	5.0	---	---	---
31.	Sulphate (as SO_4), mg/l, Max.	1000	1000	1000	---
32.	Sulphide (as S), mg/l, Max.	2.0	---	---	5.0
33.	Pesticides	Absent	Absent	Absent	Absent
34.	Phenolic compounds (as C_6H_5OH), mg/l, Max.	1.0	5.0	---	5.0
35.	Radioactive materials (a) Alpha emitters MC/ml, Max. (b) Beta emitters uc/ml, Max.	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}	10^{-7} 10^{-6}

Objective Questions

1. As per effluent standards, for disposal into the ocean pH value of treated effluent shall be _____.
2. As per designated best use classification of surface waters, for Drinking Water Source without conventional treatment but after disinfection, MPN shall be _____.
3. As per designated best use classification of surface waters, Propagation of Wild life and Fisheries, DO shall be _____.
4. As per designated best use classification of surface waters, Class E corresponds to water used for

Theory questions

1. Explain Designated Best Use Classification of Surface water given by CPCB.
2. Give effluent standards 2. for at least 10 pollutants.
3. Write Short note on effluent standards.