

Analysis of Physical Quality Parameter of Water and Waste water

Tejas D.Khediya (M.E.CIVIL-WRM)

Lecturer in Civil Engineering Department
Sir Bhavsinhji Polytechnic institute, Bhavnagar

Abstract-Water is the most essential commodity for the sustenance of life. The availability of water on earth are immense in which mostly sea water which is unfit for drinking or irrigation purpose. The amount of fresh water is huge as well, but its distribution over the globe is uneven. The demands for drinking, other domestic needs are increases from 150 to 500 liters a day per person. Water plays an important role in making human life for survive. As man uses water he pollutes it and when the waste water is returned to open bodies it contaminates the natural waters. So the quality of water and waste water plays an important role for experts in all over the world. The paper includes the physical quality parameter examined in water and waste waters.

Keywords-water, waste water

1. Introduction

As we all know water is the most important requirement for human life to survive. Depending upon the intended use of water certain quality parameters are established and based on this criteria quality standard is specified. Physical parameters play an important role for quality of water and waste water. The quality of water depends on the location of sources and environmental protection in given area.

Goals for examination of water and waste water:

Water:

- Determination of physical, chemical, biological characteristics of water.
- Determination of pollution sources.
- Suitability of water for various purposes like drinking, industrial, irrigation etc.
- The treatment given to the water to bring the quality of water to the required standard before supplying it to the public.
- Size of various treatment units of water treatment plant.
- Preparation of sequential process of water treatment plants.

Waste water:

- Estimation of pollution load and their damage caused by introduction into the water bodies and on land for irrigation.
- Estimation of potential damage to sewers and sewage treatment plants.
- Preliminary assessment for planning and operation of waste water treatment plants.
- Testing of selected parameter for calculation of discharge by regulating authorities.
- To find out toxic compound such as cyanide, mercury etc. and evaluates the degree of toxicity in the treatment system.
- To find out the substances that causes difficulties in treatment.

2. Physical parameters- Following are the physical parameters which respond to the sense of light, taste and smell

2.1 Colour

The presence of colour in water and wastewater, even a small amount, is highly visible and affects the aesthetic value. Colour is often caused by organic matter. High levels of colour in wastewater have an impact on photosynthesis activity by reducing the penetration of sunlight to lower levels in the water body affecting aquatic life. Pure water is colourless. Colour imparted in water and waste water is due to decaying of vegetable or organic substances dissolved in it. Colour caused by suspended matter is called as apparent colour. Colour of water is expressed by in mg/l in platinum cobalt scale. The shade of colour present in water is determined by comparing it with standard unit consisting 1 mg of platinum per liter of water. Coloured water is not aesthetically acceptable for domestic consumption so according to USPHS drinking water standard is 10-20 ppm are acceptable on platinum cobalt scale. Coloured water is unsuitable for drinking, other domestic needs, dyeing, and laundering, dairy production. Many colour bodies are colloidal in nature and act as adsorbents and concentrate many trace metals and exert toxicity to aquatic life. The water containing natural colour is yellow brownish in appearance. Table 1 give the water quality problems based on the appearance. Colour water requires more quantity of chlorine for disinfection. Measurement of colour should be done within 72 hours of collection.

Table 1 Water quality problems based on the appearance.

Types of colour in water	Reason
Milky	Precipitation of carbonates, excessive air, suspended solids
Blackish	Manganese, iron, anaerobic bacteria
Yellowish	Presence of humid compound, aerobic and anaerobic bacteria
Reddish	Presence of Dissolved or precipitated iron, iron, IRB bacteria, anaerobic/aerobic bacteria
Foam	Foaming agent

(Source: Driscoll, 1986; Lehr, 1980; Oram, 1990)

2.2 Temperature

It is one of the most important parameters in natural surface water systems. The most desirable range of temperature for a public water supply is below 40⁰ to 50⁰ F. The temperature of natural water is seldom below 40⁰ F. The temperature above 500 F makes water less palatable. The temperature above 80⁰ F is undesirable and above 90⁰ F the water is unfit for water supply schemes. Temperature of surface waters governs to a large extent the biological species present and then- rate of activity. Temperature has an effect on most chemical reactions that occur in natural water systems. Temperature also has a great effect on the solubility of gases in water. The use of water for dissipation of waste heats in industry and the subsequent discharge of the heated water may result in dramatic temporary change in receiving streams.

Temperature of wastewater is commonly higher than that of water supply. Depending on the geographic location the mean annual temperature varies in the range of 10⁰ to 21⁰C with an average of 16⁰C.

Importance of temperature: - Affects chemical reactions during the wastewater treatment process. Affects aquatic life (Fish.). Oxygen solubility is less in warm water than cold water. Optimum temperature for bacterial activity is in the range of 25⁰C to 35⁰. Aerobic digestion and nitrification stop when the temperature rises to 50⁰ C. When the temperature drops to about 15⁰c, methane producing bacteria become in active. Nitrifying bacteria stop activity at about 5⁰c.

2.3 Odour and Taste

It is important to note that some chemicals, especially organic compounds and bacterial agents, may be at toxic or at pathogenic (i.e., disease causing) levels, without any observable clues to a problem. For this reason, it is recommended that you have your water tested at least annually. The odour and taste in water and waste water is due to presence of mineral salts, domestic sewage, decomposing organic matter, industrial wastes, chemical compound etc. given in table-2 and table-3. As temperature changes the odour of water is change. The odour may be fishy, sweetish, mouldy, vegetable, greasy etc. The odour of both cold and hot water should be determined. The waste water or water having foul smell is objectionable and should be not being supplied to the public.

Intensity of odour is measured in terms of threshold number. Threshold Odour Numbers are whole numbers that indicate how many dilutions it takes to produce odour-free water. Odour intensity is measured by diluting the sample with odour free to threshold number. Threshold number is numerically equal to the volume of sample of water in cm³ required to be added to 100cm³ of odour free fresh water when the mixture just starts giving the typical smell in the diluted sample. If 8 cm³ of sample water added to 100 cm³ of fresh water does not give any odour, while if more than 8 cm³ of water when added to 100 cm³ of water gives odour in the diluted sample then the threshold number will be 8. For public water supply the threshold number should not be more than 3. The test is conducted at 20⁰c.

Table 2 Water quality problems based on the odour

Types of odour in water or waste water	reason
Musty smell	Hydrogen sulphide, sulphate reducing bacteria, bacteria
Oily smell	Gasoline and oil contamination
Gas smell	Organic decomposition,
Chemical smell	Organic chemical

Taste in water may result from any or combination of microorganisms either dead or alive, dissolved gases such as H₂S, CH₄, CO₂ or oxygen combined with organic matter, mineral substances such as sodium chloride, iron compounds, carbonate and sulphate of other elements, phenols and oily matter especially after chlorination.

Table 3 Water quality problems based on the taste

Types of water taste	Reason
Salty taste	High sodium
Alkali taste	High hardness, Total dissolved solids, high alkalinity
Metallic taste	Low pH, high metal content, corrosive water

2.4 Turbidity

The presence of suspended material like clay, silt, finely divided organic material and other inorganic material in water is known as turbidity. Turbidity indicates the muddiness of water therefore measure the extent to which light absorbed or scattered by fine suspended solids and colloidal solids. Turbidity is a measure of resistance of water to the passage of light through it.

Turbidity of water is caused by suspended and colloidal impurities in ppm (parts per million) by optical observation. Turbidity is expressed in parts of suspended matter per million parts of water by weight. I.e. 1 ppm is equivalent to 1 mg per liter. For drinking water a turbidity of less than 10 ppm is desirable. The optimum value is 5 ppm. Turbidity in water can be removed by filtration, sedimentation, clarification in water treatment plant process. Turbidity was previously determined by Jackson turbidity units (JTU). This unit is now replaced by more appropriate unit called Nephelometric turbidity unit (NTU) because of the Nephelometric method of measurement of 1000 turbidity's.

The following are common methods of measuring turbidity of water

1) By turbidity rod:- Turbidity rod is a graduated aluminium rod about 203 mm long. A graduated non stretchable tape about 122 mm is attached at the upper end of the aluminium rod. At lower end of the aluminium rod a screw containing needle is inserted. The diameter of the platinum needle is 1 mm and length is 25 mm. On graduated tape there is a mark for eye position.

For measuring turbidity of water the rod is lowered in water. Eye is kept constantly at the marked position and the needle is watched. The rod is lowered slowly in water till the needle just disappears from the vision due to turbidity of water. The reading of a graduated tape near the water surfaces directly gives turbidity in ppm.

2)By Jackson turbidity meter- It consists of a metal stand, a metal container with glass tube and standard candle .A small portion of the water sample is taken in the tube and the candle flame images is observed from top through the water in the tube. More water is then added until the image of the flame is disappears. When flame disappears, the graduation on the tube up to which water is poured indicates turbidity. Turbidity up to 25-1000 ppm can be recorded by this instrument.

3) Nephelometer-It is the modern commercial turbidity meter in which the light intensity is measured at right angles to the ray in contrast to the conventional turbidity meters in which the light intensity is measured after the same passes straight through the turbid water. The value of turbidity measured by a nephelometer is generally expressed as NTU (Nephelometric Turbidity Unit)

Indian standards for drinking water: Based on physical parameter drinking water required higher level of purity. Table 4 gives the drinking water standard as per Indian standards.

Table 4 Drinking water standards based on colour, taste and odour, turbidity

Physical parameter	Indian Standards (IS-10500-1991)		ICMR		WHO	
	D	P	D	P	D	P
Colour (Hazen units)	5	25	5	25	5	25
Taste and odour	Unobjectionable		Nothing disagreeable		Unobjectionable	
Turbidity (NTU)	5	10	5	10	5	10

D-desirable limits

P-permissible limits

ICMR-Indian Council of Medical Research

WHO-World Health Organization

Conclusion:-The physical parameters of water and waste water explain in this paper is helpful to ensure safety to public health. It becomes essential that the water to be supplied to public through public water supply scheme should be thoroughly examined.

References

- [1]Rangwala “Water supply and sanitary engineering” (2016)
- [2] A.K.Upadhyay and D.Lal “water supply and waste water engineering”
- [3] Birdie G.S. “Water supply and sanitary engineering”
- [4]Dr B.Kotaja and N.Kumara Swamy “Environmental Engineering laboratory manual”, first edition (1994)
- [5] http://www.opcertschool.com/media//DIR_6501/ef44b18872f090cbffff823ffffe904.pdf
- [6] <http://www.water-research.net/index.php/water-treatment/tools/drinking-water-smells-taste-and-odors>

