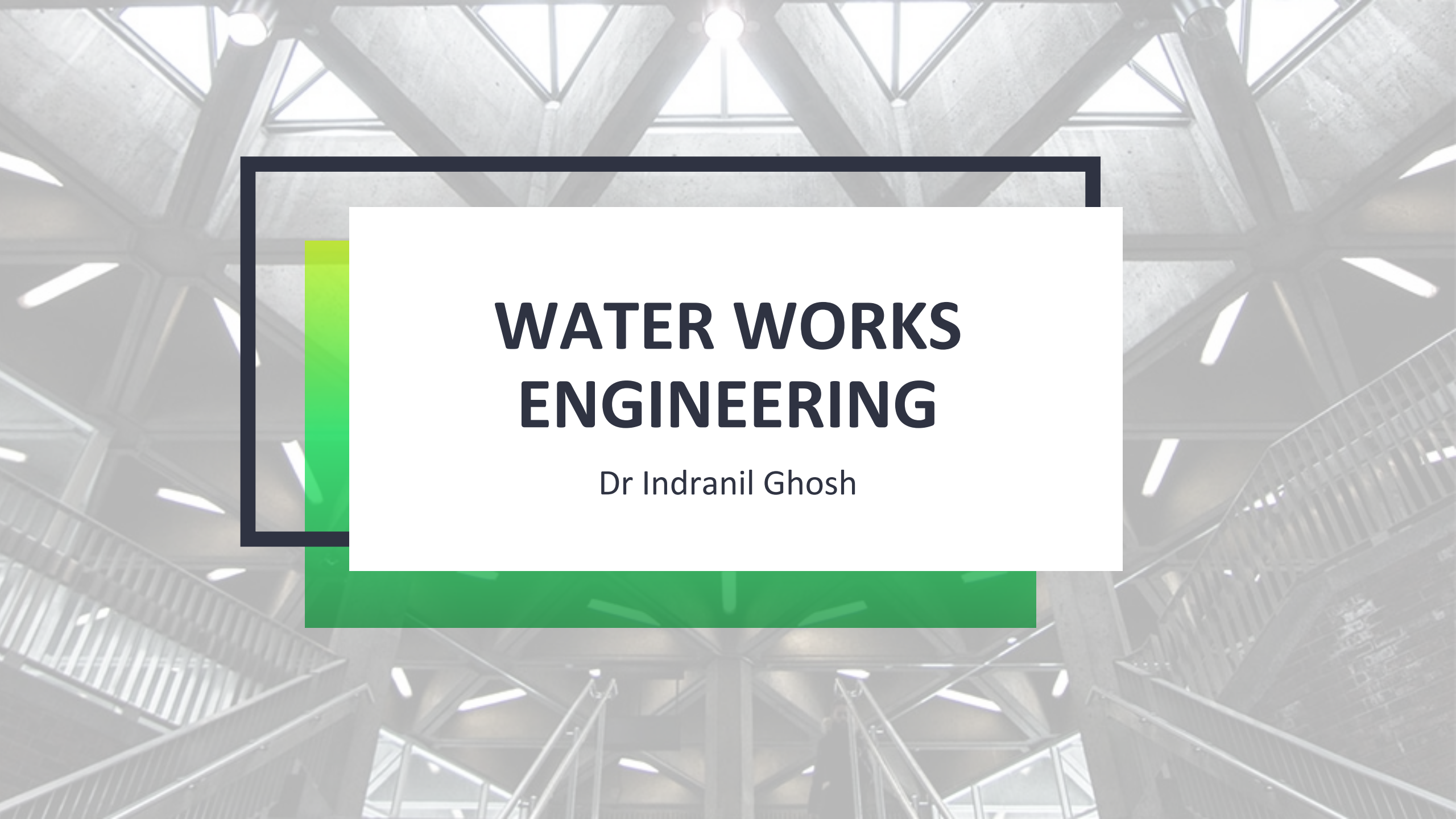

WATER WORKS ENGINEERING

Dr Indranil Ghosh

DIFFERETNT STAGES OF WATER WORKS ENGINEERING

STAGES OF WATER WORKS ENGINEERING

- A] COLLECTION OF RAW WATER FROM THE SOURCES
- B] TREATMENT OF WATER
- C] DISTRIBUTION OF TREATED WATER TO THE CONSUMER
- D] TREATMENT OF WASTE WATER

WATER QUALITY PARAMETER

The parameters which are used to monitor the quality of water, are called **water quality parameters**. There are four different classes of water quality parameters-

i) ***Physical parameter*** ⇒ temperature, colour, taste, turbidity, total solid, suspended solid, dissolve solid etc.

ii) ***Chemical parameter*** ⇒ pH, alkalinity, hardness, heavy metals, dissolve oxygen, biological oxygen demand, chemical oxygen demand, oil & grease etc.

iii) ***Biological parameters*** ⇒ Presence of E. coli in water. Usually with the help of MPN test (i.e., most probable number) we can determine the presence of it.

iv) ***Radiological parameter*** ⇒ Presence of radio active particles in water

DISSOLVE OXYGEN (DO)

Oxygen is available in water in dissolved condition. This is called dissolved oxygen (DO). The concentration of DO depends on pressure, temperature and other physical, chemical and biochemical conditions of water.

- The following points reveal the importance of DO as a parameter –

1. It is necessary to know DO levels to assess quality of waste water and to keep a check on stream pollution.
2. In liquid waste DO is the factor that determines whether biological changes are removed by aerobic or anaerobic organisms.
3. DO test is the basis of BOD test which is an important parameter to evaluate pollution potential of waste.
4. Oxygen is an important factor in corrosion. DO test is used to control amount of oxygen in boiler fed water either by chemical or physical methods.

CRITICAL DISSOLVED OXYGEN

The minimum concentration of oxygen in the water needed for the growth of a culture which has been submerged, where oxygen is the limiting factor to the growth of the culture.

EFFECTS OF LOW DO ON AQUATIC LIFE

- Direct Mortality
- Reduced Swimming Performance
- Reduced Growth
- Impaired Development
- Reduced Spawning Success
- Reduced Fecundity/Fertility
- Altered Behavior
- Indirect Effects (Susceptibility to Predation, Susceptibility to pathogens, and Susceptibility to Contaminants)

FACTORS INFLUENCING DO

The physical factors that influence DO are temperature, altitude, salinity, and stream structure.

Temperature inversely controls the solubility of oxygen in water; as temperature increases, oxygen is less soluble. In contrast, there is a direct relationship between **atmospheric pressure** and DO; as the pressure increases due to weather or elevation changes, oxygen solubility increases. **Salinity** also reduces the solubility of oxygen in water. **Stream structure** also influences DO concentrations. Atmospheric oxygen becomes mixed into a stream at turbulent, shallow riffles, resulting in increased DO levels.

BIOLOGICAL OXYGEN DEMAND (BOD)

Biological oxygen demand (BOD) is an important water quality parameter. It is defined as the quantity of dissolved oxygen (DO) required during stabilization of the decomposable organic matter presence in water by aerobic micro organisms. In other word, the amount of oxygen demanded (or required) by microorganism to stabilize organic wastes aerobically, is called Biological Oxygen Demand (BOD).

BOD_5 AT 20^oC

Microorganisms take several weeks to complete decomposition of organic waste present in water. This is impracticable for the laboratory experiment, because the result, i.e., demand of oxygen, would be available after long period. To avoid this, there is a standard practice simply to measure the oxygen demand of the microorganism for the five days period at 20°C. This Biological Oxygen Demand (BOD) is referred to as BOD_5 at 20^oC and definitely, its value is lower than actual or ultimate BOD (BOD_u).

CHEMICAL OXYGEN DEMAND (COD)

The Chemical Oxygen Demand (COD) is one of the important water quality parameters. This is used to determine the quantity of oxygen required to oxidize the waste materials (both biodegradable & non biodegradable) in the waste sample, under specific conditions of oxidizing agent, temperature and time. This method is more scientific than the BOD.

$K_2Cr_2O_7$.

B O D METHOD

i) This method determines the biologically oxygen demand.

ii) Demanded oxygen is supplied by the water itself in the form of dissolve oxygen (DO).

iii) This method determines the oxygen demand for the biodegradable waste only.

iv) The value of BOD is always less than COD.

v) The duration of BOD test or method is very high.

vi) BOD method is less scientific than COD method.

COD METHOD

i) This method determines the chemically oxygen demand.

ii) Demand oxygen is supplied by the oxidizing agent

iii) This method determines the oxygen demand for the both biodegradable as well as non biodegradable wastes.

iv) The value of COD is always greater than BOD.

v) Only 2 hrs. are required to complete the COD test.

vi) COD method is more scientific than BOD method.

OIL & GREASE

Oil & grease present in waste water can be measured with the help of partition-gravemetric method.

According to this method, first 250 ml acidified sample is placed in separatory funnel. Then the aquous layer is discarded first and the solvent layer is allowed to pass through the filler paper into a pre weighted flask.

$$\text{Oil \& grease (mg/L)} = \frac{(A-B)X1000}{V}$$

- Where, A = final weight of flask
- B = initial weight of flask
- V = volume of sample.
- The permissible limit of oil & grease in waste water is 10 mg/L for inland surface water & 20 mg/L for the public sewers.

PH

For the most practical purposes the pH of aquous solution can be taken as negative logarithm of hydrogen ion concentration [H^+]. pH value of a sample less than 7 indicates acidic, more than 7 is alkaline while 7 is the neutral.

The pH of natural water lies in the range of 4.4 to 8.5. Its values depend upon the Co2, HCO3-, CO3= etc

The pH determination is usually done by electrometric method which is most accurate method and free from interferences.

THANK YOU