

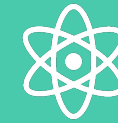
# WASTE WATER QUALITY PARAMETERS

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# ELEMENTS



**Dissolve  
Oxygen (DO)**



**Biological  
Oxygen  
Demand (BOD)**



**Chemical  
Oxygen  
Demand (COD)**

**Oil & Grease**

# **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.

# **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.




## ***FIVE DAY BOD (BOD<sub>5</sub>)***

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<sub>5</sub> AT 20°C AND DEFINITELY, ITS VALUE IS LOWER THAN ACTUAL OR ULTIMATE BOD (BOD<sub>U</sub>).

# ***THE STEPS INVOLVED IN FIVE DAY BOD TEST***

- i) THE SAMPLE SHOULD BE COLLECTED FROM THE SOURCE AND DILUTED APPROPRIATELY. THE DILUTION OF RAW SAMPLE OF WASTE WATER IS REQUIRED BECAUSE FOR THE DECOMPOSITION OF ORGANIC WASTE PRESENT IN WASTE WATER NEEDS A HIGHER AMOUNT OF DISSOLVED OXYGEN (DO). BUT, THE CONCENTRATION OF DO IS MAXIMUM 9.1 MG/L AT 20°C. USUALLY PURE WATER WHICH IS FREE FROM ANY MICROORGANISM, USE FOR THE DILUTION. THE DILUTION FACTOR (P) IS MEASURED AS

$$P = \frac{\text{volume of raw sample}}{\text{volume of raw sample} + \text{volume of pure water used for dilution}}$$



ii) This diluted water should be kept inside a reagent bottle having volume of 300 ml. The bottle should be kept in dark to avoid photosynthesis (if some algae are present in sample water). Because photosynthesis may increase the concentration of DO in the 'diluted' sample waste water. At the same time the bottle should be stoppered to avoid any further addition of atmospheric oxygen to the sample waste water.

iii) The initial concentration of DO ( $DO_i$ ) should be measured at 20°C by means of any standard method.



iv) After getting the initial concentration of DO, the bottle should be kept inside the 'BOD incubator'

where temperature should be fixed at 20°C and other parameters like humidity, pressure should be maintained.

v) After 'five day' period, the bottle should be removed from the 'incubator' and the final concentration of DO ( $DO_f$ ) is measured at the same temperature i.e. 20 C. The difference of DO's, i.e. ( $DO_i - DO_f$ ) indicates the amount of dissolved oxygen consumed by the microorganisms during this five days period to decompose the organic matters present in this diluted waste water.

vi) The  $BOD_5$  at 20°C of that raw sample water can be measured as

$$BOD_5 \text{ at } 20^\circ C = \frac{DO_i - DO_f}{P}$$

# **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.

# DIFFERENTIATE BETWEEN BOD & COD METHODS

<i>B O D method</i>	<i>C O D method</i>
i) This method determines the biologically oxygen demand.	i) This method determines the chemically oxygen demand.
ii) Demanded oxygen is supplied by the water itself in the form of dissolve oxygen (DO).	ii) Demand oxygen is supplied by the oxidizing agent $K_2Cr_2O_7$
iii) This method determines the oxygen demand for the biodegradable waste only.	iii) This method determines the oxygen demand for the both biodegradable as well as non biodegradable wastes.
iv) The value of BOD is always less than COD.	iv) The value of COD is always greater than BOD.
<b>v) The duration of BOD test or method is very high.</b>	<b>v) Only 2 hrs. are required to complete the COD test.</b>
vi) BOD method is less scientific than COD method.	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-GRAVIMETRIC 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 PREWEIGHTED FLASK.



# THANK YOU!

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