Chemical Oxygen Demand (COD)

COD approximately oxidize all organic matter in water to CO_2 because of presence of strong oxidizing factor such as (Potassium permanganate $KMnO_4$ and Potassium dichromate $K_2Cr_2O_7$) & under acidic condition (Therefore use H_2SO_4), the least interval for happen oxidation is 3 hours.

The factor that play role in actual oxidizing process **is oxygen**; that liberated from reaction of permanganate solution with acid as in equation:-

$$2KMnO_4 + 3H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5O$$

The amount of consuming oxygen is equal to oxidized organic material and for calculate the amount of atomic oxygen which remaining and not consuming add **KI (Potassium iodide)** to the solution which will react with H_2SO_4 to liberate free Iodide, which then titrate against Sodium Thiosulfate & for calculation of the amount of iodide which equivalent to Sodium Thiosulfate and equal to the amount of atomic oxygen which not using in oxidation process.

Procedure:-

1. Take 2 sized beakers with capacity of (250 ml) and mark to the first one (Sample) and to the second one (Blank).
2. Take (10-20 ml) from sample water and put it in the beaker (S) & (10-20 ml) from distilled water put it in the beaker B.
3. Add (5 ml) from potassium permanganate solution to both S & B.
4. Add (10 ml) from diluted sulfuric acid to both S&B.

Note: The color of the sample with potassium permanganate solution should be stay violet blue, a condition to assurance oxidation of all organic material from the moment of addition to the end of incubation period. In situation of disappearance of violet blue color add (5 ml) from KMnO4 solution, mark the adding volume, and then add equal amount from (Blank) compares solution.

5. Incubate the sample & compares solution as following:-

A/ 2 hours interval in temperature of 40 C°.

B/ 3 hours interval in temperature of 28C°.

C/ 3 minutes interval in water bath in temperature of 85C°.

The first and second incubation use for oxidation of organic and inorganic materials that subject for oxidation and may be use one of two methods. **The**

third incubation use for oxidation of inorganic material to know the oxygen consuming for oxidation of organic material in the course by :

COD (Total) $_{\text{2hours 40C° Or 3 hours 28C}}$ **-** **COD (inorganic)** $_{\text{3minuts 85C°}}$ **= COD (organic)**

6. After incubation, add to both (B & S) **KI** solution equal to the volume of $KMnO_4$ in 3rd step. There will be form free Iodide solution in both (B& S) as a result to reduction of KI from remaining oxygen in both (B & S).
7. Start titration against sodium thiosulfate for both (B & S) to limit titration end point When the color change from yellow to colorless and limit the volume of consuming sodium thiosulfate calculation method:-

$$\text{COD mg/l} = \frac{(\beta - \alpha) \times \text{Na Thio} \times 8 \times 1000}{\text{volumof sample}}$$

β: Volume of sodium thiosulfate used against sample

α: Volume of sodium thiosulfate used against distilled water

Na Thio =0.1

- ✓ The oxidized value from organic material by using acidic Potassium Permanganate equal (85%) and for measuring COD (100%) from organic material follow the equation.

$$COD\ 100\% = \frac{\text{COD} \times 100}{85}$$