

C6 - Chemical Oxygen Demand Determination

1. Principle

COD is the quantity of oxygen consumed by oxidizable water matters in defined procedure conditions ; these matters can be organic (biodegradable as lipids, proteins, glucides, urea, or refractory chemicals as aromatic compounds...) or mineral matters (ferrous iron, ammonia...).

In defined conditions, any matters in water are oxidized by an excess of potassium dichromate, in an acid medium, and in presence of silver sulphate and mercury sulphate ; the potassium dichromate excess is dosed by iron and ammonia sulphate (Mohr's salt).

Range of application : $30 \text{ mg O}_2 / \text{L} < \text{COD} < 700 \text{ mg O}_2 / \text{L}$

2. Procedure

Sample volume : $10 \text{ mL} = V \text{ mL}$

Add $5 \text{ ml K}_2\text{Cr}_2\text{O}_7$ 0.04 mol / L

Add 15 mL sulphuric acid – silver sulphate and some glass beads

Introduce the sample in the adapted flask with the adapted reflux cooling column

Boiling during 2 hours ($293 \text{ }^\circ\text{K}$)

Cool the flask

Complete the volume until about 350 mL with deionized water

Add 5 drops of phenantroline ferrous sulphate : solution turns green

Pour Mohr's salt ($T = 0.12 \text{ mol / L}$) until solution turns red : $V_1 \text{ mL}$

Carry out this experiment with demineralized water : $V_0 \text{ mL}$ ($V_0 > 9.5 \text{ mL}$)

$$\text{COD (mg O}_2 / \text{L)} = 8000 * (V_0 - V_1 / V) * T$$

3. Practical work

Carry out the COD determination of the "raw water" and the "treated water".

4. Report

Note V , V_0 and V_1 .

Interpret V_0 value

Determinate the COD value for each water.

Interpret the COD of the treated water if the discharge standard is $125 \text{ mgO}_2 / \text{L}$.

Determinate the COD removal efficiency (%).

5. Required material and reagents

For one experiment :

- 50 mL potassium hydrogenophthalate $\text{KC}_8\text{H}_5\text{O}_4$ 0.4253 g/L (2.0824 mmol / L) noted “raw water”
- 50 mL potassium hydrogenophthalate $\text{KC}_8\text{H}_5\text{O}_4$ 0.04253 g/L (0.20824 mmol / L) noted “treated water”

- 50 mL sulphuric acid – silver sulphate :
preparation of one litre :
add 40 g Ag_2SO_4 to 40 mL water
add carefully 960 mL concentrated sulphuric acid ($\rho = 1.83 \text{ g / mL}$)
- 50 ml potassium dichromate $\text{K}_2\text{Cr}_2\text{O}_7$ 0.04 mol / L

preparation of one litre :

dissolve 80g HgSO_4 in 800 mL of water
add carefully 100 mL concentrated sulphuric acid ($\rho = 1.83 \text{ g / mL}$)
cool and add 11.767 g potassium dichromate $\text{K}_2\text{Cr}_2\text{O}_7$
transfer in a 1L volumetric flask and complete with demineralized water

- 50 mL Mohr’s salt $[(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2, 6 \text{H}_2\text{O}]$ 0.12 mol / L
- 5 mL phenantroline ferrous sulphate (ferroin)
- 5 boiling granules
- 200 l fresh deionized water

Material :

COD mineralizator

adapted flask and cooling columns