C4 - Oxygen concentration determination in water

Principle

Water oxygen concentration units are : mg O_2 / L or saturation percentage (%) .
The saturation percentage is measured in comparison to the oxygen concentration in a demineralized water, at the same temperature :
If T = 0°C, 100 % = 14,6 mg O_2 / L
T = 20 °C, saturation for 9.2 mg O_2 / L.
The presence of chloride, for example, decreases oxygen solubility :
if $[Cl^-]$ = 10 mg / L and T = 20 °C, saturation = 8.3 mg O_2 / L

The sensor consists of 2 electrodes :
a cathode on which this reaction happens : $O_2 + 2\ H_2O + 4\ e^- \longrightarrow 4\ OH^-$
an anode (Ag) which furnishes these electrons : $4\ Ag + 4\ Cl^- \longrightarrow 4\ AgCl + 4\ e^-$

So this metal Ag disappears and is transformed in AgCl.
An electrolyte around the electrodes allows ionic exchanges and contains oxygen whose concentration is measured.

The sensor is subject to a constant voltage : it induces a current whose intensity is proportional to the water oxygen concentration.

The measure must be done in stirred water because oxygen is consumed at the membrane level (30 to 50 cm / s). Some conductimeters have an incorporated stirrer.

A temperature increase induces a oxygen concentration decrease. The oxymeter measures water temperature and translates the concentration value in a saturation percentage value.

Calibration :
- 0 % in a saturated sodium sulphite solution
- 100 % in the air.

Maintenance :
The membrane is very vulnerable.
The membrane and the electrolyte must be changed regularly ; the electrodes must be cleaned.

Field of application : waste water treatment (activated sludge, biofilters, BOD measurment…), raw waters, drinking waters (saturation> 75 % recommended).