Wallace & Tiernan® Analysers and Controllers
DEPOLOX® 4 Residual Cell

The Depolox® 4 Chlorine Residual Cell utilises a measurement principle that is markedly different to that employed by less sophisticated models.

The 2-electrode 'galvanic' or amperometric cell, which was employed by Wallace & Tiernan in earlier times, is simple in design but has a complex theoretical basis due to its uncontrolled nature. The two metals commonly employed as electrodes are copper and platinum and these assume an electrical potential when placed in water. If the two electrodes are connected externally to the solution, then a galvanic cell is formed and electrons pass through the circuit from the copper to the platinum electrode (Fig.1).

In the absence of a reducible species such as chlorine in the solution, only a minimal current flow will be observed. If the system remains in the absence of chlorine for any time the surface of the electrodes will probably develop oxides. The presence of chlorine or other oxidants will exert chemical effects at both electrodes. The copper may form complexes with chloride, resulting in ionisation of the copper allowing electrons to pass to the platinum which becomes cathodic. These electrons will effect reduction of any chlorine species passing to the electrode surface (Fig.2).

The more electrons removed from the cathode, the greater the current flow in the circuit will be. The efficiency of reduction is dependent on the potential of the platinum electrode which is in turn influenced by the chemistry at the copper electrode. The amount of chlorine available for reduction at the cathode depends on several variables, most importantly the flow rate passed the electrode and the concentration of chlorine in the bulk of the solution. Thus if the flow rate is held constant the current will be proportional to the concentration of chlorine species present. In practice the hypochlorous acid gives a greater response than hypochlorite ion and this contributes to the pH effect in the cell.

The main problem with a 2-electrode approach is that it has no fixed reference point. Therefore the potential at the platinum electrode may stray into areas where substances other than chlorine, such as oxygen or certain organics, may be reduced. The electrochemistry of the cell may be altered in the absence of chlorine, necessitating regular recalibration if the condition occurs.

Key benefits

- Stability
- Rapid response to changing residuals
- Proven reliability
- Long intervals between servicing
- Low total life cost
- Wide range of measurement
- No expensive reagents

Product Sheet

Water Technologies

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Additionally, a strong hysteresis effect is observed when the cell is exposed to high residuals which are then lowered.

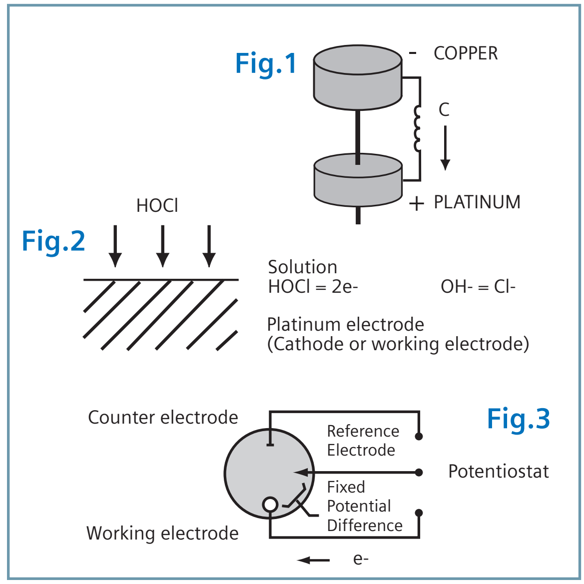
The 3-electrode potentiostatic system utilised in the Depolox® 4 cell is also based on the principle of the reduction of chlorine at a platinum working electrode. However, in other respects it is markedly different. The 3-electrodes consist of 1 silver/silver chloride reference electrode, 1 platinum counter-electrode and 1 platinum working electrode. The silver/silver chloride electrode is placed in a potassium chloride electrolyte which makes contact with the test solution via a porous junction. This electrode will always hold the same electrical potential irrespective of the solution in which it is placed. The working electrode is then maintained at a fixed potential with respect to the reference electrode by means of a feedback ‘potentiostatic’ electronic circuit. The conventional electrical current passes through the counter electrode in proportion to the concentration of chlorine or other oxidising species present in the test solution (Fig.3). In effect, this means that electrons are provided to the working electrode in proportion to the numbers of reducible species at the surface.

This gives a system that is inherently more stable than the 2-electrode arrangement. The working electrode is held at a constant potential which both increases its specificity to chlorine and maintains the chemistry at the surface. This system is thus much less susceptible to zero drift, cross sensitivity to other species and hysteresis.

In principle the new cell requires much less operator attention in terms of recalibration and failures and may be used for applications which previously would have been avoided.

Features

- Potentiostatic 3-electrode measuring cell for disinfectants and oxidising agents (Cl_2, ClO_2, O_3, $KMnO_4$)
- Fast response time (T90 ≤ 20s) due to absence of membrane covering
- Wall-mounted housing with plexiglass body to accommodate electrodes
- Hydromechanical electrode cleaning system
- Controlled sample water flow rate
- Built-in Pt100 temperature sensor (optional)
- Sample water shut-off valve with integral flow control
- Electrode service life approx. 5 years
- Easy to install and maintain
- Option of electronic compensation for pH fluctuations



Technical data

Sample Water Flow Rate:
Adjustable by flow control valve, factory setting: 33 l/h

Inlet Pressure at Measuring Cell Input:
Min. 0.15 bar, max. 4 bar (no back pressure)
Min. 0.15 bar, max. 2 bar (with back pressure)
A pressure reducing valve is available.

Back Pressure at Measuring Cell Outlet:
In non-pressurised version, sample water drains away freely max. 1.5 bar (pressurised version of measuring cell)

Measuring ranges (potable water):
10 ranges to 100mg/l

Accuracy:
0.01 mg/l ± 1 digit (2% F.S.)

Sensitivity:
0.01 mg/l (1% F.S.)

Stability:
±2% F.S. under typical conditions for 1 month

Response Time:
20 seconds (T90)

Electrode service life:
approx. 5 years

Housing Dimensions (W x H x D):
260 x 230 x 165 mm

Weight:
3.8 kg (including packaging)

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