HACH-LANGE Electrochemistry
Determination of Chloride in alcohols using an ISE (Ion selective electrode)

Application APP-ECH-0022
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Introduction

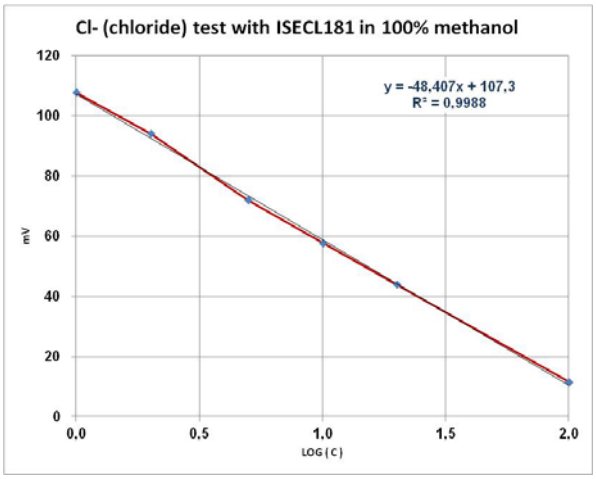
Bio-alcohols are used in bio-fuels. The composition of those fuels has to be controlled to avoid ingredients, which may corrode the metal housing of an engine. Chloride (Cl^-) is a very corrosive ion and must be absent, because it can initiate a corrosion process, what finally leads to damage.

The Hach HQ40d Multimeter with ISECL18101 ion selective probe for Cl^- ions, is a perfect system to analyze for Cl^- in alcohols. Normally, electrochemical sensors are designed for aqueous solutions only and organic solutions like alcohol need a specific reference system. The IntelliCal ISECL18101 works without any modification directly in the alcoholic sample.

Calibration and sample measurement

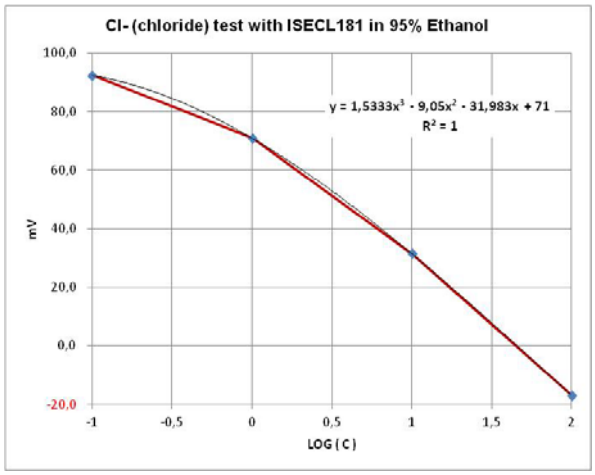
Prepare at least 4 standard solutions of an alcohol / water mixture what is identical to the composition of the sample. For Methanol a 100% Methanol solution can be used to dissolve Sodium Chloride (NaCl). Ethanol needs some water to dissolve NaCl, because pure Ethanol will not dissolve NaCl. Therefore a 95% Ethanol + 5% DI water mixture can be used for the calibration.

Start with a stock solution of 1000 mg/L Cl^-, what is 1.655 g NaCl salt dissolved in 1 L Methanol. Take corresponding volumes to dilute the stock solution to the required lower Cl^- standards. The table on the right shows a measurement of the ISECL18101 in 6 standards. Using 1, 10 and 100 mg/L for calibration the calculated slope is -48.5 mV/pX and offset +107mV. The ISECL18101 reacts linear over the complete range between 1 and 100 mg/l Cl^- in Methanol.



Cl- conc. (mg/l)	Log (c)	mV measured
1	0,00	107,8
2	0,30	94,1
5	0,70	72,0
10	1,00	57,7
20	1,30	44,0
100	2,00	11,6

The Chloride analysis in Ethanol is different to Methanol, because Ethanol is less polar than Methanol or Water. Below the table shows the measurements of ISECL181in a 95 Ethanol solution with different amount of Cl^-.
A stock solution of 1,655 g NaCl / 1 L was prepared with 95% Ethanol + 5 % DI water. Compared to Methanol the calibration curve of Cl^- in Ethanol is not linear, but a cubic function. Therefore the sensitivity at lower Cl- concentrations decreases faster than in Methanol.
The slope calculated from the 1, 10, 100 mg/L Cl- standards is -43.9 mV/pX and offset 72.5 mV.
The ISECL18101 reacts almost linear over the range between 1 and 100 mg/l Cl^- in Ethanol.



Cl- concentration (mg/l)	LOG (C)	mV
0,1	-1	92,4
1	0	71,0
10	1	31,5
100	2	-16,9

Maintenance

After each measurement rinse the ISE thoroughly with DI water and store the probe in the storage solution.