

Determination of Langelier Index in Water

DOC316.52.93108

Based on Hach method 8073

ISO 10523: 2008

ISO 6059: 1984

ISO 9963: 1994

Total Alkalinity and Ca Hardness: 10 - 1000 mg/L CaCO₃

1. Introduction

Langelier Index (LI) is used as an indicator for corrosivity of water. It measures the ability of water to dissolve or deposit calcium carbonate. It is based on several measurements:

- Conductivity, for TDS (Total Dissolved Solids) determination
- pH
- Temperature
- Total Alkalinity
- Ca Hardness

2. Principle

This method allows an automatic determination of the Langelier Index. First, the conductivity value of the sample is externally measured and entered in the titrator. Then, an automatic sequence is launched for total alkalinity and Ca hardness titrations in the same beaker.

Total alkalinity is determined by the addition of HCl up to 4.5 pH. Then, a complexing buffer is added to the sample through an embedded pump. Thus, the Ca hardness is titrated by Na₂EDTA with ISE (ion selective electrode) in alkali media.

At the end of the sequence, the Langelier Index is calculated.

3. Electrodes and reagents

Electrodes: Combined pH electrode with temperature sensor, IntelliCAL PHC805
Calcium specific combined electrode, Ca²⁺ I.S. Electrode 9660C
Legacy adapter configured with the parameters that follow:

Parameter	Select ISE
Sensor Name	Enter the exact name of the sensor as programmed in the application (e.g., ISECa9660C). <i>Note: the sensor name is case sensitive.</i>
Default Temperature	Enter the ambient temperature (e.g., 25 °C or 77°F)

Titrants: Hydrochloric acid, HCl 0.02 mol/L solution in deionized water
Disodic EDTA, Na₂EDTA 0.01 mol/L solution in deionized water

Hardness buffer: TRIS (Tris(hydroxymethyl)aminomethane) 0.275 mol/L+ Acetylacetone 0.035 mol/L
For 1 L of solution, in a 1 L volumetric flask, dissolve 33.3 g of TRIS in deionized water and add 3.5 g of acetylacetone. Complete up to 1 L with deionized water. Do not use this buffer for longer than one month

Storage: Calcium solution 0.1 mol/L (CaCl₂) for ISE Ca electrode storage or activation if needed

pH buffers: Refer to [9.1 pH electrode calibration](#)

Standards: Refer to [9.2 HCl 0.02 mol/L calibration](#) and [9.3 Na₂EDTA 0.01 mol/L calibration](#) for titrant solution calibrations

Solvent: Deionized water

4. Settings

4.1. Langelier Index determination

The settings have been defined with:

- Sample volume: 50 mL
- Titrant concentrations: 0.02 mol/L for HCl and 0.01 mol/L for Na₂EDTA
- Syringe volumes: 10 mL for both titrants

Name	Default parameter	Unit
Application		
Application name	Langelier Index	
Advisable syringe	10 mL	
Sample		
Name	Water ? ¹	
Amount ²	50	mL
QC		
Name	QC Sample	
Electrode		
Recommended	ISECa9660C	
Electrode		
Recommended	PHC805	
Titrant: HCl 0.02 M		
Name	HCl	
Real concentration	0.0200	mol/L
Titrant: Na₂EDTA 0.01 M		
Name	Na ₂ EDTA	
Real concentration	0.01000	mol/L
External measurement³		
Active	Yes	
Message	External conductivity measurement	
Stirring speed	25	%
Input conductivity (=G1)		
Active	Yes	
Message	Please enter the sample conductivity value at 25 °C (77 °F)	
Stirring speed	25	%
Min. value	0	µS/cm
Max. value	2000	µS/cm
Leveling		
Active	No	
Sample homogenization⁴		
Active	Yes	
Time	15	seconds
Stirring speed	25	%
Message	Sample homogenization, please wait...	
pH		
Active	Yes	
Max. stability time	120	seconds
Stability criterion	0.050	pH/min
Stirring speed ⁴	0	%
Result 1 (R1) name	pH	
R1 hide	Yes	
R1 min.	0	pH
R1 max.	14	pH

¹ "?" in the name, indicates that the instrument automatically increments the sample name with a number for each analysis.

² Refer to [4.2.1 Sample amount](#)

³ Refer to [4.2.4 Conductivity input value](#)

⁴ Refer to [4.2.5 pH measurement](#)

Name	Default parameter	Unit
R1 QC min.	0	pH
R1 QC max.	14	pH
Total Alkalinity		
Active	Yes	
Stirring speed	25	%
Predose Ordinate	6	pH
Predose Speed	20	mL/min
Delay	5	seconds
Max. vol. stop point	25	mL
Ordinate stop point	3.4	pH
Stop on last EQP	Yes	
EP1 ordinate	4.5	pH
Result 1 (R1) name	Total Alkalinity	
R1 hide	Yes	
R1 min.	10	mg/L
R1 max.	1000	mg/L
R1 QC min.	10	mg/L
R1 QC max.	1000	mg/L
Result 2 (R2) name	Temperature	
R2 hide	Yes	
R2 min	0	°C
R2 max	80	°C
R2 QC min	0	°C
R2 QC max	80	°C
Manual buffer addition		
Active ⁵	No	
Automatic buffer addition		
Active ⁵	Yes	
Reagent	Buffer addition – 20 mL	
Pump ID	Pump 1	
Time	7	seconds
Stirring speed	0	%
Hardness Ca		
Active	Yes	
Stirring speed	25	%
Predose ordinate	300	mV
Predose speed	20	mL/min
Delay	5	seconds
Max. vol. stop point	25	mL
Ordinate stop point	150	mV
Stop on last EQP	Yes	
IP min. ordinate	150	mV
IP max. ordinate	300	mV
Result 1 (R1) name	Hardness Ca	
R1 hide	Yes	
R1 min.	10	mg/L
R1 max.	1000	mg/L
R1 QC min.	10	mg/L
R1 QC max.	1000	mg/L
Result 2 (R2) name	TDS	
R2 hide	Yes	
R2 min.	0	mg/L
R2 max.	1000	mg/L
R2 QC min.	0	mg/L
R2 QC max.	1000	mg/L
R2 equation	FX*G1	

⁵ Only one of these two fields must be set to "Yes"

Name	Default parameter	Unit
R2 user value ⁶	0.5	
Result 3 (R3) name	Langelier Index	
R3 hide	No	
R3 min.	-99999	
R3 max.	99999	
R3 QC min.	-99999	
R3 QC max.	99999	
Result 4 (R4) name	Ryznar Index	
R4 hide	Yes	
R4 min.	-99999	
R4 max.	99999	
R4 QC min.	-99999	
R4 QC max.	99999	

4.2. Recommendations for modification of settings

Mainly for analysis time reduction, some parameters can be adjusted. It has to be noted that the impact can be a loss of precision on the results.

4.2.1. Sample amount

Sample amount is set at 50 mL by default. It has to be adjusted and changed in the editor, depending on the expected sample concentrations according to the following table.

<i>Sample volume / Titrant added (mg/L CaCO₃ of total alkalinity or Ca hardness)</i>	<i>0.50 mL</i>	<i>10 mL</i>	<i>20 mL</i>
<i>20 mL (qs 50 mL deionized water)</i>	25.0	500	1000
<i>25 mL (qs 50 mL deionized water)</i>	20.0	400	800
<i>50 mL</i>	10.0	200	400

4.2.2. Predose

Predoses are defined in both titrations up to a certain ordinate with a titrant addition speed of 20 mL/min. For low equivalent volume for total alkalinity titration, the predose can be stopped over the fixed ordinate and lead to a 0 mg/L result. That is why, in this case, it is recommended to deactivate the predose in ordinate for expected volumes lower than 5 mL. If in the analyzed sample, the equivalent volume is always lower than 5 mL, it is possible to set a predose in volume to reduce analysis time.

4.2.3. Leveling

It is possible to use a leveling method only for a sample volume of 50 mL. It is deactivated by default.

To use this method, an external pump is required. All elements (probes, tubes from the titrator and the tube from the external pump) have to be well installed on the probe holder. The beaker has to contain a level of sample higher than the position of the tube of the external pump. When the beaker is attached to the probe holder, this method allows the system to automatically remove the excess sample by a defined pump working time, and always keep the same sample volume before launching the analysis.

In order to define this volume, autoleveling calibration sequence has to be previously executed (refer to section [9.4 Autoleveling calibration](#)).

When this option is active, the working time of the external pump must be set (default 30 s). The minimum working time must allow the pump to be removing air during the last few seconds of the external pump activation.

Note: Do not forget to re-edit the sample amount with the expected value when deactivating the leveling method.

⁶ Refer to [6.2 Results calculation](#)

4.2.4. Conductivity input value

Two options are available for the conductivity input value:

- The conductivity is measured when the sample is installed on the titrator, for example with a CDC401 conductivity probe connected to an HQd instrument and placed on the probe holder. By default, a message appears when the application starts, to have time to perform this measurement during the analysis sequence before entering the value in the titrator.
- The conductivity is previously measured on another instrument and so the first message can be deactivated to go directly to the conductivity input value.

4.2.5. pH measurement

This application follows the ISO 10523: 2008 standard which recommends stirring the sample a few seconds and then measuring the pH without sample stirring. To perform the pH measurement with stirring, deactivate the method named **Sample homogenization** and set the required stirrer speed in the pH measurement section.

5. Procedure

5.1. Electrode / Titrant calibration

If the pH electrode, and/or titrants calibration, and/or autoleveling calibration is required, refer to section [9 Appendix: pH electrode, titrants and autoleveling calibrations](#).

5.2. Sample analysis

Pour the required sample amount (refer to table in section [4.2.1 Sample amount](#)) into a beaker. Complete to 50 mL with deionized water if needed. Add a stir bar and fix the beaker on the probe holder.

Start the application. Enter the conductivity value (refer to section [4.2.4 Conductivity input value](#)) and then the sequence is completely automatic. The pH measurement is done according to ISO 10523: 2008. The sample is stirred for 15 s, and then the pH value is measured without stirring. The total alkalinity of the sample is determined by titration with HCl 0.02 mol/L up to pH 4.5. After addition of the buffer, the Ca hardness is finally measured in the same beaker.

6. Results

6.1. Displayed results

At the end of the sequence, only the Langelier Index is displayed, but all important parameters used for the Langelier index calculation are automatically calculated and stored:

1. TDS (mg/L) as a result of conductivity at 25 °C (77 °F) ($\mu\text{S}/\text{cm}$)
2. pH (pH)
3. Temperature (°C) taken during the total alkalinity analysis
4. Total Alkalinity (mg/L CaCO_3)
5. Ca Hardness (mg/L CaCO_3)

6.2. Results calculation

- TDS (mg/L): $\text{TDS} = \text{FX} \times \text{Conductivity}$

FX: Default conversion coefficient set at 0.5. It can be changed in the application editor through the user value in the TDS section depending on the SOP being used

Conductivity in $\mu\text{S}/\text{cm}$

- Total Alkalinity (mg/L CaCO_3): $\text{Total Alkalinity} = \frac{V_{\text{eq1}} \times C_{\text{HCl}} \times 50045}{V_{\text{smp}}}$

V_{eq1} : Volume of titrant added during the titration of total alkalinity to reach pH 4.5 in mL

C_{HCl} : Concentration of HCl titrant solution in mol/L

V_{smp} : Sample volume in mL

- Ca Hardness:

$$\text{Ca Hardness} = \frac{V_{\text{eq2}} \times C_{\text{Na2EDTA}} \times 100090}{V_{\text{smp}}}$$

V_{eq2} : Volume of titrant added during the titration of Ca hardness to reach the inflection point in mL
 C_{Na2EDTA} : Concentration of Na₂EDTA titrant solution in mol/L
 V_{smp} : Sample volume in mL

- Langelier Index:

$$\text{LI} = \text{pH} - \text{pH}_s$$

$$\text{LI} = \text{pH} - \left[10.0754 + 2.432636 \times e^{\left(\frac{T}{86.89927} \right)} - 0.2006 \times e^{(-0.004624 \times \text{TDS})} - \log (\text{Ca Hardness}) - \log (\text{Total Alkalinity}) \right]$$

- Ryznar Index:

Data supplied by this application can also lead to Ryznar Stability Index (RSI). It is defined as follows:

$$\text{RSI} = 2 \text{ pH}_s - \text{pH}$$

$$\text{RSI} = 2 \times \left[10.0754 + 2.432636 \times e^{\left(\frac{T}{86.89927} \right)} - 0.2006 \times e^{(-0.004624 \times \text{TDS})} - \log (\text{Ca Hardness}) - \log (\text{Total Alkalinity}) \right] - \text{pH}$$

It is hidden by default but can be displayed at the end of the analysis by setting **R4 hide** to **No** in the application editor.

7. Langelier Index determination on tap water

The results described below are indicative and obtained for a given sample in optimized conditions respecting good laboratory practices. These indicative values are sample-dependent, electrode-dependent and operating cell-dependent.

Results for 10 determinations of tap water with default settings:

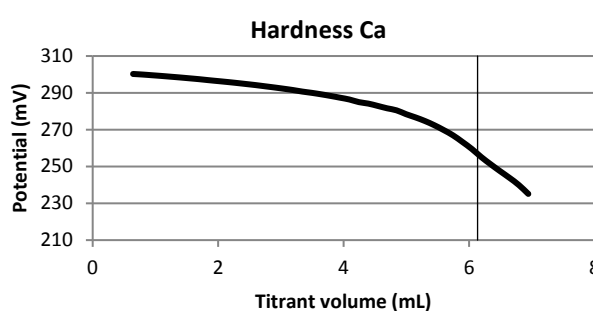
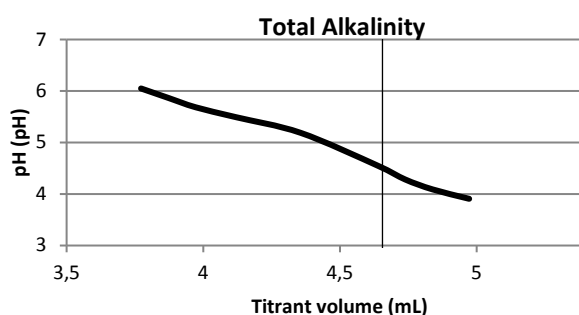
Sample: 50 mL of tap water

Temperature of analysis: Room temperature

Mean value of Langelier Index: 0.40

Standard deviation: 0.02

Relative standard deviation: 4.2%



8. Bibliography

- Langelier, W. F., "The Analytical Control of Anticorrosion Water Treatment" *Journal of American Water Works Association* 1936, 28, 1500.
- ISO 10523:2008 *Water quality -- Determination of pH*
- ISO 9963:1994 *Water quality -- Determination of alkalinity*
- ISO 6059:1984 *Water quality -- Determination of the sum of calcium and magnesium -- EDTA titrimetric method*
- Hach method 8073 *Langelier and Aggressive Indices*

9. Appendix: pH electrode, titrants and autoleveling calibrations

To increase the accuracy of the Langelier Index determination, it is recommended to perform a pH electrode calibration every week. For the titrants, it is recommended to calibrate them after a bottle change or after a long storage time.

9.1. pH electrode calibration

9.1.1. Electrode and buffers

Electrode: Combined pH electrode with temperature sensor, IntelliCAL PHC805.

pH standards: IUPAC pH 1.68, pH 4.01, pH 7.00, pH 10.01 and pH 12.45 are set by default. It is possible to change these according to your SOP (refer to the full user manual for details).

9.1.2. Electrode calibration settings

By default the electrode calibration is done with the parameters described below:

Name	Default parameter	Unit
Application		
Application name	Langelier Index	
Electrode		
Type	pH	
Recommended electrode	PHC805	
Calibration frequency	7	days
Stability criterion	0.050	pH/min
Max. stability time	300	seconds
Stirring speed	25	%
Stirring duration	15	seconds
Calibration mode	Auto	
Buffer set	IUPAC 1.68 , 4.01, 7.00, 10.01, 12.45	

Note: The parameters are defined to calibrate the electrode following the ISO 10523:2008 standard which recommends stirring the buffer before the measurement, and to stop stirring during measurement. If your SOP requires stirring during the measurement process, set the **Stirring duration** to **0 s**.

9.1.3. Electrode calibration procedure

It is recommended to calibrate the electrode at a temperature close to the sample temperature.

Pour a sufficient amount of buffer into a beaker so that the electrode dips into the solution. Add a magnetic stir bar and launch the calibration sequence. Rinse the electrode between each buffer. The electrode can be calibrated with up to five different buffers.

9.1.4. Calibration results

At the end of the series of buffers, the following results are displayed:

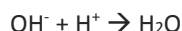
- Slope in mV/pH
- Slope in % compared to the theoretical slope (- 59.16 mV/pH)
- Offset in mV

The acceptance limits for the PHC805 electrode for the slope are 97-102% and between - 30 and + 30 mV for the offset.

9.2. HCl 0.02 mol/L calibration

9.2.1. Principle

The strong acid used as titrant has to be calibrated with NaOH which reacts with H⁺ ions according to:



9.2.2. Electrode and reagents

Electrode: Combined pH electrode with temperature sensor, IntelliCAL PHC805
Titrant: Hydrochloric acid, HCl 0.02 mol/L solution in deionized water (commercially available)
Standard: Sodium hydroxide, NaOH 0.02 mol/L solution in deionized water (commercially available)
Deionized water

As the standard solution absorbs carbon dioxide from the atmosphere, carbonate species are formed and other inflection points can appear. This phenomenon leads to bad calibrations due to the presence of more than one inflection point on the titration curve (refer to the warning message at the end of the calibration). In these conditions, the sodium hydroxide solution should not be used for titrant calibration.

If commercially available standard is not used, NaOH solutions have to be prepared with freshly boiled deionized water and not exposed to ambient air. Freshly prepared solutions have to be used straight away for calibration and carefully stored in a polythene flask between calibrations. To limit the carbonation during storage, minimize the head space volume.

9.2.3. Settings

The following parameters have been set to use about 5 mL of titrant for the calibration.

Name	Default parameter	Unit
Application		
Application name	Langelier Index	
Electrode		
Recommended electrode	PHC805	
Titrant: HCl 0.02 M		
Name	HCl	
Nominal concentration	0.02	mol/L
HCl 0.02 M method: Calibration		
Active	Yes	
Calibration frequency	0	days
Stirring speed	25	%
Predose type	Volume	
Predose volume	3	mL
Delay	5	seconds
Max. vol. stop point	7	mL
Ordinate stop point	2.0	pH
Stop on last EQP	No	
IP1 min. ordinate	4.5	pH
IP1 max. ordinate	8.5	pH
Min. titrant conc.	0.018	mol/L
Max. titrant conc.	0.022	mol/L
Standard name	NaOH	
Standard amount	5	mL
Min. amount	4	mL
Max. amount	6	mL
Concentration	0.02	mol/L

Inflection points detection and result acceptance

The degradation of the standard solution of NaOH can easily and quickly appear and lead to bad results for calibrations. To prevent this situation, the detection range of the inflection point and stop conditions have been optimized to validate the status of the standard solution through a possible multiple IP detection. Therefore, it is not recommended to modify the settings described below.

The **Stop after last EQP** field is selected as **No** to make sure that the titration will not be stopped at the first IP detection and will not hide the other(s) if they exist. The **Max. vol. stop point** being at 7 mL, the titration will always stop at this volume. For the same reason the **IP1 min. ordinate** and **IP1 max. ordinate** fields are set respectively at 4.5 pH and 8.5 pH.

With these settings, at the end of a standard titration, if an EQP has been found and if there is no warning regarding the number of IPs detected, the result is considered as reliable. Otherwise, if the message **More than one IP has been found for this expected IP** appears, it is recommended to reject the result and perform another titration. If it there is no improvement, it is better to prepare a fresh standard solution.

9.2.4. Procedure

Accurately measure 5 mL of NaOH 0.02 mol/L solution, and put it in a beaker. Add a sufficient amount of deionized water to cover the electrode and the delivery tip with solution. Put in a magnetic stir bar and place the beaker on the titrator. Dip the electrode and delivery tip into the solution. Launch the titrant calibration sequence.

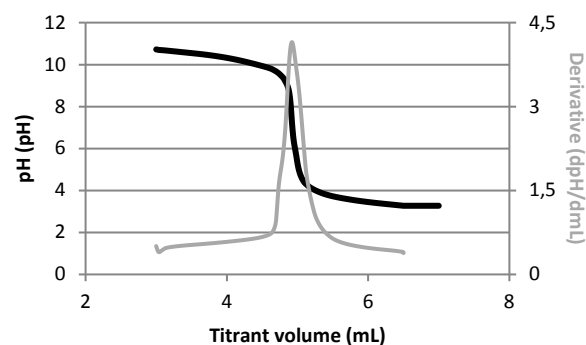
9.2.5. Result

The result is expressed as mol/L concentration of the titrant and based on the following formula:

$$C_{\text{HCl}} = \frac{V_{\text{NaOH}} \times C_{\text{NaOH}}}{V_{\text{HCl}}}$$

Where:

- C_{HCl} : Titrant concentration in mol/L
- V_{NaOH} : Volume of standard solution (NaOH) in mL
- C_{NaOH} : Concentration of standard solution (NaOH) in mol/L
- V_{HCl} : Volume of HCl at the equivalence point in mL



The calibration result can be accepted if five determinations give a result with a relative standard deviation of less than 1%.

9.2.6. Example of titrant calibration on five determinations

The results described below are indicative and obtained for a given titrant in optimized conditions respecting good laboratory practices. These indicative values are sample-dependent, electrode-dependent and operating cell-dependent.

Standard: 5 mL of 0.0200 mol/L NaOH solution

Temperature of analysis: Room temperature

Concentration of titrant: 0.0204 mol/L

SD: 0.0002 eq/L

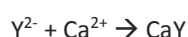
RSD: 0.89 %

Titration curve:

9.3. Na₂EDTA 0.01 mol/L calibration

9.3.1. Principle

The Na₂EDTA used as titrant for hardness determination has to be calibrated with Ca²⁺ solution. The standard used is a solution of CaCl₂ at 1000 mg/L as CaCO₃.



9.3.2. Electrode and reagents

Electrode: Calcium specific combined electrode, Ca²⁺ I.S. Electrode 9660C

Titrant: Disodic EDTA, Na₂EDTA 0.01 mol/L solution in deionized water

Standard: CaCl₂ solution at 1000 mg/L as CaCO₃

Deionized water

9.3.3. Settings

The following parameters have been set to use about 5 mL of titrant for the calibration.

Name	Default parameter	Unit
Application		
Application name	Langelier Index	
Advisable syringe	10 mL	
Electrode		
Recommended electrode	ISECa9660C	
Titrant: Na₂EDTA 0.01 M		
Name	Na ₂ EDTA	
Nominal concentration	0.01	mol/L
Na₂EDTA 0.01 M method: Manual buffer addition		
Active ⁷	No	
Na₂EDTA 0.01 M method: Automatic buffer addition		
Active ⁷	Yes	
Reagent	Buffer addition – 20 mL	
Pump ID	Pump 1	
Time	7	seconds
Stirring speed	0	%
Na₂EDTA 0.01 M method: Calibration		
Active	Yes	
Calibration frequency	0	days
Stirring speed	25	%
Predose type	Ordinate	
Predose ordinate	300	mV
Predose speed	20	mL/min
Delay	5	seconds
Max. vol. stop point	8	mL
Ordinate stop point	150	mV
Stop on last EQP	Yes	
Min. increment size	0.02	mL
Max. increment size	0.8	mL
IP1 min. ordinate	150	mV
IP1 max. ordinate	300	mV
Min. titrant conc.	0.00900	mol/L
Max. titrant conc.	0.01100	mol/L
Standard name	CaCl ₂	
Standard amount	5	mL
Min. amount	4	mL
Max. amount	6	mL
Concentration	1000	mg/L
Molar weight	100.09	g/mol

9.3.4. Procedure

Accurately measure 5 mL of CaCl₂ 1000 mg/L as CaCO₃ standard solution and put it in a beaker. Add a sufficient amount of deionized water to cover the electrode and the delivery tips with solution (qs 50 mL). Put in a magnetic stir bar and place the beaker on the titrator. Dip the electrode and delivery tips into the solution. Launch the titrant calibration sequence.

⁷ Only one of these fields must be set to "Yes"

9.3.5. Result

The result is expressed as mol/L concentration of the titrant and based on the following formula:

$$C_{\text{Na}_2\text{EDTA}} = \frac{V_{\text{std}} \times C_{\text{std}}}{V_{\text{Na}_2\text{EDTA}} \times 100090}$$

Where:

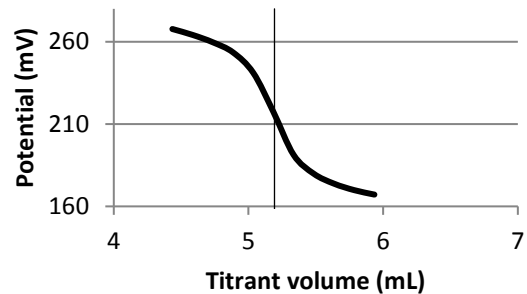
$C_{\text{Na}_2\text{EDTA}}$:	Titrant concentration in mol/L
V_{std} :	Volume of calcium standard solution in mL
C_{std} :	Concentration of calcium standard solution in mg/L or ppm as CaCO_3
$V_{\text{Na}_2\text{EDTA}}$:	Volume of Na_2EDTA at the equivalence point in mL

The calibration result can be accepted if five determinations give a result with a relative standard deviation of less than 1 %.

9.3.6. Example of titrant calibration

The results described below are indicative and obtained for a given titrant in optimized conditions respecting good laboratory practices. These indicative values are sample-dependent, electrode-dependent and operating cell-dependent.

Standard: 5 mL of CaCl_2 standard solution at 1000 mg/L as CaCO_3 .
Temperature of analysis: Room temperature
Concentration of titrant: 0.00966 mol/L
SD: 0.00003 mol/L
RSD: 0.3 %
Titration curve:



9.4. Autoleveling calibration

This option is **ONLY** available from the calibration menu if **Method Leveling** is set to Active (**Yes**). Refer to the documentation delivered with the external pump for a correct installation, paying particular attention to the suction tube from the pump.

9.4.1. Settings

Name	Default parameter	Unit
Application		
Application name	Langelier Index	
Advisable syringe	10 mL	
Sample		
Min. amount	20	mL
Max. amount	55	mL
Leveling		
Active	Yes	
Time	30	seconds
Autoleveling calibration		
Solution name	NaOH	
Concentration	0.00200	mol/L

At the end of the titration, the result is compared to the minimum and maximum sample amounts defined in the **Sample** section of the application editor.

For this application, leveling is usable only for a sample volume of 50 mL so **Sample min. amount** has to be set to **45 mL** instead of 20 mL if **Method Leveling** is set to Active (**Yes**). It is recommended to work with a sample volume between $\pm 10\%$ of the targeted sample amount.

9.4.2. Standard preparation

For the determination of the remaining sample volume in the beaker after leveling, a titration of a standard with a known concentration is required. For this application, the determination is done with a 0.002 mol/L NaOH solution.

For 1 L of standard solution, in a 1 L volumetric flask, accurately pour 100 mL of 0.02 mol/L NaOH standard solution and complete to 1 L with freshly boiled deionized water.

9.4.3. Procedure

Pour a sufficient amount of the standard solution in a beaker that allows the external pump tube to be immersed in the liquid. In the calibration menu, select **Autoleveling calibration** and then the application being used. For this application, the titration settings are the same as those used for HCl calibration.

When the sequence is launched, the sample leveling is done and then the same titration as HCl calibration is performed.

9.4.4. Result

At the end of the sequence, the result obtained is the volume remaining in the beaker after leveling. It is automatically written in the **Sample amount** field in the application editor and will be used in the next titration calculations of the application.

$$V_{\text{smp}} = \frac{V_{\text{titrant}} \times C_{\text{titrant}}}{C_{\text{Standard}}}$$

With:

V_{smp} :	Sample volume in mL
C_{Standard} :	Concentration of standard solution in mol/L (currently NaOH 0.002 mol/L)
C_{titrant} :	Concentration of titrant in mol/L (currently HCl 0.02 mol/L)
V_{titrant} :	Volume of titrant added for the titration in mL (for a targeted sample volume of 50 mL it should be close to 5 mL)

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