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MQuant®

Total Hardness Test

1. Definition

The hardness (total hardness) of a given water is due to its content of salts of the alkaline earth metals calcium, magnesium, strontium, and barium ("hardening constituents"). Since strontium and barium are generally present in waters only in traces, the hardness is defined as the content in a water of calcium ions, Ca^{2+} , and magnesium ions, Mg^{2+} ("hardness ions"). The conventional procedure is to relate the statement of the water hardness only to calcium, in other words to express also the content of magnesium ions as calcium content.

The units for the water hardness relate to calcium or its compounds CaO ($1^\circ \text{d} \triangleq 10 \text{ mg/l CaO}$) or CaCO_3 ($1^\circ \text{e} \triangleq 14.25 \text{ mg/l CaCO}_3$; $1^\circ \text{f} \triangleq 10 \text{ mg/l CaCO}_3$), with the magnesium content being expressed as calcium content and included in the calculation accordingly.

2. Method

In the presence of a green indicator the hardness ions Ca^{2+} und Mg^{2+} react with Titriplex® III¹⁾ to form a colorless, stable complex. The hardness ions that are present in excess relative to Titriplex® III react with the indicator to form a red complex. The reaction zones of the test strip, which are impregnated with differing amounts of Titriplex® III, thus assume a green to red color, depending on the hardness of the water sample. The hardness is measured **semi-quantitatively** by visual comparison of the reaction zones with the color rows of a color scale.

¹⁾ ethylenedinitrilotetraacetic acid disodium salt dihydrate

3. Measuring range and number of determinations

Measuring range / color-scale gradation ¹⁾	Number of determinations
<150; 150 - 250; >250 mg/l CaCO_3 <1.5; 1.5 - 2.5; >2.5 mmol/l CaCO_3 <10.5; 10.5 - 17.5; >17.5 °e	100

¹⁾ for conversion factors see section 9

4. Applications

Sample material:

Groundwater and surface water
Drinking water
Mineral water

5. Influence of foreign substances

This was checked individually in solutions with a hardness of 0 mmol/l CaCO_3 . The determination is not yet interfered with up to the concentrations of foreign substances given in the table. Cumulative effects were not checked; such effects can, however, not be excluded.

Concentrations of foreign substances in mg/l			
Cu^{2+}	10	Ni^{2+}	10
Co^{2+}	10	Zn^{2+}	10

6. Reagents and auxiliaries

The test strips are stable up to the date stated on the pack when stored closed at +15 to +25 °C.

Package contents:

Tube containing 100 test strips

Other reagents:

MQuant® Universal indicator strips pH 0 - 14, Cat. No. 109535
Sodium hydroxide solution 1 mol/l Titripur®, Cat. No. 109137
Hydrochloric acid 1 mol/l Titripur®, Cat. No. 109057
Calcium chloride dihydrate for analysis EMSURE®, Cat. No. 102382

7. Preparation

- The pH must be within the range 5 - 8.**
Adjust, if necessary, with sodium hydroxide solution or hydrochloric acid.
- Other MQuant® Total Hardness Tests for measuring range <4 - >26 °e:**
Cat. No. 110025 - 100 test strips
for measuring range >6 - >31 °e:
Cat. No. 110046 - 100 test strips

8. Procedure

Immerse **both reaction zones** of the test strip in the pretreated sample (**15 - 30 °C**) for **1 sec** (**not in running water!**).

Shake off excess liquid from the strip and **after 1 min** determine with which color row on the label the colors of the reaction zones coincide most exactly.

Read off the corresponding result.

Assessment:

Hardness range	mg/l CaCO_3	mmol/l CaCO_3 (Ca)	°e
soft	<150	<1.5	<10.5
moderately hard	150 - 250	1.5 - 2.5	10.5 - 17.5
hard	>250	>2.5	>17.5

Note on the measurement:

The color of the reaction zones may continue to change after the specified reaction time has elapsed. This must not be considered in the measurement.

9. Conversions

required given	mmol/l CaCO_3 (Ca)	mg/l CaCO_3	mg/l Ca	English degree °e	French degree °f	German degree °d
1 mmol/l CaCO_3 (Ca)	1	100.1	40.08	7.02	10.01	5.61
1 mg/l CaCO_3	0.010	1	0.400	0.070	0.100	0.056
1 mg/l Ca	0.025	2.50	1	0.175	0.250	0.140
1 English degree °e	0.142	14.25	5.71	1	1.43	0.799
1 French degree °f	0.100	10.00	4.00	0.702	1	0.560
1 German degree °d	0.178	17.85	7.15	1.25	1.78	1

10. Method control

To check test strips and handling:
Dissolve 3.67 g of calcium chloride dihydrate in distilled water, make up to 1000 ml with distilled water, and mix. Ca content: 1000 mg/l ($\triangleq$ 25 mmol/l CaCO_3).
Dilute this standard solution with distilled water to 80 mg/l Ca ($\triangleq$ 2.0 mmol/l CaCO_3) and analyze as described in section 8.
Additional notes see under www.qa-test-kits.com.

11. Note

Reclose the tube containing the test strips immediately after use.

