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MColortest™

Residual 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 °d ≙ 10 mg/l CaO) or $CaCO_3$ (**1 °e ≙ 14.25 mg/l $CaCO_3$**; 1 °f ≙ 10 mg/l $CaCO_3$), with the magnesium content being expressed as calcium content and included in the calculation accordingly.

2. Method

Colorimetric determination with color card

Calcium and magnesium ions react with an indicator to form a red complex compound. The residual hardness is measured **semiquantitatively** by visual comparison of the color of the measurement solution with the color fields of a color card.

3. Measuring range and number of determinations

Measuring range / color-scale graduation [1]	Number of determinations
0.05 - 0.10 - **0.19** °e	400
0.7 - 1.4 - **2.7** **mg/l $CaCO_3$**	

[1] for conversion factors see section 8

4. Applications

Sample material:

Boiler water and boiler feed water

Check of ion-exchanger plants for the production of deionized water

5. Reagents and auxiliaries

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

Package contents:

3 bottles of reagent RH-1 (indicator solution)
1 test vessel
1 color card

Other reagents:

MColorpHast™ 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

6. Preparation

- **The pH must be within the range 5 - 8.**
  Adjust, if necessary, with sodium hydroxide solution or hydrochloric acid.
- Filter turbid samples.

7. Procedure

Rinse the test vessel several times with the pretreated sample.		
Pretreated sample (**15 - 30 °C**)	5 ml	Fill the test vessel to the 5-ml mark.
Reagent RH-1	2 drops [1]	Add and mix.
Place the test vessel on the white area next to the color fields of the color card and determine with which field the color of the measurement solution, when viewed from above, coincides most exactly. Read off the result in °e or mg/l $CaCO_3$ from the color card.		

[1] **Hold the bottle vertically while adding the reagent!**

Note on the measurement:

If the color of the measurement solution is equal to or more intense than the darkest color on the scale, repeat the measurement using **fresh** samples diluted with distilled water until a value of less than 0.19 °e (2.7 mg/l $CaCO_3$) is obtained.

Concerning the result of the analysis, the dilution must be taken into account:

Result of analysis = measurement value x dilution factor

8. 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

9. Notes

- Reclose the reagent bottle immediately after use.
- Rinse the test vessel **with distilled water only**.
- **Information on disposal can be obtained at www.disposal-test-kits.com.**

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