

Method Abstract

Summary:

The primary ions that contribute to water hardness are calcium(II) and magnesium(II). Ions of other elements such as strontium, iron, aluminum, zinc, and manganese also add to water hardness, but their concentrations are typically negligible relative to those of calcium and magnesium.

The magnesium disodium salt of ethylenedinitrilotetraacetic acid (Mg-EDTA) exchanges the magnesium for calcium on an equivalent basis. The free magnesium that is present in the sample plus the magnesium displaced from the Mg-EDTA by calcium reacts with calmagite, buffered at pH 10. This reaction produces a red-violet complex, and the absorbance is measured at 520 nm. The concentration of this complex is directly proportional to hardness. The results are expressed as weight of calcium carbonate per volume.

Interferences:

There are no significant chemical interferences with this method. Filter turbid samples prior to determination.

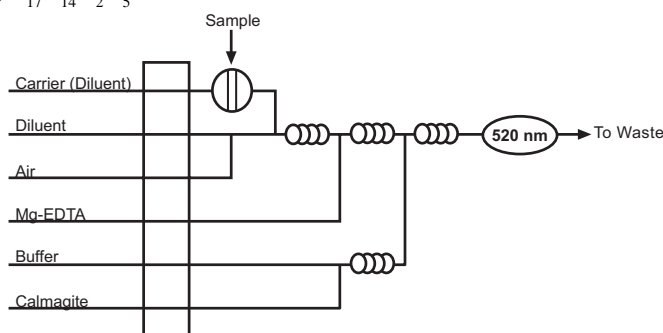
Performance Specifications:

Range:	100–500 mg/L CaCO ₃	10–100 mg/L CaCO ₃
Throughput:	45 samples/hour	45 samples/hour
Precision:		
10 mg/L	—	<8% RSD
30 mg/L	—	<2% RSD
75 mg/L	—	<2% RSD
100 mg/L	<8% RSD	<2% RSD
300 mg/L	<2% RSD	—
500 mg/L	<2% RSD	—
Method Detection Limit (MDL):	7.0 mg/L CaCO ₃	2.0 mg/L CaCO ₃

Chemicals:

Ammonium Chloride, NH ₄ Cl	Ethylenedinitrilotetraacetic Acid, Magnesium Disodium Salt,
Ammonium Hydroxide, 28–30% as NH ₃ , NH ₄ OH	(NaO ₂ CCH ₂) ₂ NCH ₂ CH ₂ N(CH ₂ CO ₂) ₂ Mg
Brij®-35, 30% w/v (OI Analytical Part #A21-0110-33)	Hydrochloric Acid, concentrated, HCl
Calmagite, C ₁₇ H ₁₄ N ₂ O ₅ S	Methyl Red Indicator Solution, 0.1% w/v

Basic Flow Diagram:



Selected References:

Methods for Chemical Analysis of Water and Wastewater; EPA-600/4-79-020; U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory: Cincinnati, OH, 1984; Method 130.1.

Standard Methods for the Examination of Water and Wastewater, 20th ed.; American Public Health Association: Washington, D.C., 1998.

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