



Iron and Manganese Analysis in Mineral Water Industry



Introduction

In mineral water production, consistent control over the water composition is crucial for both product quality and regulatory compliance. Iron (Fe) and manganese (Mn) are naturally occurring elements that must be monitored closely due to their impact on taste, appearance, equipment integrity, and microbiological stability.

Hach's EZsc Series analyzers offer reliable, automated online monitoring of these metals, while Hach's laboratory photometric systems provide precise measurements for quality control, validation and compliance testing.

Importance of Iron and Manganese Monitoring

Origin in Natural Waters

- **Iron (Fe^{2+})** and **manganese (Mn^{2+})** are found in groundwater under reducing conditions.
- These metals leach from geological formations or enter via corroded pipes or anthropogenic sources.

Effects on Product and Process

Aspect	Iron (Fe)	Manganese (Mn)
Taste	Metallic, astringent	Earthy, bitter
Visual quality	Yellow-brown discoloration	Black or gray deposits
Equipment impact	Pipe clogging, scaling	Fouling of filters and valves
Microbial risk	Iron/manganese bacteria formation	Biofilm development

Regulatory Limits (EU / Germany)

- **Iron:** $\leq 0.2 \text{ mg/L}$
- **Manganese:** $\leq 0.05 \text{ mg/L}$
Mineral and Table Water Ordinance MTVO
Drinking Water Ordinance – TrinkwV



Online Monitoring with Hach EZsc Series Analyzers

EZsc Series Overview

The **Hach EZsc Series** analyzers are automated online instruments for continuous measurement of trace metals in water. These systems are widely used in waterworks, beverage production and process monitoring. With the high-temperature oxidation TOC/TN analyser setup, samples were taken using a submersible pump.

Measurement Principle

Colorimetric photometry: Metal ions react with specific reagents to form colored complexes. Absorbance is measured photometrically and correlates to concentration.



EZ1025sc Manganese Analyzer

Parameter	Model	Method	Typical Range
Iron	EZ1024sc	Colorimetric measurement using TPTZ colour solution, conform with APHA 3500-Fe (B)	0.01–1.0 mg/L
Manganese	EZ1025sc	Colorimetric measurement using formaldoxime method at 450 nm	0.01–0.5 mg/L

Key Advantages

- Fully automated with integrated sample prep, calibration, and cleaning
- Continuous 24/7 online monitoring
- High accuracy at low ppb levels
- Data transmission via analog/digital/SCADA interfaces
- Alarm functions and reagent monitoring for proactive maintenance



Iron and Manganese Removal in Water Treatment

When natural water exceeds target concentrations, treatment is necessary prior to bottling. A typical treatment process includes:

Oxidation

Converts soluble Fe^{2+} and Mn^{2+} to insoluble oxides/hydroxides
Common oxidants:

- Air (aeration)
- Potassium permanganate (especially for Mn)
- Ozone or chlorine (for rapid oxidation)

Filtration

- Iron and manganese oxides are removed via media filters (sand, gravel, Birm, etc.)
- Precipitation may be enhanced with coagulants or pH adjustment

Post-treatment

- pH stabilization
- CO_2 adjustment for mineral balance
- Final quality control including turbidity, microbiology and mineral content



Laboratory Photometric Determination of Iron and Manganese (Hach)

For spot-checking, validation of online results, and regulatory documentation, lab-based photometry remains essential.

Instruments

DR4900	VIS spectrophotometer
DR6000	EZ1025

Both devices offer:

- Pre-programmed methods for LCW test kits
- Barcode-assisted reagent identification
- Full traceability and ISO-compliant result logging

Reagent Sets (LCW Series)

Parameter	Reagent Set	Method	Measuring Range
Iron	LCW532	1.10-Phenanthroline	0.005-2.0 mg/L
Manganese	LCW021	PAN method + oxidation	0.005 - 0.5 mg/L

LCW reagents are liquid-based kits designed for high accuracy, low detection limits, and ease of use in laboratory environments. Requires pre-oxidation step.



DR4900 VIS spectrophotometer



DR6000 UV-VIS high-end spectrophotometer



Iron trace, reagent set, 0.005-2.0mg/L Fe



Manganese reagent set 0.005-0.5 mg/L Mn

Benefits of Laboratory Testing

- Excellent repeatability and accuracy
- Simple procedure with ready-to-use reagents
- Validation of online results and process efficiency
- Suitable for raw water, filtered water and final product samples

Conclusion

Accurate monitoring and control of iron and manganese are critical for producing high-quality mineral water. Elevated levels can compromise product clarity, taste, and compliance.

Hach EZsc Series online analyzers offer a powerful solution for real-time process control, while Hach **laboratory photometric methods** provide detailed analysis for validation and regulatory documentation. Together, they form a robust monitoring system that ensures reliable operation, optimized treatment and product consistency.

