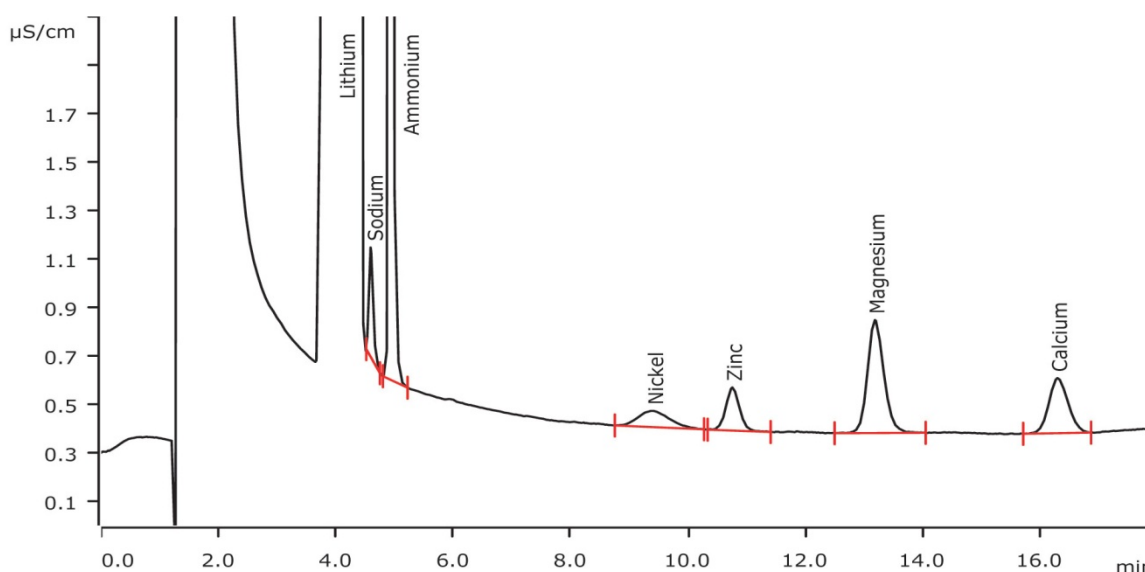


Zinc, nickel, calcium, and magnesium in borated water of a pressurized water reactor (PWR)



In pressurized water reactors (PWRs), light water is used as primary coolant. Boron (as boric acid) readily absorbs neutrons and is added to the coolant to control reactivity. Lithium hydroxide assures a pH value greater than 7 to prevent corrosion. This application allows to measure sub-ppb levels of zinc, nickel, calcium, and magnesium besides high boric acid and lithium hydroxide concentrations.

Results

Cation	Concentration [µg/L]	RSD [%] n = 90	Recovery [%]
Nickel	2.01	3.8	100.4
Zinc	2.07	4.6	103.5
Magnesium	2.43	1.5	113.5
Calcium	2.68	2.1	109.8

Sample

Artificial PWR primary circuit water (2 g/L boron, 3.3 mg/L lithium)

Sample preparation

Inline Preconcentration with Matrix Elimination (MiPCT-ME)

Columns

Metrosep C 4 - 250/2.0	6.1050.230
Metrosep C 4 Guard/2.0	6.1050.600
Metrosep C PCC 1 HC/4.0	6.1010.310

Solutions

Eluent (inline eluent preparation)	2.5 mmol/L nitric acid 0.5 mmol/L <u>oxalic acid</u>
Liquid handling	Ultrapure water

Analysis

Direct conductivity detection

Parameters

Flow rate	0.4 mL/min
Injection volume	1.0 mL
P _{max}	25 MPa
Recording time	18 min
Column temperature	32 °C

Instrumentation

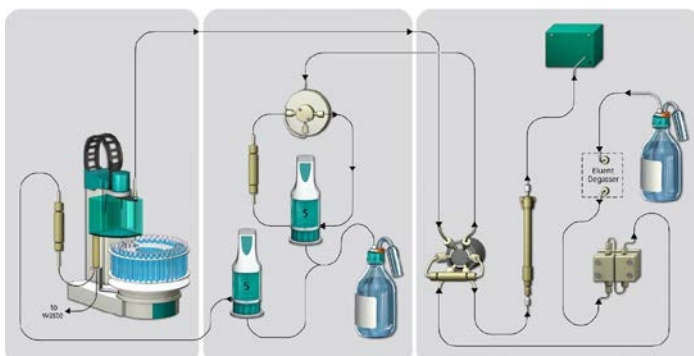
850 Professional IC Cation	2.850.1010
IC Conductivity Detector	2.850.9010
858 Professional Sample Processor	2.858.0010
2 x 800 Dosino (liquid handling)	2.800.0010
849 Level Control for Inline Eluent Preparation	2.849.1030

Calibration MiPCT-ME

Calibration range	Factor of 20
Standard solution:	
All cations	20 µg/L
1. Level	50 µL = 1.0 µg/L
2. Level	100 µL = 2.0 µg/L
3. Level	250 µL = 5.0 µg/L
4. Level	500 µL = 10 µg/L
5. Level	750 µL = 15 µg/L
6. Level	1000 µL = 20 µg/L



Flow chart



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