



Analysis of Sea Water by ICP-MS

CETAC DSX 100 Matrix Elimination / Preconcentration System

Problem: Although the technique of ICP-MS is very powerful by virtue of its sensitivity and selectivity, one of the operational limitations is that of the total amount of dissolved solids which may be introduced into the system. This limitation comes about in part because samples may deposit condensate on the sampler cones over a prolonged analytical run causing signal changes and hence degrading the signal stability. The effect of such higher levels of dissolved salts may also be to cause polyatomic interferences on key target analyte elements. One particular example of this effect is in the determination of trace elements in heavier environmental samples such as seawater and borehole waters. In particular, the effect of oxide / hydroxide adduct ions of alkali and alkaline earth elements, common constituents in such natural samples, can effectively mask the determinations of most transition elements. Table 1 indicates the extent of these interfering ion species.

Solution: The use of the CETAC DSX 100 matrix elimination / preconcentration system effectively removes the majority of alkali and alkaline earth elements as well as chloride and sulfate ions from the sample, in this manner the sample can be stripped of matrix and presented to the instrument as a relatively clean solution.

Advantages:

- w Selective removal of most interfering ions from solution.
- w Elimination of cone blockage problems.
- w Retention of long-term calibration integrity.
- w Reduction in polyatomic ion interferences.
- w Access to key target elements.
- w Capability to analyze high levels of dissolved solids.
- w Capability to preconcentrate for further enhancement of detection limits.
- w Off-line sample processing for maximum productivity.

Analytes and matrix types: Applicable to matrices of alkali and alkaline earth elements such as sea waters, brines, deep bore hole waters etc. Selective imino diacetate (IDA) functionality bonded onto microparticulate beads (Solid Phase Reagent SPR) can be used to retain transition metals, heavy metals, rare earths and some actinides thus allowing the matrix ions to be removed. The selectivity of IDA is shown on the periodic table opposite.

eliminated and c) throughput is improved. Results illustrated in this report demonstrate the effectiveness of the technique for the most difficult of environmental samples, seawater. In this manner the previous limitation on total dissolved solids with ICP-MS is eliminated and the flexibility of the ICP-MS technique can now be fully utilized for this difficult matrix.

Isotope	Cl	Ca	Na	K	Ar
V51	35ClO				
Cr 52	35ClOH				ArC
Cr53	37ClO				
Mn55			23NaO2	39KO	ArNH
Fe56		40CaO		39KOH	ArO
Fe57		40CaOH			ArOH
Ni58		42CaO			
Co59		42CaOH, 43CaO			
Ni60		44CaO, 43CaOH			
Cu63			ArNa		
Zn 64		48CaO			
Cu65		48CaOH			
Zn67	ClO2				

Table 1. Major interferences of alkali and alkaline earth adduct ions on transition metal isotopes in a typical seawater matrix.

Isotope	CASS- 3		NASS-4	
	Cert Value	Measured	Cert Value	Measured
Mn	2.51+/-0.36	2.72+/-0.04	0.38+/-0.023	0.403+/-0.01
Co	0.041+/-0.009	0.043+/-0.001	0.009+/-0.001	0.01+/-0.001
Ni	0.386+/-0.062	0.371+/-0.006	0.228+/-0.009	0.235+/-0.005
Cu	0.517+/-0.062	0.511+/-0.006	0.228+/-0.011	0.23+/-0.005
Zn	1.24+/-0.25	1.42+/-0.02	0.115+/-0.018	0.124+/-0.016
Cd	0.030+/-0.005	0.032+/-0.002	0.016+/-0.003	0.016+/-0.001
Pb	0.012+/-0.004	0.005+/-0.001	0.013+/-0.005	0.009+/-0.002
U			2.53 +/-0.04	2.68 +/-0.12

Table 2. Analysis and recoveries of trace elements in seawater reference materials.

Instrumentation: CETAC DSX 100 preconcentration and matrix elimination system.

Procedural Parameters: 10uL of 10% SPR-IDA reagent per 10mL of seawater.
pH adjusted to 8.0 with high purity NH_4OH .
Concentrate of beads and analyte eluted with deionized water @ pH 8.
Analytes determined by ICP-MS.