Detection Limits in Methanol

Method ID: N/A **Category: Industrial** **Technique: ICP-OES**

Summary

The determination of trace elements in volatile organic solvents is challenging by ICP. Volatile organic solvents have much higher transport efficiencies than those observed with aqueous samples and can overload and extinguish the plasma. This technical note demonstrates the use of an Ultrasonic Nebulizer coupled with a Membrane Desolvator to run a volatile solvent on the Teledyne Leeman Labs Prodigy Plus ICP-OES system.

Instrumentation

Teledyne Leeman Labs Prodigy Plus High Dispersion ICP in Axial-View Configuration, equipped with Halogen Option. Teledyne CETAC U6000AT+ Ultrasonic Nebulizer & Membrane Desolvator.

Method Parameters

Prodigy Plus Method Parameters	
Parameter	**Value**
RF Power	1.2 kW
Coolant Flow	16 L/min
Auxiliary Flow	0.5 L/min
Nebulizer Pressure	30 psi
Uptake Rate	60 rpm (~2 mL/min)
Torch	Demountable 2.5 mm bore
Integration Time	60 s
Ultrasonic Nebulizer Parameters	
Heating Temp	140 °C
Cooling Temp	3 °C
Mem. Des. Heat Temp	160 °C
Sweep Gas Flow	1.79 L/min

Calibration

Element	Std0, mg/L	Std1, mg/L
K, Cl	0	10.0
Si	0	0.5
All Remaining	0	1.0

Results

After calibration, one Analytical Reagent (ARG) grade methanol sample and one HPLC grade methanol sample were analyzed. Detection Limits were calculated for both grades by running each sample five times with three replicates. The standard deviation was then multiplied by 3 to determine the detection limits.

The results of the five samples were averaged to determine the detection limit.

	ARG		HPLC	Specification
	µg/L		µg/L	µg/L
Ag 338.289	0.15		0.36	≤ 20.0
Al 167.079	0.99		0.74	≤50.0
As 193.759	4.4		6.0	≤5.0
Au 267.595	1.5		1.1	≤20.0
B 208.890	4.2		3.2	≤10.0
Ba 455.403	3.7		0.10	≤20.0
Ca 317.933	1.6		0.71	≤50.0
Cd 214.441	0.98		0.75	≤20.0
Co 236.379	2.0		1.4	≤20.0
Cr 283.563	1.1		0.55	≤20.0
Cu 324.754	1.4		0.78	≤10.0
Fe 259.940	1.6		0.86	≤50.0
Ga 403.299	2.5		1.1	≤50.0
Ge 265.117	1.5		3.1	≤50.0
K 766.491	2.2		3.4	≤50.0
Li 670.784	0.85		0.41	≤50.0
Mg 279.553	1.3		0.75	≤50.0
Mn 257.610	1.5		0.69	≤10.0
Mo 281.615	1.2		0.81	≤300.0
Na 589.592	0.62		0.69	≤50.0
Ni 231.604	1.7		1.6	≤50.0
PO_4 178.283	12		12	≤100.0
Pb 220.353	5.0		4.0	≤50.0
SO_4 180.731	17		31	≤100.0
Sb 217.581	1.8		1.3	≤5.0
Si 251.611	4.8		3.9	≤50.0
Sn 189.991	23		14	≤50.0
Sr 407.771	0.09		0.07	≤10.0
Ti 334.941	0.36		0.17	≤20.0
V 310.230	0.52		0.44	≤300.0
Zn 202.548	1.8		1.0	≤50.0
Zr 339.198	0.19		0.07	≤300.0
Cl 134.720	203		208	≤100.0

Conclusion

The Teledyne Leeman Labs Prodigy Plus ICP combined with the Teledyne CETAC U6000AT+ successfully performed direct analysis of highly volatile organic solvents, such as methanol. Because of the robust plasma generated by the free-running 40.68 MHz generator, no dilution of the solvent was necessary. As a result, excellent detection limits were achieved with minimal sample preparation.