Application Brief

Energy and Chemicals

Agilent

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Elemental Analysis of Crude, Used Engine, and Hydraulic Oils by Radial View (RV) ICP-OES

Evaluating a fully demountable torch for semi-volatiles using the Agilent 5800 RV ICP-OES

Easy maintenance and lower running costs

Agilent Easy-fit fully demountable ICP-OES torches are simple to install and remove for quick and straightforward setup. They are also available with a choice of injector sizes and materials. The injector is removable, enabling quick changeover of injectors for torch maintenance or the analysis of different sample matrices. A fully demountable torch is now available for the analysis of semi-volatile organic samples using radial viewing with a dedicated RV ICP-OES. The torch includes a 1.4 mm ID quartz injector with an optimized geometry to minimize injector blockages and a high purity quartz outer tube to maximize its lifetime.

An Agilent 5800 RV ICP-OES fitted with a standard double-pass spray chamber and a glass concentric slurry nebulizer was used to analyze crude and used oil samples using the operating parameters in Table 1. Samples were introduced to the 5800 using an integrated AVS 7 switching valve and an Agilent SPS 4 autosampler.

Table 1. 5800 ICP-OES operating parameters.

Parameter	Setting	Parameter	Setting
RF Power (kW)	1.30	Pump Tubing (Sample & Internal Standard)	PVC Solvaflex black-black
Plasma Gas Flow (L/min)	12.0	Internal Standard	25 µg/g Co in A-Solv ICP solvent
Auxiliary Gas Flow (L/min)	1.40	Oxygen Injection	Not required
Viewing Mode (Height, mm)	Radial (7)	Pump Rate – Uptake (mL/min)	19
Nebulizer Gas Flow (L/min)	0.55	Pump Rate – Inject (mL/min)	3.9
Replicates/Read Time (s)	3 / 3	Valve Uptake Delay (s)	6
Stabilization Time (s)	12	Injection Time (s)	2
Rinse Time (s)	0	Injection Loop (mL)	1

Performance with used engine oils

Used engine oils were analyzed following ASTM standard test method D5185-18. The method was validated by analyzing a series of elements at 5 mg/kg in a metallo-organic standard diluted 1:10 in Agilent A-Solv ICP solvent. This standard was measured after every 20 used oil samples. Excellent long-term stability was achieved over 8 hours (Figure 1). Periodic recalibration or reslope was not required, as all measurements were within ±10% of the expected value.

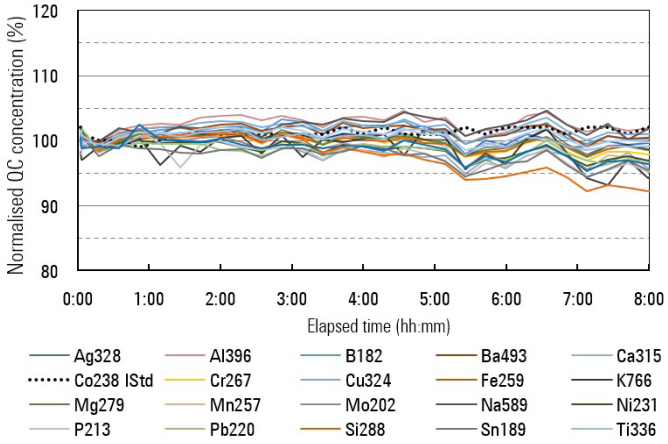

Figure 1. Long-term stability for the metallo-organic standard measured after every 20 used oil samples over 8 hours.

Performance with used hydraulic oils

A used hydraulic oil, diluted 1:10 with Agilent A-Solv ICP solvent, was also measured using the same method. Twenty elements in the spiked sample were measured repeatedly using Co as the internal standard. The normalized concentration of more than 560 samples analyzed continuously over 8 hours were within ±10% (Figure 2). The quartz injector showed no sign of blockage at the end of this extended analysis.

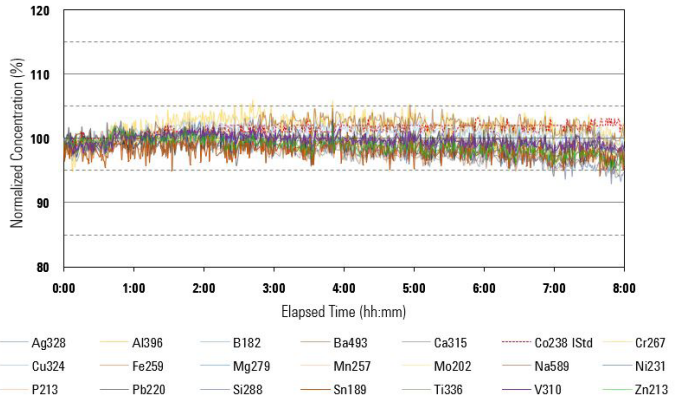

Figure 2. Normalized concentration for a spiked sample of used hydraulic oil measured continuously over 8 hours per ASTM D5185.

Performance with three crude oil samples

Three crude oil samples of three different viscosities (21–41 °API) were analyzed following ASTM standard test method D5708-15(2020). The crude oil samples were then spiked with 5 mg/kg each of Fe, Ni, and V and reanalyzed. The spike recoveries were all within ±10%, as shown in Figure 3.

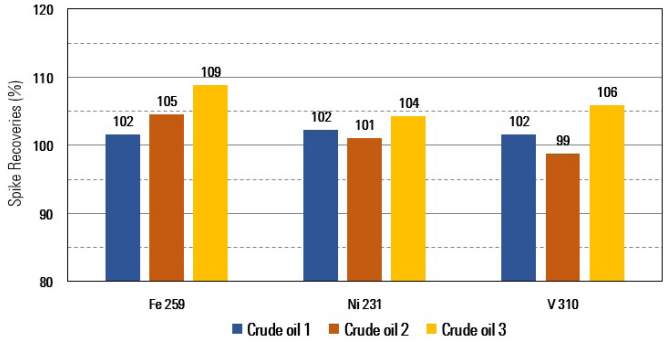

Figure 3. Spike recoveries for Fe, Ni, and V in three different crude oils.

Easy-fit fully demountable RV torch

The results obtained for engine, hydraulic, and crude oil samples demonstrate the excellent robustness and flexibility of the Easy-fit fully demountable RV torch with 1.4 mm ID injector. The injector is simple to remove for cleaning or maintenance, reducing downtime. This fully demountable torch is recommended for labs running multi-element analysis in organic matrices using Agilent radial 5100/5110 and 5800/5900 ICP-OES.

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