

ASTM Crude Oil Proficiency Testing Program: ICP (D5708B) vs. XRF (D8252) for Ni and V

PROBLEM

Crude oil can naturally contain metals like nickel (Ni) and vanadium (V). These metals need to be monitored due to their negative effects on refining processes. NYMEX regulations for these elements in sweet crude specify nickel and vanadium to be less than 8ppm and 15ppm, respectively, using ASTM D5708B (decomposition, ashing, and ICP analysis, similar to IP 501). However, the scope for D5708B does not cover the NYMEX levels for these elements.

SOLUTION

ASTM D8252 is an X-ray Fluorescence (XRF) method that is gaining traction in the industry. The D8252 scope goes considerably lower than the D5708 method, thus better covering the NYMEX specifications.

ASTM Method Scope (mg/kg)		
	Ni	V
D5708B	10-100	50-500
D8252	2.2-50	1.9-50

BENEFIT

The ASTM crude oil (CO) Proficiency Testing Program (PTP) data demonstrates that D8252 has excellent correlation with D5708B and significantly better reproducibility. This combined with the much simpler sample preparation and measurement time, makes D8252 not only a highly effective screening tool, but an effective method overall.

CO PTP Data Comparison:

Figures 1 & 2 compare average concentration and reproducibility for D5708B and D8252 data in the March 2021- July 2023 ASTM CO PTP. The graphed lines represent the average elemental concentration, and graphed bars represent data reproducibility for each program cycle using D5708B or D8252.

- The correlation between the D8252 average concentration (orange lines) and the average D5708B concentration (blue lines) is very good, but D5708B consistently biases low.
- D8252 (orange bars) has better reproducibility than D5708B (blue bars).
- D8252 will always provide results that are the TOTAL elemental concentration. Whereas D5708B, due to complex, multi-step sample preparation (decomposition with acid, drying, ashing, then digesting and reconstituted with acid), may often provide poorer precision and a lower result due to incomplete sample digestion and recovery.

Figure 1. CO PTP D5708B vs. D8252 Nickel (mg/kg)

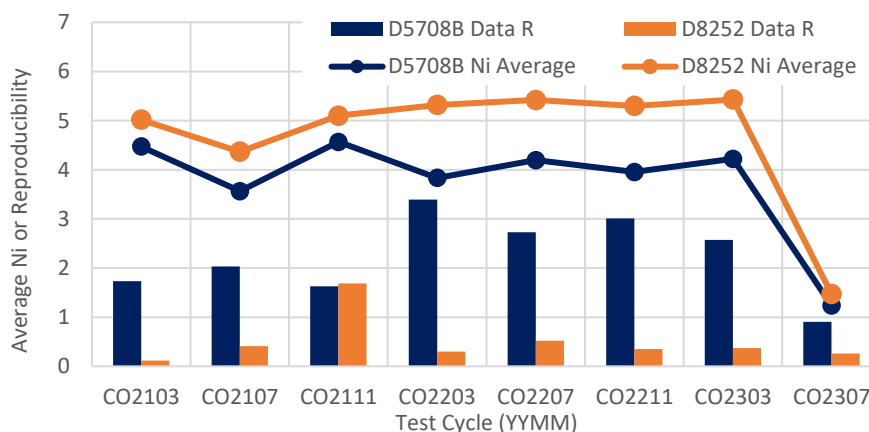
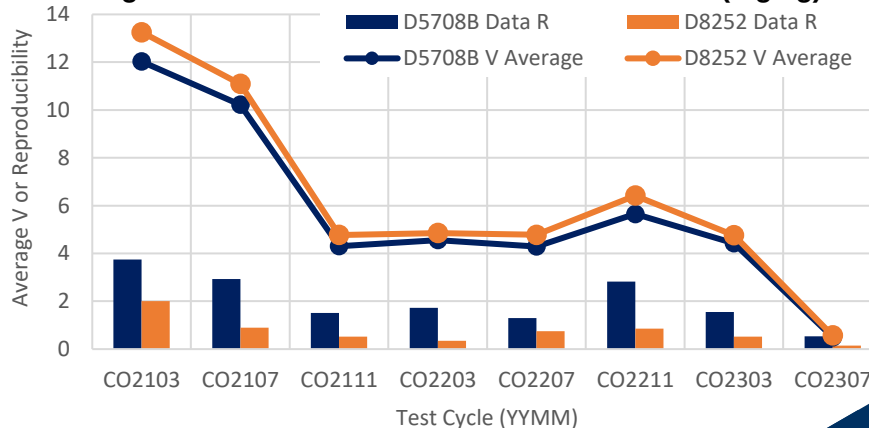


Figure 2. CO PTP D5708B vs. D8252 Vanadium (mg/kg)



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