# Matrix Correction Methods for XRF Analysis of Oils

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Fluorescent X-rays emitted from elements in a sample can be absorbed or enhanced by coexisting elements known as “matrix effect”. Quantifying the concentration of an analyte on a pre-calibrated system based on the observed intensities therefore requires taking into account the amount of matrix effect for accurate results (matrix correction). For example, accurate chlorine quantification in crude oils which can have varying amount of sulfur (several percent) requires correction for strong sulfur absorption due to its absorption edge being close to Cl Kα. For the analysis of chlorine, phosphorous and sulfur in lubricating oils or greases, overlap correction for accurate results is necessary if molybdenum is used as an additive [(1)]. The carbon to hydrogen ratio (C/H) and oxygen content is known to affect X-ray intensities of analyte measurement lines as well [(2)].

In the presentation, various matrix correction methods for oils including several prescribed by standard test methods will be discussed [3, 4, 5]. Some results on C/H correction as prescribed by ASTM D2622 will be presented as well.

References

1. ASTM D6443-14. (**2014**). “Standard Test Method for Determination of Calcium, Chlorine, Copper, Magnesium, Phosphorus, Sulfur, and Zinc in Unused Lubricating Oils and Additives by Wavelength Dispersive X-ray Fluorescence Spectrometry (Mathematical Correction Procedure),” ASTM International.
2. ASTM D2622-16. (**2016**). “Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry,” ASTM International.
3. K. Kawakyu, A. Morikawa, K. Watanabe, Y. Yamada, Y. Kataoka (**2016**). “C/H and O Correction by a Scattered X-ray Internal Standard for XRF Analysis of Oils,” Adv. X-ray Anal. 59, 65-76.
4. ASTM D5059-14. (**2014**). “Standard Test Methods for Lead in Gasoline by X-Ray Spectroscopy,” ASTM International.
5. ISO 15597:2001 (**2001**). “Petroleum and related products – Determination of chlorine and bromine content – Wavelength-dispersive X-ray fluorescence spectrometry,” International Organization for Standardization.