

DETERMINATION OF EDXRF DETECTION LIMITS OF AIR SAMPLES WITH CUSTOM LOW-LOADED MULTI-ELEMENTAL REFERENCE MATERIALS

Krystyna Trzepla, Sinan Yatkin, Warren White, Nicole Hyslop
Air Quality Research Center, University of California, Davis, CA, 95616, United States
Contact Author: ktrzepla@ucdavis.edu

The new approach to generate and utilize multi-elemental reference materials (MEs) on PTFE filters with mass loadings as close to estimated Method Detection Limits (MDLs) as possible, is presented in this study.

The MEs containing 28 elements are generated using aerosol deposition system at the University of California-Davis (UCD)^{1,2}. The derived EDXRF (Panalytical Epsilon5, Almelo, The Netherlands) MDLs based on MEs (MDL_{ME}) and calculated laboratory blanks-based MDLs (MDL_{LB}) are reported and compared based on the following methodology:

1. The laboratory blanks-based MDL (MDL_{LB}) is initially calculated using Eq.1:

$$MDL_{LB} = \overline{X_{LB}} + t_{(n-1, 1-\alpha=0.99)} \times SD_{LB} \quad (1)$$

where, $\overline{X_{LB}}$ is the mean of n laboratory blanks (208 blanks in this study), SD_{LB} is sample standard deviation of those results, and $t_{(n-1, 1-\alpha=0.99)}$ is the student's t value appropriate for a 99% confidence level with n-1 degrees of freedom (2.326).

2. Multiple MEs are generated at loadings 3 to 5 times higher than MDL_{LB} . These MEs are analyzed on different days, and ME-based MDL (MDL_{ME}) is calculated using Eq.2:

$$MDL_{ME} = t_{(m-1, 1-\alpha=0.99)} \times SD_{ME} \quad (2)$$

where m is the number of replicated measurements of MEs (m=10)

3. The higher value of MDL_{LB} and MDL_{ME} is reported as MDL.

The proposed methodology yielded similar MDL_{LB} and MDL_{ME} (abs. relative difference $\leq 25\%$) for Co, Ni, As, Se and Pb. The MDL_{LB} was lower than MDL_{ME} for Na, Mg, S, and V. whereas was higher for Al, Ca, Cr, Mn, Fe, Cu, Zn and Sr, due to random contamination on blanks and variable spectral contamination from analyzer's components.

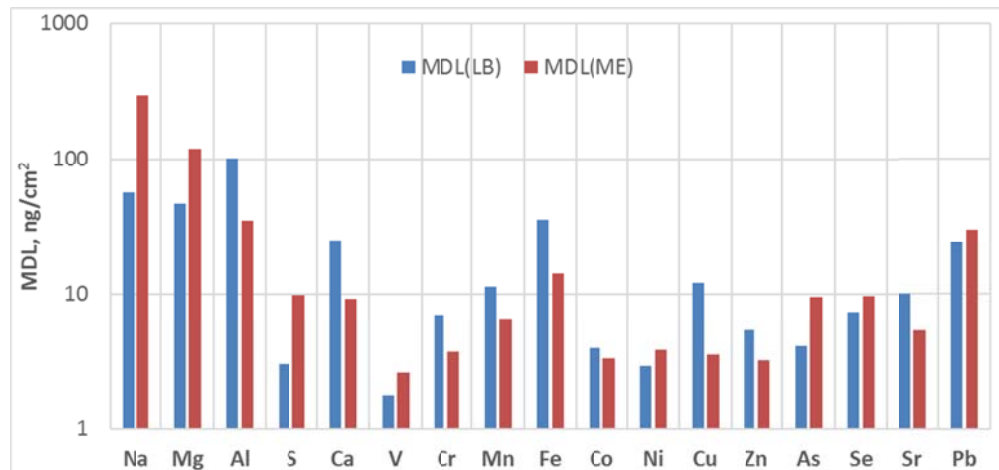


Fig.1. MDL_{LB} s and MDL_{ME} s for selected elements calculated following the proposed methodology.

[1] Indresand, H.; White, W. H.; Trzepla, K.; Perley, B. P.; Dillner, A. M., *X-ray Spectrom.*, 2012

[2] Yatkin, S.; Amin, H. S.; Trzepla, K.; Dillner, A. M., *Aerosol Sci & Technol.*, 2016