

## QUANTIFICATION OF CADMIUM, MERCURY AND LEAD IN AQUEOUS SAMPLE BY ENERGY K X-RAY FLUORESCENCE SPECTROSCOPY

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A K x-ray energy dispersive x-ray fluorescence (EDXRF) system was used to simultaneously quantify multiple volatile and semi-volatile heavy metals in aqueous samples with no sample preparation. The EDXRF system consisted of a 31 MBq (1/2001)  $^{57}\text{Co}$  excitation source together with a Low Energy Germanium (LEGe) semiconductor detector coupled with standard NIM electronics and data acquisition system. Energy resolution (FWHM) of the x-ray spectrometer was 0.86 keV at 122.1 keV. The K X-ray fluorescence from cadmium, mercury and lead at concentrations ranging from 0 to 200 mg/L for mercury and 0 to 400 mg/L for cadmium and lead were investigated. Mixed acidified solutions were prepared based on the ratio of mercury to cadmium and lead at 1:2, 1:4 and 1:8. The 100-mL samples were directly presented to the detection system without any sample pretreatment. The source-sample-detector geometry was such that the sample is positioned between the collimated excitation source and LEGe, which are oriented perpendicular to one another. Metal quantification was based on K x-ray net peak areas. The relationship of individual metal concentration and K x-rays fluorescence peaks were found to be linear within the concentration range of this study. Calibration curves were determined for each metal solution and applied to mixtures of metals. The minimum detectable levels at 95% confidence level for cadmium, mercury and lead were 0.23, 0.71 and 0.78 cps, which correspond to 51.4, 28.0 and 29.0 mg/L, respectively. The K x-rays from cadmium did not interfere with the K or the L x-rays from mercury and lead. Spectral overlap of the mercury  $\text{K}_{\alpha 1}$  x-ray with the lead  $\text{K}_{\alpha 2}$  x-ray (energy difference 1.97 keV) was observed, but was not significant if the difference in concentration is less than a factor of 10. If higher concentration differences exist, the spectral overlap can be overcome by either spectral deconvolution or analytical correction.