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CALCIUM INTERFERENCE IN CADMIUM ANALYSIS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY

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A wide range for the cadmium content of milk has been reported in the past (1 and references therein) varying from 0.09 parts per billion (ppb) to 0.1 parts per million (ppm) for fluid milk. In the articles cited which employed atomic absorption spectrophotometry, no mention was made of interferences due to light scattering. Murthy (2) states that,"Information available in the literature indicated that many of the cations and anions normally encountered do not interfere in the analysis for ...Cd...". Billings (3), however, showed that calcium, a major component of milk, can exhibit interference in atomic absorption analysis, depending on the flame employed. Billings (3), and Murthy and Rhea (2) both employed relatively cool flames which aggravate the problem of light scattering by calcium. Slavin commented on the effect of the flame on light scattering (4). Milk has an average of 1.25 g Ca per ter (5). With this and the data from Figure 4 of illings' paper (3), calculations show that in a flame such as propane-air, light scattering by calcium will result in an apparent cadmium content of about 0.03 ppm when analyzing for cadmium with a hollow cathode lamp and direct aspiration of dissolved ash solution. Murthy and Rhea reported 0.017 to 0.030 ppm cadmium in market milk. As Billings has shown, calcium can be a strong light scatterer, and the result of any work which does not take this into account should be viewed with caution.

References:

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3. Billings, G.K. 1965. Light Scattering in Trace-Element Analysis by Atomic Absorption. Atomic Absorption News-Letter 4:357.
4. Slavin, W. 1965. Comments on "Light Scattering in Trace-Element Analysis." Atomic Absorption News-Letter 4:361.
5. Jenness, Robert and Stuart Patton. 1959. Principles of Dairy Chemistry. John Wiley and Sons, New York, New York.

RECENT PUBLICATION

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TIPS FOR ANALYSTS

If you analyze solutions prepared with the aid of pipets fitted with plastic disposable tips then Sommerfeld, Love and Olsen (1) have a tip for you. Your solutions may be contaminated with the metals leached from the disposable plastic tip.

In an initial survey of the amounts of Cu, Co, Mo, Fe, Zn, Cr, Mn, Pb and Cd that could be leached with 1% HCl from these pipet tips, in pipetting, Sommerfeld et al. found that large quantities of Fe and Zn were removed from the tips and contaminated the solutions being prepared for analysis. Six different types of plastic disposable tips were studied and the range of Zn concentrations obtained from them was 0.1 to 20 ug/l. However, several combinations of acid and distilled water rinses revealed that the contaminating Zn could be relatively easily removed from all of them. With regard to Fe, non-detectable to 20 ug/l could be leached from these pipets. Rinsing removed essentially all of the Fe from most of them. However, the concentration was only reduced in one of them and another delivered an 8-fold increase after rinsing.

Rinsing time was also shown to be an important factor. Larger quantities of the contaminating metals were removed from these tips when the rinse solution was held in the tip for longer times before dispensing. Decreasing the time of rinsing decreased the efficiency of removal of the contaminant metals.

It was also reported that contact of empty rinsed tips with the cool graphite tube gave detectable levels of Fe, which was related to the amount of tip contact. This problem was eliminated by increasing the aperture of the injection port.

How old is your Pb lamp? If you use atomic absorption spectrophotometry to analyze for Pb this is an important question. Murphy and Stockton (2) have recently pointed out that the use of old Cu-Pb-Ag-Zn lamps give unreasonably high values for the concentration of Pb when Mg is present in the sample. The source of this interference was the presence of Mg in the lamp element alloy which produced an emission absorbed by Mg in the sample.

These two papers, in addition to many many others, provide support for the usefulness of evaluating recovery of the analyte in the routine application of atomic absorption spectrophotometry. With recovery studies a little time and effort is spent in producing data of value as opposed to data of very little value obtained without such studies. It would seem that if researchers refuse to take this responsibility then referees must exert their authority to insure the quality of published data.

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1. Sommerfeld, M.R., Love, T.D. and Olsen, R.D. 1975. Trace metal contamination of disposable pipet tips. Atomic Absorption Newsletter, 14:1:31-32. Jan.-Feb.
2. Murphy, J. and Stockton, H. 1975. Magnesium interference in the atomic absorption determination of lead. Atomic Absorp. Newsletter, 14:2:40-41, Mar.-Apr.