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An Investigation of the 2833Å Lead Line

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I N T R O D U C T I O N

In the lower wave length region, particularly below 2500Å, the AAS read-out is rather unstable because light from the burner flame itself is affecting the phototube. The most sensitive line for both zinc and lead are in this "unstable wave length region"; zinc at 2139Å and lead at 2171Å. There is no other known analytical absorption line for zinc, but lead has a line at 2833Å that needed to be investigated for its utility. The 2833Å lead line is the subject of this report.

P R E F E R R E D M A C H I N E O P E R A T I N G P A R A M E T E R S

The preferred machine operating parameters for the two lines were determined and were found to be as shown in table 1.

Table 1
PREFERRED MACHINE OPERATING PARAMETERS

Line	Slit Width	Acetylene	Air	Gain	Lamp Current, ma
2171Å	200µ	2.5	23	10	4
2833Å	100µ	2.5	23	7	4

E X P E R I M E N T A L P R O C E D U R E A N D D A T A O B T A I N E D

Three lead-containing samples at high (~27,000 ppm), intermediate (~6,600 ppm), and low (~20 ppm) lead were selected. Six aliquots of each digest were appropriately diluted for analysis of lead.

The following tests were made: each of the 18 samples were analyzed at both the 2833Å and the 2171Å lead lines. The relative error was determined for each line by calculating the standard deviations and the coefficients of variation. The "low lead" sample was diluted to 1/5, 1/10, and 1/20 of its original concentration to determine the detection limit for each of the lines. The sensitivity was determined by finding the concentration required to yield 50% absorption on the read-out.

Table II shows the statistical data from the replication tests. From the analytical line in the normal and the 5X scale expansion modes the sensitivity (the ppm required to produce 50% absorption) was determined to be as follows:

LINE	NORMAL MODE	5X SCALE EXPANSION MODE
2833Å	35.0 ppm	5.0 ppm
2171Å	15.0 ppm	2.5 ppm

The dilution series allowed an estimate of the detection limits for the two lines. It was found that the detection limit for the 2171Å line, if defined as that yielding 1% absorption, is 0.5 ppm Pb; a similar definition for the 2833Å line yielded 1.0 ppm Pb. Both the above definitions are statements of the detection limit for lead "in the sample" using ten grams of sample brought to 100 ml of solution. Therefore, the detection limit in the solution would be 1/10 of those stated. The coefficients of variation for each line at the three dilution levels were determined by replicate readings. The results are shown in table III.

C O N C L U S I O N S

The experimental data shows very little difference in the precision of the two lines. There is probably a slightly higher precision obtained on the 2833Å line. The 2171Å line is about twice as sensitive as the 2833Å. That advantage, however, is reduced because of the less stable character of the 2171Å line. The 2833Å line is much more "comfortable" to use because of its higher stability. Should one be working for maximum sensitivity the 2171Å line may be a better choice. For routine analyses we would choose the 2833Å line.

Table II
STATISTICAL DATA OBTAINED

SAMPLE	PPM SAMPLE, DETERMINED 2171Å	PPM SAMPLE, DETERMINED 2833Å	N	STANDARD DEV., PPM 2171Å	STANDARD DEV., PPM 2833Å	COEFFICIENT OF VAR. 2171Å	COEFFICIENT OF VAR. 2833Å
302- 1	25,600	26,800					
2	25,300	27,200					
3	25,000	26,400					
4	25,500	27,200					
5	25,300	27,500					
6	25,000	26,500					
	$\bar{X}$=25,283	$\bar{X}$=26,933	6	237	323	1.1%	1.2%
294- 1	6125	6660					
2	6325	6525					
3	6250	6625					
4	6075	6800					
5	6000	6660					
6	6300	6675					
	$\bar{X}$=6188	$\bar{X}$=6658	6	128	56	2.1%	0.9%
956- 1	18.0	20.8					
2	19.0	21.4					
3	19.5	22.4					
4	18.5	21.0					
5	19.0	21.0					
6	19.0	20.9					
	$\bar{X}$=19.0	$\bar{X}$=21.2	6	0.6	0.6	3.1	2.8

Table III
DIGESTION LIMIT DATA

DILUTION	PPM CALCULATED TO SAMPLE	N	COEFFICIENT OF VARIATION 2171Å	COEFFICIENT OF VARIATION 2833Å
1/5	3.9	6	9%	11%
1/10	2.3	6	20%	21%
1/20	1.4	6	64%	19%