Direct determination of Cd in NaCl containing metallothionein fractions of different red mullet tissues by GF-AAS

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Table 1. Precision and recovery of Cd measurement in standard solutions of Cd in 0.9% NaCl (n = 10)

Concentration of Cd, µg/L	Mean measured Cd concentration, µg/L	SD µg/L	RSD %	Recovery %
0.050	0.041	0.006	13.5	82.0
0.050	0.055	0.004	7.6	110.0
0.150	0.150	0.004	2.8	100.0
0.300	0.309	0.007	2.4	103.0
0.500	0.508	0.009	1.7	101.6
0.800	0.793	0.018	2.3	99.1
1.000	1.044	0.013	1.2	104.4
1.150	1.160	0.073	6.3	100.9

Table 2. Precision of Cd measurement in heat-treated cytosol (S50) of different red mullet tissues (n = 10)

Tissue sample	Mean measured Cd concentration, µg/L	SD µg/L	RSD %
Brain sample 1	0.068	0.006	8.7
Brain sample 2	0.115	0.005	4.4
Brain sample 3	0.129	0.005	3.9
Liver sample 1	0.387	0.006	1.6
Liver sample 2	0.644	0.006	1.0
Liver sample 3	0.517	0.008	1.5
Kidney sample 1	0.420	0.010	2.3
Kidney sample 2	0.469	0.007	1.5
Kidney sample 3	0.222	0.011	4.8
Intestine sample 1	0.464	0.009	1.9
Intestine sample 2	0.333	0.007	2.2
Intestine sample 3	1.064	0.008	0.7
Intestine sample 4	0.228	0.005	2.1

Table 3. Recovery of Cd in spiked heat-treated cytosol of different red mullet tissues. The samples were spiked in such a way that one volume of sample was mixed with one volume of appropriate standard solution.

Tissue sample	Cd sample concentration µg/L (*n=10; **n=5)	Cd standard solution concentration µg/L	Expected Cd concentration in spiked sample µg/L	Measured Cd concentration µg/L n = 5	RSD %	Recovery %
Brain sample 1	*0.068 ± 0.006	0.150	0.109	0.160 ± 0.007	4.7	146.8
Brain sample 2	*0.115 ± 0.005	0.300	0.208	0.220 ± 0.010	4.7	105.8
Brain sample 3	*0.129 ± 0.005	0.300	0.215	0.227 ± 0.007	3.0	105.6
Brain sample 4	**0.138 ± 0.006	0.300	0.219	0.215 ± 0.005	2.4	98.2
Brain sample 5	**0.080 ± 0.003	0.300	0.190	0.200 ± 0.005	2.3	105.3
Brain sample 6	**0.075 ± 0.007	0.150	0.113	0.126 ± 0.004	3.1	111.5
Liver sample 1	*0.387 ± 0.006	1.150	0.769	0.844 ± 0.016	1.9	109.8
Liver sample 2	*0.644 ± 0.006	1.400	1.022	0.984 ± 0.027	2.8	96.3
Liver sample 3	*0.517 ± 0.008	1.400	0.959	0.833 ± 0.020	2.5	86.9
Liver sample 4	**0.449 ± 0.004	1.400	0.925	0.863 ± 0.027	3.1	93.3
Liver sample 5	**0.835 ± 0.007	1.400	1.118	0.994 ± 0.040	4.0	88.9
Liver sample 6	**0.409 ± 0.004	1.150	0.780	0.734 ± 0.025	3.5	94.1
Kidney sample 1	*0.420 ± 0.010	1.150	0.785	0.793 ± 0.031	3.9	101.0
Kidney sample 2	*0.469 ± 0.007	1.150	0.810	0.800 ± 0.009	1.1	98.8
Kidney sample 3	*0.222 ± 0.011	0.500	0.361	0.384 ± 0.005	1.4	106.4
Intestine sample 1	*0.464 ± 0.009	1.400	0.932	0.937 ± 0.013	1.4	100.5
Intestine sample 2	*0.333 ± 0.007	1.000	0.667	0.687 ± 0.010	1.4	103.0
Intestine sample 4	*0.228 ± 0.005	0.800	0.514	0.511 ± 0.011	2.1	99.4

Figure captions

Figure 1. Cd and background signals obtained after addition of various volumes of EDTA (6.0 g L^{-1}), of two different pH values: a) pH of EDTA solution was ~4.5, and volume 5 μL; b) pH of EDTA solution was ~4.5, and volume 10 μL; c) pH of EDTA solution was ~4.5, and volume 15 μL; d) pH of EDTA solution was ~7.0, and volume 5 μL. All signals were obtained using solution of Cd in 0.9% NaCl (c_{Cd} = 1.5 μg L^{-1}).

Figure 2. Effect of atomisation temperature on Cd and background signals.
a) ▲ Slope of a calibration straight line created using bulk standard solution of Cd in 0.9% NaCl (c_{Cd} = 0.8 μg L^{-1}) and EDTA (pH ~7.0) as a modifier; Δ Background absorbance recorded at calibration zero.
b) ○ Cd concentration in heat-treated cytosol of red mullet kidney; ● Cd concentration in standard solution of Cd in 0.9% NaCl (c_{Cd} = 0.5 μg L^{-1}); □ Cd concentration in heat-treated cytosol of red mullet intestine.

Figure 3. Background signals recorded at calibration zero: a) signal obtained using blank solution of 0.9% NaCl with addition of EDTA; b) signal obtained using only blank solution of 0.9% NaCl, without addition of EDTA; c) signal obtained using Milli-Q water with addition of EDTA.

Figure 4. Calibration straight line created at 11 different occasions with addition of EDTA, using bulk standard solution of Cd in 0.9% NaCl (c_{Cd} = 0.8 μg L^{-1}) and heating program from Table 1.

Figure 5. The comparison of metallothionein level (MT) and background absorbance (BG) in heat-treated cytosol of four tissues of red mullet (K-kidney; IN-intestine; L-liver; B-brain). A small inserted figure represents linear regression graph illustrating high correlation between MTs and BG.

Figure 1.

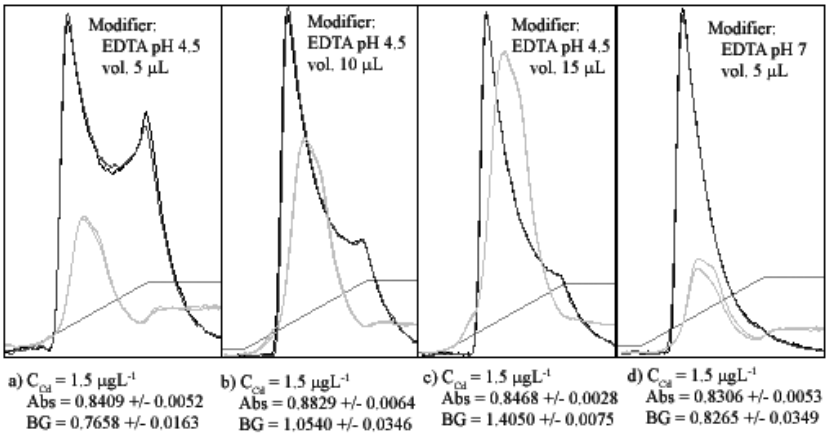

Figure 2.

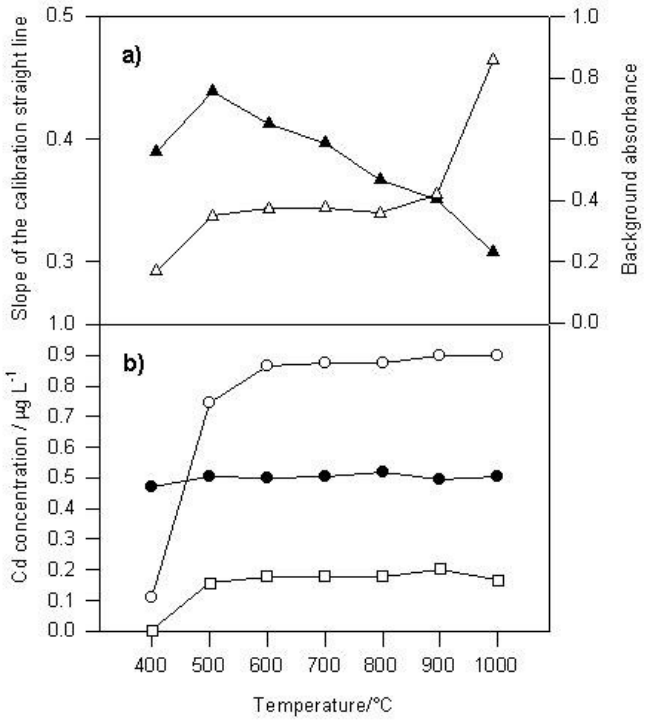

Figure 3.

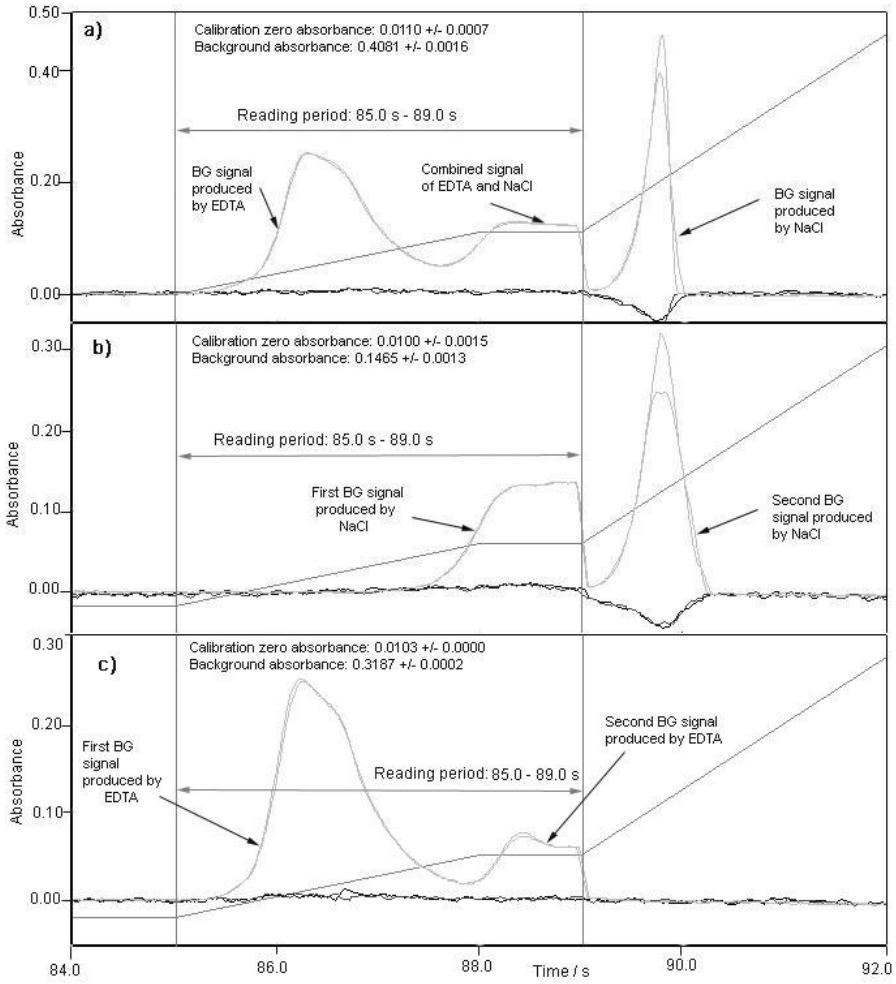
a)
Calibration zero absorbance: 0.0110 +/- 0.0007
Background absorbance: 0.4081 +/- 0.0016
Reading period: 85.0 s - 89.0 s
BG signal produced by EDTA
Combined signal of EDTA and NaCl
BG signal produced by NaCl
b)
Calibration zero absorbance: 0.0100 +/- 0.0015
Background absorbance: 0.1465 +/- 0.0013
Reading period: 85.0 s - 89.0 s
First BG signal produced by NaCl
Second BG signal produced by NaCl
c)
Calibration zero absorbance: 0.0103 +/- 0.0000
Background absorbance: 0.3187 +/- 0.0002
First BG signal produced by EDTA
Reading period: 85.0 - 89.0 s
Second BG signal produced by EDTA
Absorbance
Time / s
0.50
0.40
0.20
0.00
0.30
0.10
84.0
86.0
88.0
90.0
92.0

Figure 4.

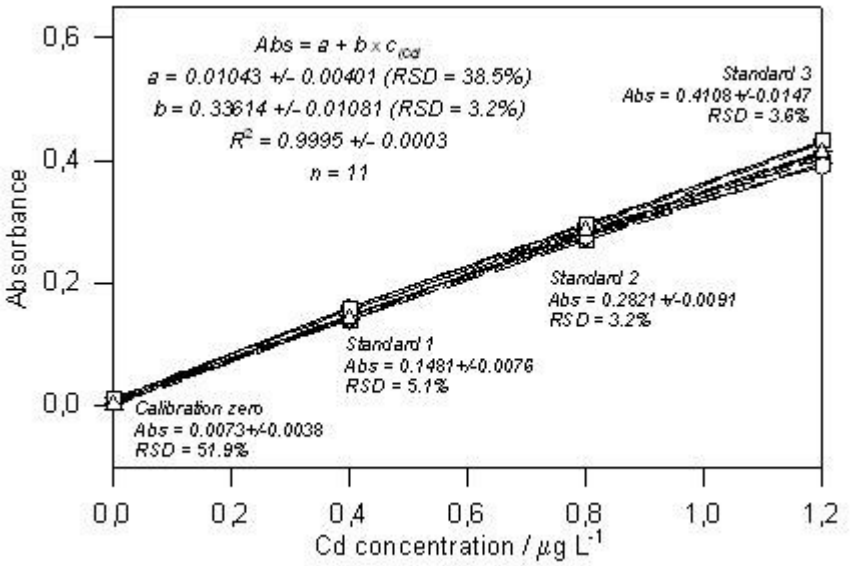

Figure 5.