

Supplementary material: Table S1, S2, S3, S4 and S5

**Table S1. Analytical features of some procedures using SS GF AAS to determine Cu, Fe and Zn.**

Metal	Sample	Linear range	LOD ( $\mu\text{g g}^{-1}$ )	Ref.
Cu	Mammalian cells	0.05 – 0.75 ng	0.048	This work
Fe	Mammalian cells	0.05 – 0.50 ng	0.024	This work
Zn	Mammalian cells	0.04 – 0.16 ng	0.0069	This work
Zn	Agriculture soil and vitamin complex	5-300 ng	4.1	39
Zn	Rice	1.75 – 2.25 mg	Down to 10	38
Fe	Rice	0.75 – 2.25 mg	Down to 10	38
Zn	Nuts	1 – 4 $\mu\text{g L}^{-1}$	0.001	41
Fe	Nuts	10 – 40 $\mu\text{g L}^{-1}$	0.0014	41
Cu	Nuts	20 – 80 $\mu\text{g L}^{-1}$	0.00072	41

**TABLE S2. Concentrations of Cu, Fe and Zn in U937 cells with the developed SS GF AAS method used in this work.**

Chelant Type	Chelant Concentration (mM)	Time (h)	Copper (ng/mg)	Iron (ng/mg)	Zinc (ng/mg)
DedTC	5	24	48.004	19.66022	145.6140
			48.731	19.00809	157.3480
			48.906	19.18155	138.3704
DedTC	5	48	21.447	18.65207	120.6512
			18.987	17.72051	117.2002
			20.702	20.11330	116.6188
DedTC	50	24	49.438	18.94730	143.0484
			50.845	18.86708	154.6436
			47.699	18.17197	145.5718
DedTC	50	48	25.294	21.03369	113.0637
			24.362	23.88148	109.2846
			26.286	19.08348	112.9599
Trien	5	24	1.965	22.81356	89.3202
			2.091	23.61021	83.6739
			2.092	23.06843	84.5169
Trien	5	48	3.936	20.58576	87.8342

			5.248	17.46327	88.9655
			5.734	19.59250	83.5146
Trien	50	24	0.432	28.47677	81.1688
			0.524	35.73231	80.4656
			---	30.95413	78.2286
Trien	50	48	0.947	18.47174	87.5913
			1.033	19.68670	88.4518
			0.904	22.27200	84.7400
TPEN	5	24	1.262	14.91566	82.5761
			1.010	14.42919	80.0973
			1.351	17.60279	83.2892
TPEN	5	48	0.237	23.98368	91.6305
			3.052	22.55148	91.3816
			1.782	20.15984	91.3178
TPEN	5	24	0.0	77.57174	24.3602
			0.0	71.77376	25.4247
			0.0	78.57917	23.3209
TPEN	5	48	0.0	57.79083	7.5040
			0.0	63.91309	5.0645
			0.0	64.83759	6.4349
Control		24	2.624	20.80696	80.6986
			2.990	23.29813	77.2253
			2.300	19.14557	75.8423
Control		48	5.381	21.65326	81.5965
			4.768	17.17902	82.4288
			4.993	22.72796	92.2379
			4.666	21.20926	77.3588

**Table S3. Analysis of Variance for the Copper Cubic Model**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Regression	11473.478	10	1147.348
Residual	24.690	24	1.029
Adjust Error	8.440	1	8.440
Pure Error	16.250	23	0.707
Total	11498.168	34	

% of the explained variation: 99.79

% of the maximum explained variation: 99.86

$MS_{REG}/MS_{RES}=1115, F_{10,24}=2.25$

$MS_{ADJ}/MS_{PURE}=11.94, F_{1,23}=4.28$

**Table S4. Analysis of Variance for the Iron Cubic Model**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Regression	12331.975	10	1233.198
Residual	125.423	25	5.017
Adjust Error	0.498	1	0.498
Pure Error	124.925	24	5.205
Total	12457.398	35	

% of the explained variation: 98.99

% of the maximum explained variation: 99.00

$MS_{REG}/MS_{RES}=245, F_{10,25}=2.24$

$MS_{ADJ}/MS_{PURE}=0.0957, F_{1,24}=4.26$

**Table S5. Analysis of Variance for the Zinc Cubic Model**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Regression	57822.238	10	5782.224
Residual	606.248	25	24.250
Adjust Error	271.432	1	271.432
Pure Error	334.816	24	13.951
Total	58428.486	35	

% of the explained variation: 98.96

% of the maximum explained variation: 99.43

$MS_{REG}/MS_{RES}=238, F_{10,25}=2.24$

$MS_{ADJ}/MS_{PURE}=19.46, F_{1,24}=4.26$