

Supplementary Material

An optimized approach for sample preparation and elemental analysis of extra-virgin olive oil by inductively coupled plasma mass spectrometry

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Table S1. Instrumental parameters and operating conditions for the ICP-OES instrument.

Radiofrequency power (KW)	1.0
Plasma gas flow (L min ⁻¹)	15
Nebulizer gas flow (L min ⁻¹)	0.75
Auxiliary gas flow (L min ⁻¹)	1.5
Observation view	Axial
Pump rate (rpm)	20
Rinse time (s)	20
Replicates	3
Replicates read time (s)	45
Stabilization delay (s)	40
Sample uptake delay (s)	30
Internal standard (emission line, nm)	Y 371.029
Element (emission line, nm)	C 193.027, C 247.856

Table S2. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 0.5 mL reagent mixture (A, B, C, D, E and F) for 10 min.

Element	WD, 10 min		0.5 mL A		0.5 mL B		0.5 mL C		0.5 mL D		0.5 mL E		0.5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-81.0	10.5	-95.6	10.3	-96.7	42.9	-96.3	23.9	-97.9	4.8	-92.7	5.3		
Al	-49.2	15.0	-13.8	8.9	-60.8	18.1	-85.6	27.9	-59.2	1.4	-23.9	3.4		
B	-44.1	9.3	-6.7	5.9	-64.6	15.4	-68.6	15.6	-19.2	4.2	-12.1	2.7		
Ba	-78.6	3.6	-61.7	1.6	-94.7	27.8	-89.9	5.8	-98.9	22.1	-79.5	9.6		
Ca	-43.8	9.8	13.6	6.2	-46.3	6.8	-69.8	8.5	-63.7	4.7	-14.8	3.1		
Cd	-55.3	17.3	-8.0	6.5	-63.5	14.4	-72.4	13.8	-64.2	6.7	-16.0	3.6		
Cr	-63.2	16.8	-30.6	8.1	-82.2	20.0	-95.2	30.1	-46.7	1.6	-61.0	0.9		
Cu	-46.7	14.5	11.9	7.0	-56.7	13.7	-68.5	14.1	-42.4	6.2	-6.5	4.1		
Fe	-51.0	8.7	-12.4	3.9	-56.3	10.0	-94.0	35.3	-73.2	2.8	-50.6	1.4		
Mg	-50.2	12.8	-7.1	5.3	-63.2	12.5	-68.3	10.1	-42.2	2.5	-9.1	1.3		
Mn	-47.8	10.5	-4.6	6.0	-57.7	10.9	-68.8	11.3	-54.6	3.7	-12.3	2.2		
Mo	-48.0	14.1	-14.9	7.4	-71.7	18.8	-85.9	31.9	-15.1	4.5	-28.2	4.9		
Na	-50.6	8.3	-41.6	4.8	-57.5	12.5	-71.0	9.3	-77.5	1.1	-14.3	1.3		
Ni	-49.3	14.1	-6.1	7.2	-62.9	15.8	-69.4	13.2	-50.0	5.2	-10.3	3.7		
P	nd		-99.1	81.0	nd		nd		nd		nd			
Pb	-55.2	14.5	-33.7	7.3	-90.1	28.2	-89.1	21.6	-98.6	35.5	-69.0	3.7		
Si	-92.5	65.2	-92.9	55.9	-93.2	42.9	nd		nd		-99.3	108.5		
Sn	-64.2	17.4	-60.5	7.1	-87.0	21.8	-96.1	35.8	-97.8	9.9	-87.3	2.8		
Ti	-56.5	10.5	-37.7	5.2	-90.0	20.9	-96.5	29.9	-85.7	6.9	-50.5	1.7		
V	-39.7	10.2	-6.1	6.0	-64.9	15.5	-80.5	23.4	-18.9	4.1	-17.8	4.5		
Zn	-56.7	16.1	-9.8	5.6	-63.3	12.9	-70.8	11.8	-53.2	4.9	-14.7	2.9		
USE, 10 min														
Ag	-78.8	9.1	-91.2	51.2	-89.7	78.5	-95.6	19.0	-98.1	4.5	-94.6	10.1		
Al	-42.5	20.0	-48.3	12.8	-35.8	23.0	-60.4	12.5	-97.3	17.0	-45.4	3.2		
B	-36.9	12.9	-48.4	11.0	-41.1	18.7	-36.8	14.8	-48.6	3.5	-31.7	7.3		
Ba	-86.8	17.4	-81.4	4.2	-73.8	11.2	-85.6	9.9	-98.7	0.4	-77.6	3.6		
Ca	-41.1	9.7	-44.7	7.5	-37.4	22.1	-45.9	5.2	-84.4	16.1	-39.0	5.4		
Cd	-46.4	13.7	-47.0	10.5	-40.0	23.2	-55.6	14.6	-94.4	2.0	-40.9	6.7		
Cr	-68.6	17.2	-76.0	12.6	-65.4	29.1	-90.5	1.3	-92.9	0.7	-83.0	3.3		
Cu	-37.1	12.8	-38.6	10.2	-32.8	22.2	-48.9	14.7	-92.6	6.5	-33.6	7.6		
Fe	-55.8	16.6	-55.7	8.7	-54.1	33.0	-82.1	5.6	-99.8	15.7	-72.9	6.2		
Mg	-41.7	9.9	-47.6	7.5	-41.1	18.5	-46.9	10.3	-85.1	0.2	-32.0	3.9		
Mn	-41.1	10.8	-43.0	7.7	-38.1	19.3	-50.0	12.0	-91.8	0.6	-36.8	3.4		
Mo	-41.1	10.8	-47.6	10.4	-55.0	25.2	-67.1	15.6	-76.8	2.6	-26.6	6.9		
Na	-47.5	14.7	-39.0	12.5	-44.9	6.5	-57.9	10.8	-43.8	0.1	-20.7	2.1		
Ni	-40.4	13.1	-45.7	10.2	-38.7	21.8	-47.7	14.9	-89.9	2.0	-32.8	7.2		
P	nd		nd		nd		nd		nd		nd			
Pb	-49.3	15.9	-67.6	9.4	-53.2	23.9	-70.2	11.4	-99.3	21.1	-64.1	1.3		
Si	-86.2	75.7	nd		-85.4	112.9	nd		nd		nd			
Sn	-61.3	14.1	-78.2	9.4	-73.4	26.7	-90.8	1.9	-99.5	55.3	-89.4	4.2		
Ti	-68.2	12.3	-69.8	12.0	-91.1	69.7	-93.1	13.3	-98.2	0.9	-63.9	5.3		
V	-42.5	10.8	-48.4	10.2	-46.1	25.2	-62.5	15.2	-71.3	2.4	-30.4	6.2		
Zn	-46.2	12.4	-48.1	10.6	-42.4	21.1	-62.3	13.4	-90.5	2.0	-38.0	5.6		

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S3. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 1 mL reagent mixture (A, B, C, D, E and F) for 10 min.

Element	1 mL A		1 mL B		1 mL C		1 mL D		1 mL E		1 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
WD, 10 min												
Ag	-64.0	11.0	-94.2	32.7	92.2	9.8	-96.6	14.5	-96.6	1.6	-83.6	4.3
Al	-32.2	8.5	13.1	2.0	-61.8	9.3	-75.6	12.6	-41.7	6.1	3.9	2.5
B	-27.8	6.1	12.4	0.7	-59.8	8.6	-64.7	16.4	-23.6	6.0	-3.5	4.0
Ba	-73.6	5.0	-48.4	1.0	-91.6	11.9	-89.6	5.9	-98.9	7.7	-66.1	2.2
Ca	-29.3	4.1	6.6	5.3	-57.7	28.6	-66.3	5.6	-44.8	6.6	6.0	1.3
Cd	-42.5	9.0	0.4	2.0	-64.4	8.6	-69.0	11.4	-43.7	6.9	0.1	3.8
Cr	-53.2	8.2	-14.3	0.5	-82.3	13.2	-92.8	13.4	-33.4	3.5	-35.2	0.9
Cu	-32.5	8.3	12.0	2.9	57.3	8.8	-64.4	11.7	-21.8	7.0	11.1	4.2
Fe	-26.9	2.6	-5.8	0.6	-61.2	4.8	-89.1	9.0	-63.1	3.5	-24.4	0.7
Mg	-35.8	3.2	1.9	1.3	-64.5	5.3	-66.8	9.9	-26.2	3.9	4.6	0.4
Mn	-35.4	5.3	3.4	0.8	-58.7	5.2	-66.2	8.5	-35.4	5.2	1.8	1.7
Mo	-26.0	6.7	-1.8	2.9	-68.4	11.6	-82.4	20.6	-8.3	6.5	0.2	4.7
Na	-36.1	2.4	-4.1	3.8	-60.1	5.0	-78.6	7.6	-72.6	2.0	-10.5	3.5
Ni	-35.6	7.6	4.1	1.8	-64.5	8.6	-66.6	11.7	-30.8	6.8	5.1	4.1
P	-97.9	21.2	nd		nd		-99.8	110.3	-97.4	3.6	-99.6	87.5
Pb	-41.5	8.6	-17.2	1.3	-85.3	13.1	-85.2	10.7	-98.2	5.7	-48.1	0.7
Si	-87.8	2.7	-88.0	38.9	-95.9	67.9	-98.2	60.1	nd		-96.9	1.9
Sn	-51.3	9.5	-47.8	3.2	-85.5	15.7	-93.7	13.8	-96.9	13.6	-82.7	5.3
Ti	-41.2	3.8	-21.6	0.7	-89.3	13.7	-95.0	15.3	-79.0	6.0	-28.0	0.5
V	-16.7	4.3	2.6	2.1	-63.3	9.5	-77.5	15.6	-12.2	5.6	10.9	4.0
Zn	-44.4	8.8	-2.5	1.7	-64.9	9.1	-68.6	10.6	-34.8	6.2	-0.7	3.3
USE, 10 min												
Ag	-58.9	0.1	-84.4	40.7	-82.6	22.1	-93.4	17.2	-96.7	0.6	-88.7	46.3
Al	-18.3	7.5	11.3	7.2	-14.9	7.0	-69.6	10.1	-92.1	11.6	-7.9	6.3
B	-19.4	4.6	-11.7	6.2	-24.7	5.1	-60.9	4.4	-62.9	3.2	-8.1	5.1
Ba	-82.5	6.8	-61.8	6.8	-66.0	2.8	-86.5	10.9	-96.9	0.8	-57.4	4.6
Ca	9.8	23.2	50.1	50.6	-17.8	3.9	-63.4	12.9	-74.3	4.5	13.7	13.6
Cd	-24.6	7.8	-6.4	6.2	-22.8	6.3	-64.6	17.9	-94.6	3.2	-12.3	6.1
Cr	-49.6	7.4	-42.8	6.1	-51.5	6.5	-92.7	9.4	-91.5	0.5	-67.3	1.0
Cu	-13.9	7.6	4.3	6.6	-12.4	6.6	-59.5	18.9	-80.3	4.1	-12.4	6.5
Fe	-32.0	5.7	-20.9	3.9	-43.1	6.1	-85.0	14.6	-98.9	2.3	-43.5	0.7
Mg	-21.6	3.3	-7.4	3.0	-24.0	3.1	-62.1	11.6	-85.7	4.6	-6.4	2.2
Mn	-21.3	4.2	-6.8	4.0	-20.4	4.5	-62.2	14.4	-88.8	0.1	-8.2	3.9
Mo	-11.3	5.6	-1.5	7.3	-43.6	10.3	-74.8	14.9	-71.9	3.4	2.4	4.5
Na	-24.6	0.8	-13.5	4.1	-31.4	0.9	-51.0	3.7	-46.9	3.0	-9.8	1.6
Ni	-18.0	6.9	-3.8	6.1	-20.0	6.3	-61.1	16.7	-83.7	2.2	-4.5	5.4
P	-98.7	29.6	nd		nd		nd		nd		-99.9	63.6
Pb	-18.8	6.2	-28.0	6.8	-38.9	6.3	-80.0	0.1	-97.9	13.3	-35.6	5.3
Si	-94.9	5.6	-99.7	14.6	-87.2	35.5	nd		nd		nd	
Sn	-41.0	7.7	-46.0	9.4	-59.6	10.2	-91.4	6.0	-99.1	15.1	-76.3	3.0
Ti	-47.0	4.4	-38.1	7.2	-89.4	17.2	-95.2	12.1	-95.8	0.7	-41.6	4.9
V	-17.3	5.4	-7.2	6.6	-28.4	7.2	-68.8	13.5	-76.7	2.3	-2.8	3.9
Zn	-22.6	6.8	-7.3	7.5	-26.1	5.6	-64.1	14.8	-86.2	2.0	-10.6	4.8

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S4. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 5 mL reagent mixture (A, B, C, D, E and F) for 10 min.

WD, 10 min		5 mL A		5 mL B		5 mL C		5 mL D		5 mL E		5 mL F	
Element	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	
Ag	-9.6	1.8	-94.0	3.8	-96.4	4.0	-92.7	4.6	-94.3	5.8	-93.0	4.1	
Al	12.8	6.5	2.2	6.4	-68.3	9.1	-67.0	6.2	-1.5	6.6	1.3	6.1	
B	3.8	1.0	-8.5	2.1	-61.4	0.5	-62.2	1.6	-3.0	1.4	-9.4	2.1	
Ba	-46.6	9.0	-24.0	3.0	-88.4	16.9	-83.7	9.9	-97.8	8.7	-73.4	3.2	
Ca	7.2	2.8	-1.5	2.9	-64.5	8.5	-69.2	5.3	0.8	1.2	-4.8	1.4	
Cd	2.3	0.7	-10.7	0.6	-69.7	1.5	-65.9	1.3	-6.2	0.7	-8.0	1.5	
Cr	-3.5	3.6	-10.6	4.1	-82.4	21.9	-90.2	38.8	-10.3	3.0	-45.9	7.0	
Cu	11.7	4.1	-0.9	3.7	-63.5	7.8	-64.6	8.2	3.1	4.3	-1.0	4.5	
Fe	4.0	0.2	-10.1	0.1	-63.6	0.3	-75.5	0.0	-52.9	0.1	-20.1	0.3	
Mg	7.4	2.0	-6.7	3.1	-67.5	3.0	-64.2	3.4	1.7	1.8	-3.1	1.8	
Mn	7.2	0.7	-6.4	0.1	-62.4	1.7	-64.6	2.1	-2.5	0.3	-4.0	1.2	
Mo	8.9	0.6	-6.0	0.5	-66.6	0.8	-77.6	1.3	3.4	0.4	-12.0	0.4	
Na	1.1	4.2	29.5	6.3	-76.2	2.1	-68.9	5.3	-76.2	3.1	-41.4	4.2	
Ni	6.7	1.0	-6.0	0.6	-69.2	0.7	-64.8	0.5	0.4	0.8	-3.6	0.3	
P	nd		nd		nd		nd		-94.7	12.0	nd		
Pb	13.4	7.2	-6.5	3.5	-82.6	2.8	-76.6	6.5	-94.3	29.6	-52.4	4.2	
Si	19.5	1.7	10.2	1.0	4.7	2.1	10.8	1.9	-1.8	1.4	9.1	1.4	
Sn	-13.9	2.1	-44.3	2.2	-80.0	2.3	-87.2	4.5	-93.6	6.4	-78.8	2.3	
Ti	-6.9	2.3	-15.1	2.8	-88.3	1.9	-91.2	2.0	-63.1	3.0	-33.1	2.8	
V	4.2	2.0	-8.5	2.3	-64.9	2.4	-73.5	2.9	-1.5	1.6	-14.4	1.8	
Zn	0.7	0.4	-11.5	0.5	-68.7	0.7	-66.0	0.4	-1.2	0.9	-6.2	0.6	
USE, 10 min		5 mL A		5 mL B		5 mL C		5 mL D		5 mL E		5 mL F	
Element	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	
Ag	-70.1	3.3	-82.5	5.8	-89.0	7.6	-92.9	8.7	-94.4	20.0	-89.4	8.5	
Al	-48.0	7.5	12.4	7.2	-73.6	13.1	-75.5	9.4	-98.0	28.0	-72.0	9.8	
B	-38.9	3.4	2.9	2.7	-61.7	3.3	-67.6	6.2	-69.3	2.8	-64.4	3.3	
Ba	-87.6	4.0	-46.6	5.0	-89.6	14.9	-86.6	6.9	-97.5	12.5	-85.5	2.2	
Ca	-22.4	4.2	50.2	2.5	-70.0	2.8	-74.6	3.6	-62.2	3.4	-64.0	4.0	
Cd	-58.9	2.4	-1.1	2.1	-71.9	2.4	-74.9	2.5	-93.9	4.0	-72.3	2.1	
Cr	-73.8	18.5	-20.9	4.9	-86.3	28.4	-95.5	59.0	-95.3	59.1	-90.2	43.1	
Cu	-50.3	7.7	11.7	5.7	-66.0	9.3	-73.1	10.2	-92.6	11.0	-69.9	9.4	
Fe	-42.9	0.6	-0.9	1.2	-69.3	1.2	-80.8	0.9	-98.9	2.6	-76.2	0.8	
Mg	-48.2	4.4	2.8	4.1	-70.6	5.5	-73.3	5.3	-86.5	4.9	-69.7	3.7	
Mn	-51.8	1.5	4.3	0.3	-66.0	2.8	-73.6	2.1	-91.4	1.8	-70.1	1.8	
Mo	-33.8	1.5	5.5	0.8	-69.2	1.3	-82.1	2.7	-81.8	3.0	-72.7	2.2	
Na	-69.2	3.8	6.2	5.5	-77.4	2.2	-72.9	6.1	-88.7	3.0	-69.0	3.6	
Ni	-49.6	2.1	3.7	2.2	-70.8	1.3	-73.5	1.5	-89.7	2.0	-70.0	1.2	
P	nd		-98.6	10.7	nd		-98.9	5.2	-98.0	8.1	nd		
Pb	-42.0	7.9	-6.1	8.5	-81.0	10.2	-79.7	17.3	-96.8	39.7	-77.1	11.5	
Si	5.0	1.4	7.9	1.2	-2.5	0.5	12.8	3.1	0.9	2.4	9.4	1.3	
Sn	-59.7	2.2	-33.3	0.1	-82.1	3.8	-91.0	1.8	-98.5	1.1	-88.0	3.6	
Ti	-64.2	2.9	-41.3	3.2	-93.8	1.3	-95.9	0.8	-95.9	3.2	-84.3	3.4	
V	-34.2	3.2	2.7	3.3	-68.5	3.2	-79.6	3.8	-84.0	3.3	-74.5	3.3	
Zn	-49.8	0.9	-0.9	0.8	-71.1	2.4	-74.4	0.1	-88.8	0.2	-71.0	0.8	

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S5. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 0.5 mL reagent mixture (A, B, C, D, E and F) for 20 min.

WD, 20 min		0.5 mL A		0.5 mL B		0.5 mL C		0.5 mL D		0.5 mL E		0.5 mL F	
Element	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	
Ag	-80.7	22.4	-97.0	27.4	-97.9	95.6	99.2	17.7	-98.6	19.3	-97.3	9.2	
Al	-37.2	9.5	-6.3	16.9	-44.4	28.7	-72.3	26.0	-83.3	6.4	-36.2	8.6	
B	30.5	8.0	11.3	6.1	-38.3	16.7	-68.6	2.5	-21.0	14.5	-16.6	0.6	
Ba	-77.1	4.0	-69.2	4.2	-82.5	48.3	-86.0	27.8	-99.3	19.8	-87.0	2.1	
Ca	-33.3	11.0	15.3	14.6	-46.6	10.1	-48.4	31.8	-78.3	24.8	-11.6	1.7	
Cd	-34.8	3.8	-4.1	0.1	-23.6	26.1	-61.6	0.6	-66.5	16.9	-12.5	1.6	
Cr	-52.2	4.7	-23.9	0.7	-67.8	83.6	-92.2	5.8	-48.5	16.2	-60.5	6.1	
Cu	-36.8	4.9	9.4	1.1	-44.4	24.7	-56.8	2.8	-40.6	14.4	-12.8	0.8	
Fe	-31.2	8.0	-13.7	13.0	-50.1	19.8	-89.1	3.2	-70.5	12.5	-61.6	9.3	
Mg	-22.9	5.9	-7.5	2.7	-50.4	19.9	-62.0	0.7	-30.1	20.3	-14.4	4.1	
Mn	-47.6	4.8	-2.1	0.3	-43.0	14.9	-60.2	1.4	-40.1	19.3	-11.8	5.0	
Mo	-40.5	5.7	-10.1	4.0	-59.4	11.3	-87.5	4.9	-15.3	10.5	-28.6	2.6	
Na	-52.7	7.1	-29.4	7.9	-60.1	25.8	-74.1	3.4	-73.8	18.1	-13.3	1.2	
Ni	-43.8	5.1	1.2	1.0	-53.6	21.2	-58.7	1.4	-45.4	15.7	-8.6	1.4	
P	-99.9	9.6	-99.4	44.2	-99.9	36.9	-99.9	33.0	-96.8	6.2	-95.9	53.9	
Pb	-46.8	4.0	-36.3	4.0	-66.2	40.4	-82.2	3.3	-98.5	27.2	-65.7	9.5	
Si	-99.9	21.3	-99.9	11.4	-99.9	14.6	-99.9	7.3	nd		-95.3	62.9	
Sn	-56.0	4.0	-57.8	5.9	-73.5	17.1	-97.4	15.1	-98.2	32.3	-87.6	0.1	
Ti	-55.1	6.3	-34.4	1.1	-75.0	19.2	-94.6	6.8	-71.5	22.8	-52.2	3.7	
V	-37.2	3.2	-2.2	0.3	-47.9	14.1	-70.2	1.9	-16.7	11.6	-20.6	0.3	
Zn	-49.2	3.0	-11.0	2.8	-53.9	18.7	-69.1	2.4	-47.3	19.1	-13.6	3.5	
USE, 20 min		0.5 mL A		0.5 mL B		0.5 mL C		0.5 mL D		0.5 mL E		0.5 mL F	
Element	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	
Ag	-81.4	12.4	-96.8	47.4	-93.5	65.6	-95.4	17.2	-99.6	19.8	-93.1	9.8	
Al	-21.6	11.5	12.0	14.9	30.9	38.7	-73.8	29.0	-99.1	6.7	-31.9	9.6	
B	-25.7	6.0	6.8	7.1	30.2	17.7	-37.7	7.5	-65.7	11.5	-31.3	0.6	
Ba	-81.8	3.0	-67.0	3.2	-58.1	22.3	-86.5	24.8	-98.6	18.8	-72.8	4.1	
Ca	27.6	9.0	-11.3	4.6	23.5	32.6	-42.6	21.8	-80.0	21.8	-25.1	3.7	
Cd	-9.1	7.8	-4.8	2.1	21.3	36.1	-53.8	6.6	-94.2	12.9	-31.3	3.4	
Cr	-34.2	6.1	-41.8	3.7	-46.0	63.6	-93.7	9.0	-93.7	18.2	-76.1	8.1	
Cu	22.3	8.4	4.7	4.1	33.3	28.1	-49.7	6.8	-93.4	16.4	-25.2	3.8	
Fe	-17.7	12.0	-24.3	5.8	-56.0	20.7	-87.8	7.9	-99.3	10.6	-59.3	8.0	
Mg	-9.2	5.9	-7.4	4.7	17.8	29.9	-42.5	7.7	-84.2	33.3	-19.4	4.9	
Mn	-25.6	14.8	-3.1	10.7	19.4	28.9	-51.9	6.5	-91.6	12.3	-25.1	7.0	
Mo	-36.3	9.7	-8.4	9.6	-39.7	21.3	-64.9	3.9	-75.6	9.5	-22.3	4.6	
Na	-52.2	11.1	-41.7	5.9	-25.5	45.6	-56.0	8.4	-42.3	16.1	-22.4	6.2	
Ni	-3.9	7.1	-1.9	4.9	26.1	25.6	-41.0	7.4	-90.5	12.7	-25.2	11.4	
P	nd		nd		nd		nd		nd		nd		
Pb	-45.5	10.6	-38.7	7.8	-20.7	53.9	-73.0	10.1	-99.2	41.1	-57.1	4.7	
Si	nd		nd		nd		nd		nd		nd		
Sn	-53.5	12.1	-54.7	6.7	-49.6	36.7	-96.9	7.5	-99.8	58.3	-86.9	7.7	
Ti	-50.3	5.8	-58.0	10.9	-90.9	49.2	-95.2	9.2	-97.4	20.8	-52.0	5.9	
V	-26.2	3.9	-7.2	9.3	0.7	24.3	-69.2	7.9	-76.0	10.6	-24.8	2.3	
Zn	-35.6	13.0	-4.2	3.0	21.0	16.7	-61.5	3.4	-90.7	17.1	-27.5	6.5	

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S6. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 1 mL reagent mixture (A, B, C, D, E and F) for 20 min.

Element	WD, 20 min		1 mL A		1 mL B		1 mL C		1 mL D		1 mL E		1 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-65.9	22.3	-98.8	88.5	-93.8	30.3	-98.5	45.7	-98.4	43.4	-95.4	14.6		
Al	11.4	6.6	11.5	10.7	-21.1	9.0	-75.8	16.4	-56.3	14.2	5.1	5.4		
B	38.7	11.8	16.3	24.7	53.8	9.9	-60.1	24.9	-21.1	14.2	-6.1	6.2		
Ba	-47.4	13.3	-51.7	19.4	-74.6	33.8	-85.3	25.6	-99.3	20.3	-70.7	6.7		
Ca	12.9	11.5	11.1	28.7	-41.4	92.1	-40.4	55.1	-37.9	19.3	10.6	4.5		
Cd	-17.1	12.8	5.0	17.7	-24.5	2.5	-55.9	21.5	-35.2	15.3	7.9	6.3		
Cr	-29.2	16.7	-13.7	97.6	-65.3	11.0	-88.9	44.0	-31.2	17.8	-38.8	6.7		
Cu	13.1	17.8	7.2	15.2	-44.8	3.8	-60.5	29.9	-14.1	14.9	8.1	4.2		
Fe	-22.5	11.9	-1.7	15.5	-51.0	17.7	-83.7	27.6	-51.2	19.2	-26.2	7.7		
Mg	-18.6	16.3	-1.7	13.7	-51.1	1.0	-56.6	24.9	-24.2	20.8	-14.5	9.4		
Mn	-10.3	8.9	9.4	13.4	-43.9	5.1	-64.4	17.0	-38.0	19.9	-7.7	7.8		
Mo	-18.4	16.4	2.0	19.4	-57.2	7.7	-72.7	17.4	-8.4	14.1	-8.3	4.7		
Na	-24.5	14.8	-10.0	23.3	-52.9	12.3	-71.5	27.8	-66.4	25.6	-19.5	5.0		
Ni	-7.2	15.7	4.0	12.6	-43.4	5.2	-63.1	20.3	-24.8	16.5	11.3	6.1		
P	nd		-97.7	21.1	-99.9	84.3	-99.9	72.0	-95.3	9.9	-98.7	83.5		
Pb	-6.2	12.8	-12.6	22.5	-68.8	43.8	-87.7	26.1	-97.3	12.7	-52.9	4.6		
Si	nd		-99.9	0.5	-99.9	34.0	-99.9	27.3	nd		-98.6	55.9		
Sn	-30.9	11.4	-49.7	24.9	-70.9	21.3	-95.6	23.9	-94.2	19.4	-81.2	5.7		
Ti	-30.6	11.7	-24.2	29.7	-72.1	10.2	-92.5	21.6	-68.0	20.6	-17.5	10.4		
V	-11.8	14.3	6.4	22.2	-48.1	4.7	-65.8	18.9	-11.9	14.2	-13.9	5.6		
Zn	-20.6	11.5	5.7	19.0	-54.9	1.6	-63.7	24.9	-26.9	18.1	-8.9	7.5		
USE, 20 min														
Ag	-57.8	22.3	-99.5	88.7	-90.6	20.3	-96.9	35.7	-97.5	33.4	-93.7	34.6		
Al	-5.3	6.3	-15.2	10.7	-14.8	8.7	-61.6	36.4	-96.9	11.2	-12.7	7.4		
B	12.1	12.9	6.8	22.7	-22.6	11.9	-26.1	24.2	-64.7	16.2	-14.7	6.9		
Ba	-81.7	12.3	-64.9	21.7	-62.4	36.8	-85.3	25.2	-97.5	23.3	-83.1	5.6		
Ca	-11.2	11.5	-15.1	28.7	-19.6	92.1	-52.4	55.1	-85.3	19.3	-12.8	4.5		
Cd	-9.8	10.8	-9.5	11.7	-28.8	12.5	-56.5	16.5	-91.4	13.3	-15.5	4.3		
Cr	-37.2	12.7	-42.5	17.6	-59.3	31.0	-91.5	14.0	-92.8	14.1	-83.6	8.1		
Cu	-4.4	13.8	-7.8	13.2	-11.8	13.8	-52.0	19.9	-90.3	17.9	-11.0	5.2		
Fe	-23.8	12.9	-20.7	14.0	-60.5	37.7	-81.2	27.9	-99.2	21.5	-50.5	6.7		
Mg	-16.8	13.3	-12.5	10.1	-21.3	21.0	-54.0	14.9	-80.8	24.8	-9.1	9.4		
Mn	-12.6	9.9	-11.6	15.4	-26.6	15.1	-54.1	14.9	-88.0	13.9	-5.9	10.0		
Mo	-11.8	16.4	-2.7	19.4	-41.8	11.7	-72.4	19.4	-71.4	13.1	-5.4	7.7		
Na	-13.6	11.8	-13.4	13.3	-19.9	14.4	-50.9	22.4	-44.3	26.6	-13.8	9.3		
Ni	-10.9	10.7	-8.5	12.1	-19.1	15.2	-52.8	11.3	-86.7	14.0	-12.2	8.2		
P	nd		nd		nd		nd		nd		nd			
Pb	-16.0	4.0	-20.5	6.8	-19.2	16.3	-76.7	10.9	-98.8	22.3	-25.4	6.7		
Si	nd		nd		nd		nd		nd		nd			
Sn	-36.6	4.7	-46.0	5.1	-41.2	20.2	-97.3	10.0	-99.4	25.1	-78.1	4.1		
Ti	-33.1	11.7	-34.1	29.7	-89.6	14.2	-94.2	31.6	-95.8	17.1	-33.1	14.4		
V	-14.7	16.9	-3.4	22.4	-9.1	6.7	-65.2	14.9	-72.2	12.5	-6.5	4.6		
Zn	-21.9	13.2	-10.8	19.9	-28.2	3.6	-63.2	22.9	-87.0	19.8	-13.9	9.5		

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S7. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 5 mL reagent mixture (A, B, C, D, E and F) for 20 min.

Element	WD, 20 min		5 mL A		5 mL B		5 mL C		5 mL D		5 mL E		5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-10.4	3.2	-95.9	0.5	-94.6	4.5	-92.8	2.8	-87.9	10.5	-87.0	5.3		
Al	11.0	5.9	6.3	5.9	-65.6	7.4	-61.5	7.0	17.3	6.0	18.0	5.7		
B	6.1	4.3	-4.5	1.7	-57.8	0.1	-56.1	1.5	3.9	3.4	4.2	2.1		
Ba	-42.0	16.4	-40.5	28.8	-77.3	28.9	-76.8	22.9	-96.9	20.2	-49.6	4.5		
Ca	6.2	2.8	3.5	3.5	-63.2	2.8	-58.5	2.9	14.5	1.9	13.3	2.0		
Cd	1.6	1.6	-7.2	1.3	-67.4	1.5	-61.6	1.4	6.4	1.2	6.7	1.5		
Cr	-3.5	3.6	-7.3	3.7	-79.9	19.7	-87.7	35.2	2.3	3.3	-10.1	3.6		
Cu	11.1	4.2	3.2	5.0	-62.0	8.4	-59.6	7.8	14.2	4.3	15.2	3.5		
Fe	4.0	0.8	-7.0	0.6	-61.9	0.6	-72.5	0.0	-21.6	0.2	-0.4	0.5		
Mg	6.6	2.6	-2.4	2.0	-65.1	3.7	-59.6	1.5	10.0	2.3	9.2	2.9		
Mn	6.6	0.3	-2.2	0.7	-60.4	1.6	-60.0	1.3	8.3	0.2	9.6	0.2		
Mo	11.0	0.6	-1.6	0.6	-64.0	1.1	-76.0	1.6	10.8	0.6	10.1	1.1		
Na	10.3	16.3	39.9	7.3	-67.0	1.5	-63.9	27.4	-72.7	1.8	-4.2	1.1		
Ni	6.8	1.8	-2.4	1.3	-66.6	1.0	-60.1	1.4	11.0	1.1	10.7	1.1		
P	-98.8	0.5	-97.9	2.5	nd		nd		-93.2	11.7	-98.6	3.9		
Pb	14.3	6.4	-2.2	6.7	-77.0	6.2	-71.8	9.9	-89.0	18.5	-22.5	6.5		
Si	0.6	0.5	5.6	2.8	-1.8	0.6	15.7	2.6	2.7	2.9	10.2	2.4		
Sn	-10.8	0.2	-40.9	1.3	-78.6	3.8	-86.8	3.1	-88.9	7.9	-74.1	6.3		
Ti	-7.6	3.2	-12.7	3.3	-86.2	2.5	-89.6	1.8	-48.4	3.6	-1.9	3.8		
V	5.5	2.3	-4.4	2.8	-62.3	2.7	-71.0	3.5	5.1	2.3	5.6	2.0		
Zn	0.9	1.0	-7.8	0.8	-66.7	1.7	-61.1	0.5	8.8	0.5	7.6	0.6		
Element	USE, 20 min		5 mL A		5 mL B		5 mL C		5 mL D		5 mL E		5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-52.9	4.8	-86.7	5.0	-90.2	13.2	-94.1	12.4	-93.6	21.4	-87.5	7.8		
Al	-19.3	7.4	9.5	7.8	-77.0	10.8	-75.8	10.0	-97.5	24.7	-70.2	12.5		
B	-14.7	4.6	0.9	2.7	-66.8	3.3	-66.4	5.7	-68.7	3.2	-63.0	0.1		
Ba	-86.9	0.5	-61.4	18.8	-90.3	22.9	-88.0	12.9	-96.9	23.9	-84.5	15.4		
Ca	-10.7	3.2	14.5	2.3	-57.7	3.0	-43.9	2.4	6.2	2.8	-31.9	3.5		
Cd	-37.1	2.5	-2.4	2.7	-76.4	2.9	-74.7	2.5	-93.7	4.6	-70.4	2.3		
Cr	-57.0	10.6	-29.2	6.2	-88.5	37.8	-95.2	52.6	-94.8	58.8	-89.2	41.6		
Cu	-25.8	7.4	11.0	6.1	-71.3	9.5	-72.8	11.0	-92.3	8.9	-68.0	10.3		
Fe	-20.4	0.4	-0.1	1.0	-73.8	2.0	-81.2	1.3	-99.2	14.3	-75.2	0.7		
Mg	-22.7	4.2	1.5	3.1	-74.6	4.5	-72.4	4.6	-85.9	5.6	-66.8	3.8		
Mn	-26.9	2.3	4.3	0.8	-71.2	1.6	-73.3	1.4	-91.5	2.0	-68.4	2.0		
Mo	-8.9	1.5	9.5	1.0	-73.6	2.1	-81.4	3.3	-80.0	2.4	-69.0	1.7		
Na	-62.4	0.4	-16.1	9.3	-79.2	10.1	-73.7	12.4	-87.3	38.9	-67.5	8.0		
Ni	-22.7	2.8	2.6	2.3	-75.2	2.2	-72.8	2.1	-89.7	1.6	-68.0	1.7		
P	-97.9	3.1	-98.6	2.2	nd		-98.3	18.6	-97.1	11.4	nd			
Pb	-13.6	9.1	-18.5	9.1	-83.0	10.5	-81.0	16.9	-97.2	47.1	-76.0	11.0		
Si	6.0	2.3	1.4	2.7	-0.2	1.1	15.6	1.2	-1.8	2.9	10.4	3.6		
Sn	-40.8	2.1	-34.3	1.0	-84.6	1.8	-91.3	0.9	-98.7	3.4	-87.8	1.5		
Ti	-46.0	4.2	-36.0	4.3	-95.0	3.4	-95.8	2.4	-96.3	1.8	-82.8	4.0		
V	-15.0	3.4	2.2	3.6	-73.4	4.2	-79.1	4.1	-82.7	3.1	-71.2	3.3		
Zn	-25.0	1.2	-2.3	1.4	-74.6	1.9	-72.7	1.1	-87.0	0.4	-67.9	0.6		

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S8. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 0.5 mL reagent mixture (A, B, C, D, E and F) for 40 min.

Element	WD, 40 min		0.5 mL A		0.5 mL B		0.5 mL C		0.5 mL D		0.5 mL E		0.5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-79.7	23.5	-98.8	43.9	-91.6	73.6	-97.2	7.8	-98.6	17.7	-98.3	10.4		
Al	-12.0	2.7	5.2	12.2	-18.3	17.5	-81.5	13.0	9.1	14.8	-11.5	10.5		
B	-24.5	7.4	-11.1	10.1	-46.0	15.7	-62.3	6.1	-9.9	6.0	-9.3	2.6		
Ba	-75.7	3.4	-69.2	9.6	-80.3	36.5	-92.2	6.3	-97.4	47.7	-81.0	0.4		
Ca	-36.7	10.4	-12.3	5.9	-47.4	6.7	-72.1	10.8	-48.5	53.9	-12.5	5.9		
Cd	-38.8	0.8	-11.9	11.4	-22.3	16.0	-70.6	7.1	-44.8	46.9	-13.4	6.7		
Cr	-53.0	2.8	-27.5	10.2	-70.7	18.8	-94.4	6.7	-10.9	17.1	-52.8	5.9		
Cu	-32.0	0.9	-2.5	10.4	-42.7	15.3	-65.1	5.5	9.8	25.7	-1.9	7.1		
Fe	-30.5	8.7	-12.9	7.7	-55.1	8.6	-94.2	17.3	-40.4	35.2	-43.4	7.1		
Mg	-16.9	5.1	-7.8	10.0	-54.8	14.3	-69.0	7.6	-10.1	19.3	-16.7	5.6		
Mn	-41.2	4.1	-4.5	9.6	-47.4	12.6	-68.8	10.2	-15.9	35.3	-14.2	3.4		
Mo	-47.4	5.0	-7.7	11.0	-57.5	13.4	-83.1	0.7	2.8	3.7	-28.8	8.7		
Na	-55.9	0.7	-21.4	11.8	-64.4	27.7	-82.7	12.7	-66.0	10.1	-10.3	7.3		
Ni	-37.9	2.5	-3.1	10.9	-50.7	17.1	-67.4	7.3	-1.2	30.3	-8.4	7.6		
P	-95.6	9.4	-95.7	12.8	-96.9	54.1	-96.4	58.5	-91.5	58.6	-98.0	43.1		
Pb	-44.8	0.9	-41.1	12.4	-69.7	31.7	-88.2	2.1	-92.0	81.9	-68.5	10.4		
Si	-81.8	19.3	-81.6	4.6	-85.0	5.7	-94.6	50.3	-95.4	54.5	-88.5	17.2		
Sn	-52.9	2.0	-58.6	9.4	-80.4	17.5	-96.1	6.0	-91.0	68.6	-84.7	6.2		
Ti	-58.5	6.9	-34.8	12.5	-80.7	17.1	-95.4	0.3	-52.3	56.7	-51.7	3.7		
V	-41.7	3.8	-5.4	10.3	-49.8	13.1	-76.8	3.7	-0.4	2.7	-14.6	7.4		
Zn	-46.1	3.9	-8.0	9.2	-52.7	12.9	-69.4	8.5	-4.8	31.2	-14.7	4.1		
Element	USE, 40 min		0.5 mL A		0.5 mL B		0.5 mL C		0.5 mL D		0.5 mL E		0.5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-72.6	15.4	-94.1	69.9	-93.9	16.0	-98.6	23.7	-97.8	17.8	-90.8	9.9		
Al	3.3	8.7	4.3	1.3	26.3	68.0	-68.9	53.9	-98.3	11.8	-16.0	11.5		
B	-31.8	6.2	-4.1	1.2	13.4	36.3	-33.7	16.0	-67.1	6.4	-15.7	3.0		
Ba	-82.4	4.4	-59.3	45.3	-50.5	10.9	-86.0	27.2	-98.0	37.7	-67.7	2.4		
Ca	-20.5	12.4	6.8	8.6	17.1	60.2	-46.2	32.7	-62.4	43.9	-11.4	3.9		
Cd	-5.0	2.8	1.4	0.8	11.7	63.8	-50.3	4.0	-93.1	26.9	-15.5	8.4		
Cr	-33.3	4.8	-32.9	1.5	-31.2	103.2	-92.0	7.6	-94.5	35.6	-66.4	3.2		
Cu	-27.7	3.9	9.6	0.9	22.0	58.7	-45.5	1.1	-91.1	23.4	-8.0	8.1		
Fe	-12.9	18.7	-7.8	1.8	-33.5	107.1	-85.3	54.5	-99.6	47.5	-46.1	4.1		
Mg	-8.6	6.2	3.2	2.0	13.6	60.5	-42.5	3.9	-84.3	37.9	-6.6	5.2		
Mn	-29.7	7.8	6.2	1.1	11.7	56.8	-54.8	2.7	-90.1	38.3	-12.3	2.9		
Mo	-24.7	9.5	-6.1	8.1	-33.2	40.5	-68.5	12.6	-76.3	5.7	-5.8	6.7		
Na	-31.6	4.7	3.2	2.2	12.8	68.0	-57.5	18.7	-44.0	19.2	-5.9	9.3		
Ni	-3.2	5.5	4.2	0.7	13.8	58.1	-44.5	2.8	-88.0	26.7	-9.7	7.2		
P	nd		nd		nd		nd		nd		nd			
Pb	-31.7	5.5	-21.6	3.7	-9.5	79.0	-79.7	6.3	-99.4	61.9	-47.3	13.0		
Si	nd		nd		nd		nd		nd		nd			
Sn	-47.8	11.5	-36.3	1.4	-41.5	103.1	-93.8	4.8	-99.7	62.1	-84.5	8.2		
Ti	-50.3	6.3	-58.2	4.1	-83.1	48.2	-93.6	5.0	-95.9	46.7	-39.0	5.7		
V	-20.1	6.8	1.4	0.8	-0.1	57.6	-64.9	2.6	-78.3	12.7	-9.2	8.9		
Zn	-32.5	5.9	1.2	0.5	9.2	25.2	-66.4	3.4	-87.6	22.0	-12.6	3.3		

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S9. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 1 mL reagent mixture (A, B, C, D, E and F) for 40 min.

Element	WD, 40 min		1 mL A		1 mL B		1 mL C		1 mL D		1 mL E		1 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-44.6	25.3	-95.0	48.2	-93.1	19.9	-97.3	13.3	-99.2	41.9	-97.9	46.0		
Al	9.7	10.2	5.8	11.2	-19.5	23.3	-62.7	10.8	-11.5	18.1	1.9	1.3		
B	-13.9	15.5	-3.7	9.1	-43.7	19.2	-60.6	13.8	-13.3	17.1	-6.4	0.2		
Ba	-48.0	17.5	-58.7	12.4	-75.5	46.0	-89.8	18.1	-99.4	12.2	-72.6	4.1		
Ca	-10.8	14.2	3.7	8.0	-47.2	16.4	-68.1	31.4	-41.9	22.2	11.7	1.3		
Cd	-8.5	17.2	-4.2	11.8	-29.5	24.0	-67.3	14.9	-37.3	18.4	-3.2	0.1		
Cr	-26.9	20.4	-13.2	12.1	-67.5	26.3	-93.2	14.3	-13.2	20.6	-34.1	0.8		
Cu	13.7	21.5	10.3	12.0	-38.5	23.1	-61.3	13.1	-6.8	16.8	9.9	1.3		
Fe	-17.8	13.0	-3.9	9.5	-51.8	13.5	-92.2	9.1	-47.5	20.5	-29.3	2.0		
Mg	-17.4	15.8	-2.3	8.9	-52.3	20.2	-56.8	15.9	-14.1	20.8	-9.8	3.0		
Mn	-11.6	14.8	-5.3	9.8	-44.7	17.6	-66.0	18.1	-15.9	21.0	-6.4	3.0		
Mo	-7.5	21.2	-1.6	13.0	-52.9	18.6	-81.7	14.6	-5.7	15.5	-3.2	1.3		
Na	-16.8	23.2	-7.1	13.6	-57.9	38.0	-78.4	16.9	-74.1	26.4	-10.4	1.4		
Ni	-7.0	22.0	-1.4	11.7	-47.8	24.4	-64.4	14.9	-9.4	18.0	6.4	0.1		
P	-96.2	19.8	-97.3	11.2	-97.9	38.4	-95.4	54.7	-94.2	22.0	-97.8	29.7		
Pb	-6.8	15.0	-11.1	13.0	-65.0	39.6	-84.5	16.8	-97.6	18.8	-56.6	0.3		
Si	-86.7	2.8	-84.2	3.1	-85.4	8.0	-96.6	75.3	-98.9	110.8	-89.9	18.8		
Sn	-24.2	22.5	-44.4	12.8	-76.8	24.4	-95.3	6.6	-93.9	21.6	-81.5	2.0		
Ti	-24.8	19.0	-22.3	13.0	-78.9	20.5	-94.5	15.6	-63.2	21.2	-13.7	2.3		
V	10.2	15.4	-3.4	12.9	-45.9	18.7	-75.1	16.3	-8.5	16.2	-4.0	0.8		
Zn	-13.7	15.6	-7.3	10.7	-50.2	21.0	-66.5	16.7	-6.3	20.0	-4.9	1.3		
Element	USE, 40 min		1 mL A		1 mL B		1 mL C		1 mL D		1 mL E		1 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-57.9	26.3	-98.0	93.4	-90.0	12.0	-95.5	43.4	-97.7	36.4	-90.5	32.6		
Al	-3.2	11.2	9.2	19.6	11.8	11.3	-66.8	5.5	-96.1	15.1	13.8	4.3		
B	-16.9	12.5	-2.2	2.6	-12.5	13.5	-23.7	0.7	-63.4	27.1	-0.2	4.2		
Ba	-79.4	14.9	-52.4	38.7	-57.4	33.4	-74.0	32.5	-97.2	22.2	-41.8	2.1		
Ca	-4.4	19.2	5.9	6.6	-14.0	76.5	-25.6	8.7	-74.7	25.2	9.9	3.3		
Cd	-10.8	16.2	4.2	1.4	-4.6	51.8	-37.6	0.4	-91.4	19.4	7.0	3.0		
Cr	-31.1	3.8	-25.0	1.0	-38.2	101.5	-86.7	2.3	-91.9	26.6	-65.8	5.9		
Cu	-11.0	15.7	5.0	0.8	5.5	51.2	-32.0	0.4	-90.0	18.3	14.5	4.3		
Fe	-10.8	13.4	-4.5	10.0	-35.2	53.7	-69.9	23.6	-99.4	30.5	-46.4	4.0		
Mg	-14.7	9.8	5.2	2.4	-12.3	48.2	-25.5	0.5	-82.5	34.6	10.1	4.3		
Mn	-14.9	18.8	6.0	1.7	-7.4	46.3	-31.2	0.3	-87.6	31.0	7.1	4.0		
Mo	-11.0	27.2	-2.2	17.0	-34.2	77.4	-58.8	41.3	-68.8	18.5	3.1	6.3		
Na	-14.3	2.3	6.6	4.3	-2.2	35.8	-18.8	1.4	-39.3	26.4	12.6	3.4		
Ni	-14.3	23.9	7.4	1.4	-1.5	46.1	-29.6	1.5	-85.8	14.7	10.4	5.1		
P	nd		-99.9	35.0	nd		nd		nd		nd			
Pb	-14.4	17.7	-17.2	12.0	-8.5	11.0	-73.1	13.9	-99.1	38.8	-14.9	3.3		
Si	nd		nd		nd		nd		nd		nd			
Sn	-36.7	12.2	-29.6	23.8	-46.0	20.1	-88.3	7.8	-99.4	21.4	-66.8	3.0		
Ti	-37.6	16.0	-35.2	30.6	-86.9	21.1	-91.6	37.7	-95.8	20.2	-13.3	6.3		
V	-7.3	16.0	4.5	18.9	-1.6	1.3	-69.0	6.3	-69.9	13.2	5.3	2.4		
Zn	-18.0	4.4	3.2	19.6	-8.1	0.3	-62.4	3.0	-86.5	17.5	7.1	3.3		

Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S10. Trueness bias percentage (Tbias%) and repeatability (CVr%) for each element by WD and USE with 5 mL reagent mixture (A, B, C, D, E and F) for 40 min.

Element	WD, 40 min		5 mL A		5 mL B		5 mL C		5 mL D		5 mL E		5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-4.3	3.4	-96.7	10.6	-95.6	9.5	-93.6	2.0	-91.5	10.1	-80.5	3.7		
Al	14.9	6.5	16.9	6.3	-63.3	9.6	-52.4	7.7	18.0	6.0	14.7	5.2		
B	7.7	3.6	7.1	1.1	-54.5	1.3	-48.3	2.2	4.0	4.2	7.4	3.3		
Ba	-49.4	16.4	-14.1	8.4	-78.5	11.4	-78.5	17.0	-96.7	55.0	-36.7	0.2		
Ca	10.1	2.7	11.5	2.8	-60.3	3.5	-50.3	3.9	17.3	2.4	14.2	2.1		
Cd	4.3	1.4	2.9	2.3	-65.3	2.1	-53.7	1.7	5.5	2.0	9.6	2.1		
Cr	-2.0	3.8	0.6	2.7	-77.9	19.2	-84.1	28.0	1.3	3.4	-5.2	4.3		
Cu	13.8	5.3	15.0	4.8	-59.5	7.9	-50.9	7.6	13.8	4.3	15.1	3.9		
Fe	4.8	0.1	3.3	1.2	-60.4	1.1	-68.1	0.4	-16.5	0.2	1.7	1.5		
Mg	7.6	3.2	6.5	2.1	-63.0	6.0	-51.8	3.9	8.7	3.2	12.1	2.8		
Mn	8.1	0.7	7.2	1.0	-58.5	2.5	-51.7	2.0	8.4	1.2	12.4	0.0		
Mo	11.5	1.1	10.1	1.1	-61.4	1.3	-71.9	1.3	8.8	0.9	14.3	0.7		
Na	0.6	13.2	5.9	14.9	-59.6	12.3	-57.4	1.7	-72.9	22.8	14.8	7.3		
Ni	8.6	1.8	8.5	2.1	-64.3	1.7	-51.8	1.7	9.8	1.8	14.0	1.6		
P	nd		nd		-99.1	4.6	nd		-91.3	7.2	nd			
Pb	15.8	6.5	8.9	7.3	-71.9	8.7	-67.1	5.0	-89.0	12.0	-9.7	4.7		
Si	13.1	1.1	4.2	1.0	3.6	0.7	15.6	2.9	7.2	2.5	10.2	2.2		
Sn	-8.0	1.7	-35.1	2.6	-76.9	4.2	-84.1	5.9	-87.4	6.5	-73.1	3.1		
Ti	-2.8	3.1	-6.3	3.7	-83.4	2.7	-87.2	3.4	-43.5	4.0	-0.2	4.1		
V	5.3	2.9	7.2	3.1	-60.9	2.8	-65.6	4.3	2.6	2.5	8.5	2.6		
Zn	2.9	0.9	2.0	1.0	-64.8	1.5	-53.0	0.2	8.9	0.3	10.9	0.3		
Element	USE, 40 min		5 mL A		5 mL B		5 mL C		5 mL D		5 mL E		5 mL F	
	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%	Tbias%	CVr%
Ag	-34.8	5.1	-84.7	9.0	-88.8	13.8	-90.6	11.9	-91.8	10.2	-85.8	10.7		
Al	5.1	8.2	11.6	7.9	-70.0	7.3	-70.0	10.3	-95.6	38.8	-50.0	8.4		
B	2.1	5.3	1.1	3.8	-62.2	1.6	-63.9	3.5	-44.8	2.6	-41.6	4.3		
Ba	-87.2	4.4	-52.0	21.9	-89.5	48.7	-83.8	72.3	-96.9	45.0	-79.9	5.2		
Ca	81.9	3.4	12.1	3.0	-15.7	3.3	-33.4	2.8	-72.3	5.2	-32.9	2.4		
Cd	-11.7	2.3	-1.8	2.6	-69.6	2.8	-69.3	2.6	-89.6	3.4	-53.4	2.5		
Cr	-31.8	6.1	-23.0	6.0	-85.7	30.6	-94.0	51.7	-87.5	31.6	-80.9	24.3		
Cu	0.5	7.2	10.7	7.4	-63.0	10.0	-66.8	10.2	-86.9	10.0	-49.2	8.3		
Fe	0.2	0.4	-0.5	1.2	-66.3	1.5	-77.1	0.5	-98.8	5.0	-61.6	1.5		
Mg	0.4	4.3	1.0	3.8	-66.7	5.0	-67.3	5.9	-77.4	5.0	-48.7	4.9		
Mn	-4.5	0.5	3.3	0.8	-62.9	1.9	-68.0	3.0	-85.4	2.1	-50.7	1.8		
Mo	10.3	1.3	7.1	1.4	-67.3	2.1	-77.5	2.5	-60.9	1.8	-49.5	1.6		
Na	-58.2	1.5	-0.1	2.7	-76.0	6.3	-57.6	10.4	-83.3	67.2	-55.8	4.4		
Ni	1.2	2.7	3.4	2.5	-68.5	2.3	-67.7	2.4	-81.8	2.6	-48.8	2.7		
P	-98.6	2.8	-98.1	0.6	nd		nd		-97.0	1.2	nd			
Pb	11.8	10.1	-12.0	9.5	-80.3	11.8	-76.6	9.7	-97.4	29.9	-65.3	10.0		
Si	5.4	2.1	0.3	2.2	-0.2	0.6	14.2	4.0	6.0	3.4	7.9	2.6		
Sn	-24.7	0.5	-33.1	1.2	-79.9	2.6	-88.3	4.4	-99.3	1.8	-82.0	5.3		
Ti	-15.5	3.9	-38.2	4.3	-93.8	3.0	-94.8	2.7	-95.2	9.1	-74.1	3.3		
V	3.2	3.8	2.1	4.0	-65.8	4.6	-75.1	4.5	-66.1	3.4	-52.5	4.2		

Zn	-0.6	1.3	-2.4	1.1	-66.4	1.6	-67.4	0.4	-82.7	0.1	-50.4	0.8
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Abbreviation: nd, not determined for the element concentration \leq method detection limit.

Table S11. Recovery percentage (R%) and precision [repeatability intra-day (CVr%) and reproducibility inter-day (CVR%)] for each element in EVOO 1 by inductively coupled plasma mass spectrometry.

Element	Spike – level 1 ^a			Spike – level 2 ^a		
	R%	CVr%	CVR%	R%	CVr%	CVR%
Ag	94	0.3	1.5	93	1.2	1.9
Al	110	5.4	4.3	106	5.2	4.9
As	96	0.6	7.8	87	1.3	1.7
B	105	3.4	3.5	95	1.7	3.2
Ba^b	-	2.2	17	107	2.8	12
Be	99	1.8	1.7	94	1.2	1.8
Bi	100	3.2	2.3	96	1.3	2.1
Ca^b	-	-	-	94	2.0	9.9
Cd	94	0.6	1.7	91	1.6	1.8
Ce	98	0.4	2.2	96	1.8	1.8
Co	99	1.6	2.9	99	0.9	4.3
Cr	102	1.9	1.6	97	0.7	2.6
Cs	99	0.9	2.3	94	2.6	2.7
Cu	104	1.5	1.4	97	0.0	1.6
Dy	96	0.7	1.9	92	2.4	2.0
Fe^b	-	-	-	87	14	20
Ga	102	1.4	8.2	90	0.1	2.1
K	91	3.6	2.8	85	1.4	2.3
La	98	0.5	2.0	96	2.7	2.8
Li	107	0.6	1.7	99	0.8	1.2
Mg	97	1.5	7.6	87	2.1	4.5
Mn	106	1.0	2.6	96	0.6	1.9
Mo	93	1.6	2.9	93	0.9	2.3
Na	95	2.8	11	92	2.5	8.5
Nb	99	0.2	6.8	90	0.2	1.9
Nd	95	0.1	2.2	93	1.8	2.7
Ni	99	0.3	2.9	98	2.6	5.0
P	98	3.9	3.3	88	1.8	2.6
Pb	100	2.1	3.3	96	1.1	2.1
Pr	97	0.5	2.5	93	1.9	2.2
Rb	98	1.2	6.0	91	0.1	2.6
Sb	92	1.4	1.3	91	3.2	2.9
Se	90	3.2	4.8	89	0.1	2.5
Si	116	12	28	91	3.9	27
Sn	96	1.5	1.6	90	3.1	2.7
Sr	97	1.6	6.3	106	0.2	2.0
Tb	100	4.0	3.6	93	2.3	1.7
Te	93	2.6	3.6	90	2.5	2.9
Ti	100	0.9	2.3	95	0.4	1.1
Tl	102	2.2	3.3	98	1.2	1.9
U	96	1.4	1.5	92	2.5	1.9
V	101	1.0	0.6	97	1.1	2.8
W	101	2.5	2.7	99	1.5	2.8
Zn	107	14	15	95	8.6	13

Zr	98	1.3	7.2	90	1.3	1.5
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^a Instrument concentration for all trace elements at 0.005 and 0.02 mg L⁻¹, and for major elements (B, Ca, K, Mg, Na, P, Si and Sr) at 0.2 and 1 mg L⁻¹, respectively.

^b Recovery experiments for Ba, Ca, and Fe were performed only at spike level 2.

Table S12. Recovery percentage (R%) and precision [repeatability intra-day (CVr%) and reproducibility inter-day (CVR%)] for each element in EVOO 2 by inductively coupled plasma mass spectrometry.

Element	Spike – level 1 ^a			Spike – level 2 ^a		
	R%	CVr%	CVR%	R%	CVr%	CVR%
Ag	96	2.8	2.5	92	1.7	2.3
Al	108	3.8	20	98	3.6	10
As	96	1.6	6.4	88	1.0	2.3
B	108	2.2	3.9	100	1.6	5.2
Ba ^b	-	0.6	13	107	0.5	9.2
Be	98	2.1	2.7	98	3.5	4.0
Bi	100	0.2	2.9	102	2.4	5.5
Ca ^b	-	-	-	85	3.2	8.7
Cd	96	0.5	2.9	93	1.5	2.5
Ce	101	1.4	3.4	96	0.4	1.4
Co	98	1.5	5.5	102	3.2	6.5
Cr	101	1.2	6.9	101	2.7	4.5
Cs	102	1.1	2.9	97	0.2	3.9
Cu	103	1.1	3.5	97	4.3	3.4
Dy	99	0.9	3.4	95	2.4	3.1
Fe ^b	-	-	-	89	0.4	17
Ga	100	0.2	6.3	91	3.6	3.3
K	97	3.8	4.4	90	1.2	3.6
La	101	0.8	2.7	96	0.7	2.1
Li	105	1.7	1.6	103	3.6	3.7
Mg	96	3.1	5.4	87	5.5	4.2
Mn	105	0.5	0.8	99	3.7	3.1
Mo	96	4.2	3.9	94	0.3	3.5
Na	93	2.2	7.6	91	3.8	6.1
Nb	99	1.3	5.5	91	2.4	4.2
Nd	98	1.8	3.7	94	1.3	2.3
Ni	97	5.1	6.0	100	3.7	7.2
P	97	1.1	3.8	91	3.1	3.8
Pb	100	1.2	4.1	104	2.1	6.5
Pr	100	1.8	3.2	94	0.2	2.0
Rb	99	0.3	5.1	91	2.3	3.5
Sb	96	1.2	2.7	91	1.2	1.4
Se	98	2.5	9.7	88	2.4	2.5
Si	115	13	27	89	13	25
Sn	96	1.8	3.3	92	1.3	1.2
Sr	98	0.4	5.7	101	2.0	3.0
Tb	102	1.4	5.0	96	1.4	4.3
Te	94	2.7	2.8	91	1.7	2.1
Ti	103	2.5	2.5	98	2.9	2.7
Tl	102	0.9	4.0	105	1.2	6.5
U	96	0.4	4.0	98	0.5	5.4
V	101	1.8	2.1	100	0.9	2.7
W	102	0.6	4.4	96	0.9	5.5
Zn	120	12	16	91	15	16
Zr	95	0.1	8.7	85	0.5	2.6

^a Instrument concentration for all trace elements at 0.005 and 0.02 mg L⁻¹, and for major elements (B, Ca, K, Mg, Na, P, Si and Sr) at 0.2 and 1 mg L⁻¹, respectively.

^b Recovery experiments for Ba, Ca, and Fe were performed only at spike level 2.

Table S13. Recovery percentage (R%) and precision [repeatability intra-day (CVr%) and reproducibility inter-day (CVR%)] for each element in EVOO 3 by inductively coupled plasma mass spectrometry.

Element	Spike – level 1 ^a			Spike – level 2 ^a		
	R%	CVr%	CVR%	R%	CVr%	CVR%
Ag	96	0.1	2.5	90	2.4	2.2
Al	110	7.2	22	106	4.2	11
As	97	0.6	9.1	91	2.0	2.2
B	110	1.4	2.6	99	1.4	2.8
Ba ^b	-	1.7	1.6	113	0.8	8.0
Be	100	1.9	3.1	95	0.5	0.7
Bi	102	1.5	1.1	98	1.5	1.8
Ca ^b	-	-	-	92	6.1	17
Cd	92	0.4	1.7	92	0.1	1.0
Ce	99	0.5	1.0	96	1.2	1.5
Co	99	2.4	1.7	102	0.4	6.2
Cr	103	1.0	3.2	100	1.7	2.8
Cs	96	0.5	1.2	97	0.9	2.4
Cu	108	1.1	4.3	98	0.3	1.4
Dy	93	2.1	1.8	94	0.2	1.5
Fe ^b	-	-	-	112	5.5	17
Ga	101	1.2	8.3	90	0.9	1.4
K	95	2.9	5.6	85	0.3	3.3
La	98	0.6	1.9	95	0.4	1.1
Li	107	0.2	3.7	102	0.2	0.9
Mg	97	1.3	8.6	92	0.9	4.7
Mn	106	0.1	3.1	100	0.4	1.5
Mo	94	2.6	1.8	92	0.6	1.1
Na	97	0.5	11	90	1.2	8.0
Nb	99	0.1	7.4	91	0.8	1.8
Nd	92	1.6	2.7	92	0.8	1.1
Ni	97	0.8	1.9	112	1.0	12
P	101	1.4	4.0	90	0.2	2.1
Pb	102	1.4	1.3	99	1.4	2.5
Pr	95	1.0	0.8	92	0.4	1.8
Rb	99	1.0	7.0	92	2.6	2.9
Sb	91	1.0	2.0	92	0.8	0.7
Se	93	0.5	4.4	90	2.3	3.3
Si	117	1.8	14	100	4.5	20
Sn	97	1.5	2.3	93	0.1	0.5
Sr	98	0.1	8.0	106	1.9	1.8
Tb	96	3.1	2.2	94	1.0	2.2
Te	92	0.9	3.2	92	0.3	0.5
Ti	101	0.4	2.7	96	0.4	0.7
Tl	104	2.7	2.3	101	1.4	2.8
U	98	1.3	1.1	94	1.0	2.1
V	103	0.7	2.3	99	0.5	1.7
W	105	2.0	1.4	99	0.6	2.8
Zn	101	6.7	16	90	3.6	5.8
Zr	98	0.3	8.9	92	0.8	0.9

^a Instrument concentration for all trace elements at 0.005 and 0.02 mg L⁻¹, and for major elements (B, Ca, K, Mg, Na, P, Si and Sr) at 0.2 and 1 mg L⁻¹, respectively.

^b Recovery experiments for Ba, Ca, and Fe were performed only at spike level 2.

Table S14. Recovery percentage (R%) and precision [repeatability intra-day (CVR%) and reproducibility inter-day (CVR%)] for each element in peanut oil by inductively coupled plasma mass spectrometry.

Element	Spike – level 1 ^a			Spike – level 2 ^a		
	R%	CVR%	CVR%	R%	CVR%	CVR%
Ag	93	2.6	3.6	90	0.1	0.5
Al	94	10	32	100	2.9	9.9
As	94	0.9	6.9	85	0.6	1.8
B	108	3.4	3.7	98	0.4	2.1
Ba ^b	-	1.6	5.9	117	2.1	2.7
Be	98	2.9	3.0	97	0.2	2.0
Bi	101	0.1	2.6	98	0.3	2.4
Ca ^b	-	-	-	92	2.2	2.9
Cd	98	0.7	3.0	92	1.4	1.8
Ce	98	1.6	3.4	96	0.1	2.5
Co	98	1.4	6.2	101	0.3	5.6
Cr	100	0.7	7.6	99	0.1	1.9
Cs	102	0.6	2.7	95	1.6	2.3
Cu	102	3.3	5.6	98	0.1	5.1
Dy	99	1.4	3.7	93	1.0	2.3
Fe ^b	-	-	-	100	9.5	18
Ga	100	1.0	6.1	92	1.4	0.9
K	99	2.4	7.0	81	1.9	1.5
La	97	0.6	3.0	95	0.7	1.9
Li	105	1.0	3.1	102	0.7	1.1
Mg	96	4.2	3.9	92	1.3	3.7
Mn	104	4.9	6.1	99	0.1	1.5
Mo	92	1.4	4.7	92	1.0	1.1
Na	93	3.2	6.6	88	1.0	7.4
Nb	97	1.5	4.4	91	2.1	1.7
Nd	99	2.3	4.4	93	0.7	2.6
Ni	95	4.2	8.6	99	0.6	5.4
P	97	1.0	5.7	91	2.7	2.0
Pb	99	0.9	4.4	99	1.2	2.3
Pr	100	1.2	3.5	92	1.1	1.6
Rb	98	0.3	3.8	91	0.1	1.0
Sb	95	0.6	2.1	90	0.2	0.5
Se	94	1.8	3.4	89	0.8	2.0
Si	92	4.0	22	84	4.9	21
Sn	96	1.1	2.9	93	1.7	1.6
Sr	97	0.6	4.6	109	1.0	1.6
Tb	103	1.9	5.1	94	0.4	2.6
Te	96	1.5	4.1	90	0.3	2.1
Ti	100	1.1	1.5	96	0.6	1.6
Tl	99	0.4	5.2	100	2.5	2.6
U	95	0.4	3.4	94	2.7	2.5
V	102	2.0	2.6	97	0.8	1.0
W	99	1.1	4.9	98	1.9	1.8
Zn	96	1.5	13	96	2.5	11
Zr	98	0.6	4.8	90	1.7	1.3

^a Instrument concentration for all trace elements at 0.005 and 0.02 mg L⁻¹, and for major elements (B, Ca, K, Mg, Na, P, Si and Sr) at 0.2 and 1 mg L⁻¹, respectively.

^b Recovery experiments for Ba, Ca, and Fe were performed only at spike level 2.