

Proposed Methodology to Evaluate CO₂ Capture Using Construction and Demolition Waste

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1. Supplementary information about precision of some techniques.

The chemical analysis by XRF, soluble ions by ICP-OES and elemental carbon were measured using the general research service of University of Seville. These laboratories work as general services for all the researchers of the university that require them. This General Service have the international ISO 9001:2015 certification (a quality management system, QMS). Under this certification, the different laboratories make periodic calibrations and validations of the instruments and techniques offered.

1.1. The mayor elements measurement by XRF

The XRF instrument was calibrated using a series of standards (of the order of 25) certified multi-element in different concentrations and matrices (Table SM.1). These standards are measured 10 times to determine the limits of detection and quantification, as well as the error in measurement (Table SM.2). Once the quantification is done, the methods are validated with 5 different standards to those used in the calibration (Table SM.3). The sample (Table 1) was measured at the end of October and the calibration of the instrument was in September.

Table S1. List of certificated standars used for XRF calibration.

STANDARD NAME	MATRIX TYPE	STANDARD NAME	MATRIX TYPE
MGR-N (GEOPT-19)	Gabbro	NCS DC73303 (GBW07105)	Basalt
OPY-1 (GEOPT-20)	Ultramaphic rock	NCS DC73304 (GBW07106)	Slate
MGT-1 (GEOPT-21)	Granite	NCS DC73305 (GBW07107)	Limo and dolomite
OU-9 (GEOPT-23)	Pegmatita	NCS DC73306 (GBW07108)	Syenite
OU-10 (GEOPT-24)	Longmyndian greywacke	NCS DC73309 (GBW07311)	River sediments
HTB-1 (GEOPT-25)	Basalt	NCS DC73323 (GBW07405)	Soil
NCS DC70002 (GBW07234)	Copper ore	NCS DC73325 (GBW 07407)	Soil
NCS DC71301 (GBW07109)	Syenite	JF-1	Felspart

NCS DC71302 (GBW07110)	Andesite	JCRM R303	Calcined bauxite
NCS DC71303 (GBW07111)	Granodiorite	JCRM R304	Silimanite
NCS DC71304 (GBW07112)	Gabbro	GYP-A	Gypsum
NCS DC71306 (GBW07114)	Dolomite	GYP-C	Gypsum
NCS DC73301 (GBW07103)	Granite	BCR-032	Phosphate
NCS DC73302 (GBW07104)	Andesite	SRM 634A	Portland cement

Table S2. Detection limit (L.D.), quantification limit (L.C.) and relative error for the measurement of the major elements by XRF in Panalytical Axios spectrometer of the SGI Laboratorio de Rayos X (University of Seville) [September 2014].

	SiO ₂ %	Al ₂ O ₃ %	Fe ₂ O ₃ %	MnO %	MgO %	CaO %	Na ₂ O %	K ₂ O %	TiO ₂ %	P ₂ O ₅ %	SO ₃ %
L.D.	0.02	0.01	0.28	0.02	0.00	0.03	0.09	0.02	0.03	0.00	0.07
L.C.	0.05	0.02	0.28	0.02	0.01	0.03	0.11	0.02	0.09	0.01	0.08
RELAT. ERROR	0.021	0.007	0.058	0.139	0.025	0.042	0.030	0.032	0.049	0.042	0.191

Table S3. Major elements comparative between monitor standards (calibration validation) in white box and the certificate value in grey box [September 2014].

	SiO ₂ %	Al ₂ O ₃ %	Fe ₂ O ₃ %	MnO %	MgO %	CaO %	Na ₂ O %	K ₂ O %	TiO ₂ %	P ₂ O ₅ %	SO ₃ %
MBL-1 (GEOPT 22)	51.79 ± 1.10	14.45 ± 0.10	9.63 ± 0.56	0.13 ± 0.02	6.41 ± 0.16	5.43 ± 0.23	4.35 ± 0.13	3.82 ± 0.12	1.99 ± 0.10	0.83 ± 0.03	0.03 ± 0.01
OPC-1 (GEOPT 26)	21.70 ± 0.46	4.52 ± 0.03	3.22 ± 0.19	0.39 ± 0.05	2.52 ± 0.06	62.47 ± 2.63	0.11 ± 0.00	0.35 ± 0.01	0.26 ± 0.01	0.04 ± 0.00	1.46 ± 0.28
GYP-B	1.00 ± 0.02	0.18 ± 0.00	0.12 ± 0.01	0.01 ± 0.00	1.68 ± 0.04	35.42 ± 1.49	0.02 ± 0.00	0.08 ± 0.01			43.83 ± 8.38
JCRM R041	27.83 ± 0.59	70.15 ± 0.47	0.57 ± 0.03	0.00 ± 0.00	0.33 ± 0.01	0.07 ± 0.01	0.21 ± 0.01	0.18 ± 0.01	0.08 ± 0.00	0.12 ± 0.00	0.03 ± 0.01
NCS DC71305 (GBW07113)	73.51 ± 1.57	13.06 ± 0.09	3.21 ± 0.19	0.14 ± 0.02	0.12 ± 0.01	0.58 ± 0.02	2.52 ± 0.08	5.48 ± 0.18	0.24 ± 0.01	0.04 ± 0.01	0.05 ± 0.01

1.2. Chemical analysis by ICP-OES.

For the ICP-OES, a certified multi-elemental standard solution (Certipur Certified Reference, EMD Millipore Corp) and silicon standard (PlasmaCal ICP/IPCMS Standard, SCP Science) are used for the calibration of the equipment. The standards are measured before and after between 10 rank of samples or batches of lower number. The results obtained are subject to controlled uncertainty (Relative Standard Deviation (RSD) <5%) and the correlation coefficient of the calibration lines are accepted above 0.99.

Table SM.4 shown the result of samples measured by ICP and represented in the Figure 7 of the manuscript.

Table S4. Soluble Ca, Mg, and Si ions measured untreated and treated after 240 and 720 h of reaction for MPC2 and their standard deviations.

Particle Size (mm)	Reaction Time (hours)	Ca (mg/l)	Ca Standard Deviation	Mg (mg/l)	Mg Standard Deviation	Si (mg/l)	Si Standard Deviation
Orig	0	103.3	1.3	5.15	0.03	10.59	0.16
< 4	240	53.4	1.6	3.093	0.014	12.00	0.14
<4	720	49.84	0.47	5.140	0.011	16.28	0.19
2 – 4	240	69.8	3.2	3.60	0.03	8.76	0.19
2 – 4	720	62.7	3.0	5.89	0.08	14.14	0.23
1 – 2	240	45.0	2.0	2.593	0.010	6.58	0.06
1 – 2	720	27.6	0.3	6.87	0.12	16.71	0.33

1.3. Elemental analyzer (C-elemental).

The analyser is calibrated at least once a year or after repairs, adjustments or if necessary after verification of the instrument. The calibration used at the time of measurement was performed with a certified standard of Cystine (Pure Compound Series Calibration Material, Leco Corporation). The standard is measured 10 times and RSD is accepted < 5%, in this case it was < 2%. Calibration is validated every day using a soil standard measured three times and accepted RSD <5%.