

Supplementary Information

Table S1: Element mass fractions of sewage sludge ash, sewage sludge and samples from lab-scale and pilot-scale experiments (L 1000 = lab scale experiment at 1000 °C, P 750 - P 1000 = pilot-scale experiments at 750-1000 °C, SD = standard deviation, in triplicates), n.d.=not determined)

	Ash		Sewage sludge		L 1000		P 750		P 800		P 850		P 900		P 950		P 1000	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
	mg/kg																	
Mn	5260	45	121	2	2340	17	2010	22	2190	7	2100	9	2030	2	2020	15	2130	13
Mo	16.3	3.5	6.4	1.2	n.d.		9.1	2.6	11.0	0.5	11.2	3.4	7.6	3.3	10.8	2.2	9.8	1.2
Sb	16.3	1.4	4.0	0.8	n.d.		14.3	2.5	11.0	0.1	7.9	0.9	6.5	0.7	6.9	0.1	7.3	0.9
Sn	100.7	8.8	10.0	0.9	n.d.		67.3	2.5	68.7	1.2	63.6	5.5	57.7	1.5	60.9	1.4	48.6	2.1
Ti	3400	2	1440	22	3980	27	3380	22	3680	26	3600	1	3530	6	3560	6	3810	95
Zr	245	11.6	95	0.8	n.d.		161	1.9	182	2.3	187	16.7	174	1.8	178	0.4	188	2.3

Table S2 Element mass balance for matrix and trace elements at different set temperatures (measured temperature in kiln is 15-25 °C lower) for the pilot-scale experiment. Elements are sorted in categories “remain in solid” and “removal via gas phase” depending on temperature. Element mass balance is calculated on element mass fractions (table 1) and weights of SSA (5000 g) and SS (1000 g) in starting material mixtures (8000 g) and product (5930-6804 g).

	Temperature					
	750 °C	800 °C	850 °C	900 °C	950 °C	1000 °C
Starting	8000 g					
Product	6804 g	6539 g	6350 g	6370 g	6500 g	5929 g
remain in solid						
Al	91 ± 2	93 ± 3	90 ± 2	87 ± 3	88 ± 2	84 ± 4
Ca	99 ± 1	103 ± 1	96 ± 1	94 ± 1	96 ± 1	93 ± 2
Fe	117 ± 3	124 ± 3	118 ± 3	113 ± 3	115 ± 3	110 ± 3
K	123 ± 6	118 ± 7	112 ± 7	111 ± 7	109 ± 8	103 ± 7
Mg	101 ± 1	102 ± 1	97 ± 1	99 ± 1	98 ± 1	95 ± 1
P	88 ± 3	91 ± 5	87 ± 6	84 ± 6	85 ± 7	80 ± 7
Si	113 ± 15	106 ± 14	112 ± 15	122 ± 19	109 ± 14	93 ± 14
Cu	4 ± 8	-2 ± 8	4 ± 11	6 ± 8	6 ± 8	12 ± 8
Mn	-9 ± 2	-14 ± 1	-6 ± 1	-3 ± 1	-5 ± 2	-1 ± 2
Ti	-8 ± 1	-12 ± 1	-7 ± 0	-5 ± 0	-8 ± 0	-6 ± 3
Zn	11 ± 2	3 ± 3	3 ± 9	13 ± 2	9 ± 3	15 ± 2
Zr	17 ± 5	10 ± 4	10 ± 12	16 ± 4	12 ± 4	15 ± 4
removal via gas phase						
As	98 ± 21	95 ± 13	97 ± 19	85 ± 12	77 ± 11	69 ± 10
Cd	90 ± 4	89 ± 7	76 ± 4	76 ± 2	71 ± 4	46 ± 3
Mo	70 ± 57	81 ± 21	81 ± 48	55 ± 99	80 ± 37	66 ± 31
Pb	96 ± 5	83 ± 5	69 ± 5	72 ± 6	80 ± 5	68 ± 5
Sb	114 ± 21	84 ± 8	59 ± 25	48 ± 31	52 ± 13	51 ± 29
Sn	89 ± 9	87 ± 8	79 ± 12	72 ± 8	77 ± 8	56 ± 9

Table S3: Mean temperature at the hottest temperature zone of the kiln (mean temperature of measuring points at 1000 mm, 1200 mm and 1400 mm length) compared to set temperature.

temperature [°C]	
set	measured
750	757
800	773
850	822
900	887
950	937
1000	990

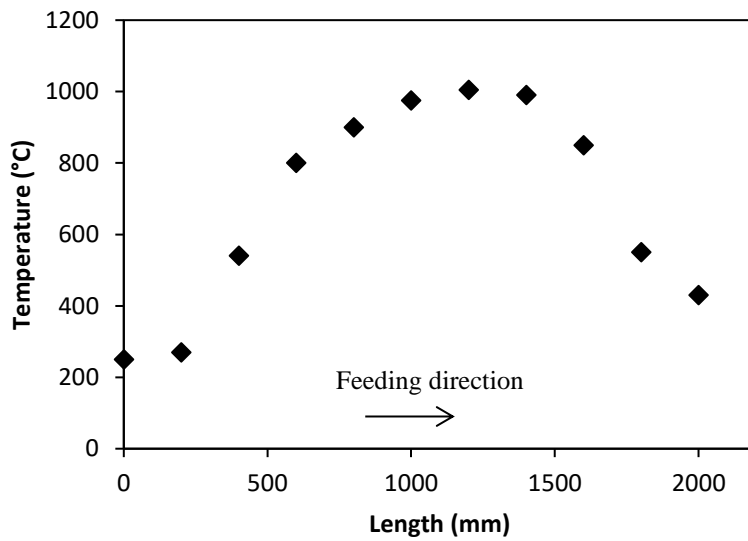


Fig. S1: Temperature profile in material bed over the length of the rotary kiln in operation during steady state conditions.