

Supporting Information for:

The influence of SO₂ and HCl concentrations on the consumption of sodium bicarbonate during flue gas treatment

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Supporting information

Table S1. Data from individual experiments

No. of experiment	Reactor temperature [°C]	Flue gas volume [m ³ /h]**	Excess air during the combustion process [-]	c ₁ (SO ₂) [mg/m ³]**	c ₁ (HCl) [mg/m ³]**	c ₂ (SO ₂) [mg/m ³]**	c ₂ (HCl) [mg/m ³]**	m (sorbent) [g/m ³]**	Concentration of O ₂ in flue gas [%]**	Conversion of SO ₂ [%]	Conversion of HCl [%]
1	224.5	12.23	1.70	496.28	97.68	42.43	4.47	2.09	8.58	91.45	95.42
2	193.0	12.19	1.75	495.87	153.64	43.74	3.55	2.10	8.07	91.18	97.69
3	255.3	12.19	1.76	455.57	42.92	38.12	5.34	1.93	8.95	91.63	87.55
4	224.3	12.09	1.92	428.93	103.82	102.31	6.00	1.62	9.01	76.15	94.22
5	225.3	12.18	1.78	465.11	72.58	208.69	2.21	1.28	8.81	55.13	96.96
6	221.8	18.05	2.06	413.73	58.65	41.07	6.04	1.65	10.70	90.07	89.70
7	172.7	12.13	1.88	445.78	127.42	41.97	18.29	1.90	9.21	90.58	85.64
8	223.7	12.22	1.72	470.37	148.78	44.72	11.61	2.60	8.30	90.49	92.19
9	223.5	12.14	1.84	245.55	218.75	35.47	9.87	2.06	8.81	85.55	95.49
10	224.9	12.33	1.57	1120.31	115.38	54.30	22.87	4.37	7.15	95.15	80.18
11	224.7	12.33	1.57	253.18	113.44	33.33	15.65	1.51	7.10	86.83	86.20
12	224.5	12.33	1.55	1564.28	114.65	60.65	7.80	5.39	6.97	96.12	93.19
13	224.5	12.20	1.75	481.80	35.95	41.35	9.75	2.32	8.44	91.42	72.89
14	224.8	12.32	1.57	541.60	122.58	38.54	27.51	2.35	7.23	92.88	77.56
15	224.7	12.33	1.56	1549.16	103.78	47.02	9.58	5.48	7.05	96.96	90.76
16	226.4	12.22	1.70	535.94	441.00	36.58	16.43	7.62	8.12	93.17	96.27
17*	225.7	12.29	1.59	1085.85	297.04	48.32	3.88	9.57	7.25	95.55	98.69
18	226.0	12.23	1.70	269.71	436.33	39.36	4.17	6.16	8.08	85.41	99.04
19	173.9	12.26	1.66	258.59	413.34	37.60	3.89	5.89	7.80	85.46	99.06
20	223.5	12.28	1.59	551.25	N/A	209.65	0	1.06	7.27	61.97	N/A
21	224.3	12.25	1.62	555.35	N/A	106.33	0	1.47	7.48	80.85	N/A
22	223.6	12.27	1.60	546.61	N/A	45.44	0	2.14	7.37	91.69	N/A
23	254.8	12.25	1.63	543.80	N/A	47.29	0	1.75	7.56	91.30	N/A
24	192.1	12.28	1.62	550.39	N/A	46.40	0	1.82	7.50	91.57	N/A
25	223.8	12.16	1.83	680.05	126.11	48.39	2.80	3.62	8.94	92.88	97.78
26	224.3	12.26	1.66	831.85	227.98	53.33	1.86	4.74	7.17	93.59	99.19
27*	243.0	12.29	1.62	1031.58	254.04	62.99	1.75	7.08	7.69	93.89	99.31
28	239.2	12.26	1.67	660.82	489.53	78.99	3.24	8.45	8.10	88.05	99.34

* Experiments exempted from the development of regression models

** Refers to concentrations in real flue gas (real humidity, real oxygen concentration) at 101,325 Pa and 0 °C

Table S2. Regression data – sorbent consumption

<i>Regression statistics</i>	
Multiple R	0.9967
R Square	0.9934
Adjusted R Square	0.9494
Standard Error	0.3289
Observations	26

	<i>Coefficients</i>	<i>Std Error</i>	<i>t Stat</i>	<i>P-values</i>
c ₁ (SO ₂)	3.346E-03	0.000139	23.99816	8.8E-18
[c ₁ (HCl)] ^{1.5}	6.023E-04	1.86E-05	32.46483	1.02E-20
c ₂ (SO ₂)	-3.258E-03	0.001178	-2.76468	0.011028

Table S3. Regression data – sorbent conversion

<i>Regression statistics</i>	
Multiple R	0.9245
R Square	0.8548
Adjusted R Square	0.8349
Standard Error	0.0671
Observations	26

	<i>Coefficients</i>	<i>Std Error</i>	<i>t Stat</i>	<i>P-values</i>
Intercept	5.756E-01	0.036759	15.65863	2.06E-13
c ₁ (SO ₂)	1.293E-04	4.04E-05	3.197503	0.004156
[c ₁ (HCl)] ^{1.5}	-4.042E-05	4.31E-06	-9.38742	3.76E-09
c ₂ (SO ₂)	6.842E-04	0.000291	2.349207	0.028203



Figure S1. Photo of the experimental unit

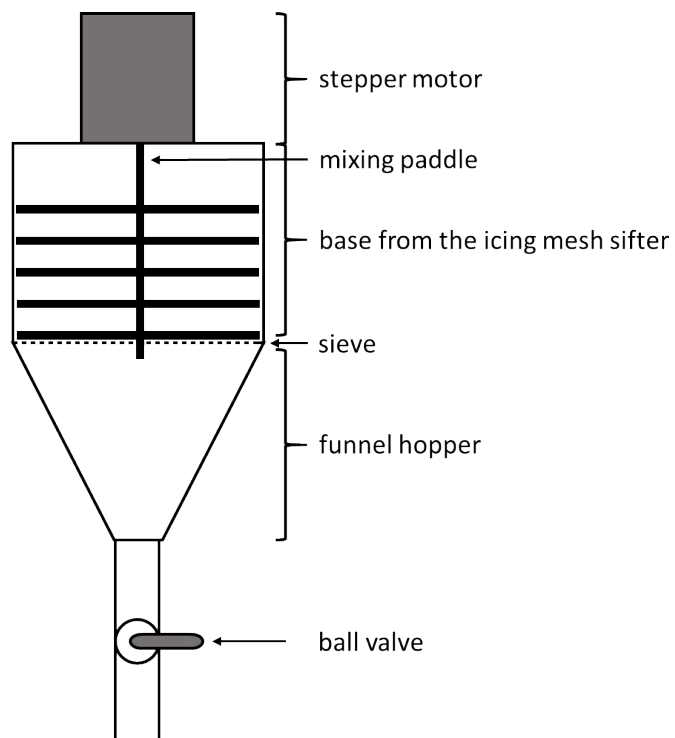


Figure S2. Diagram of the sorbent feeder

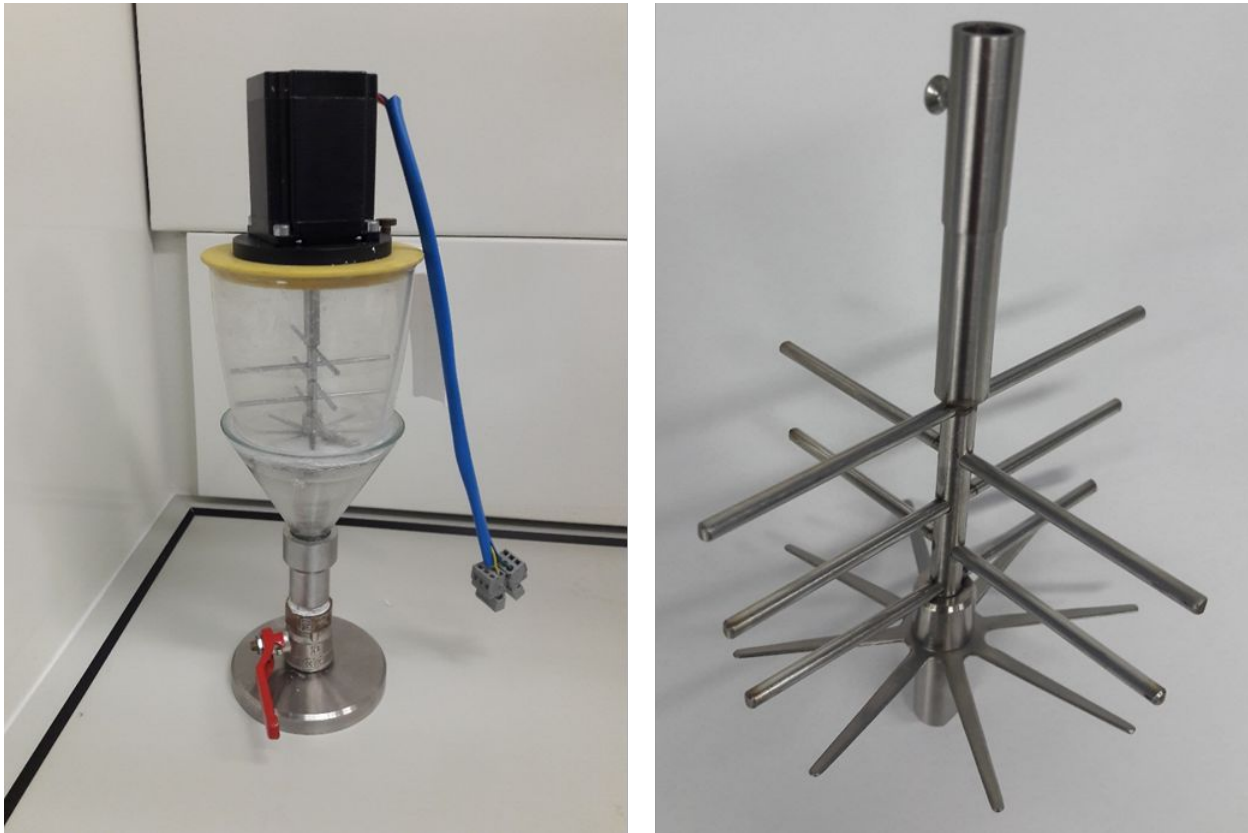


Figure S3. Sorbent feeder and its mixing paddle

The influence of sorbent consumption on the pollutant conversions

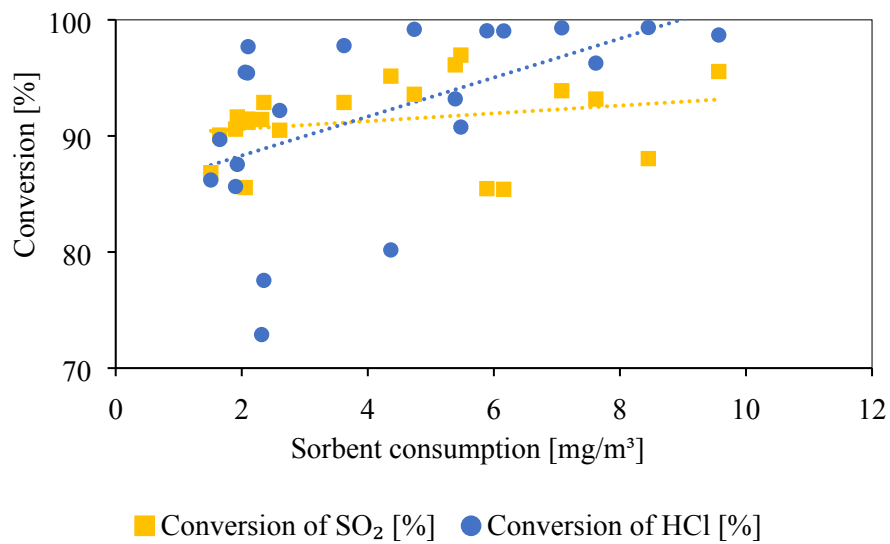
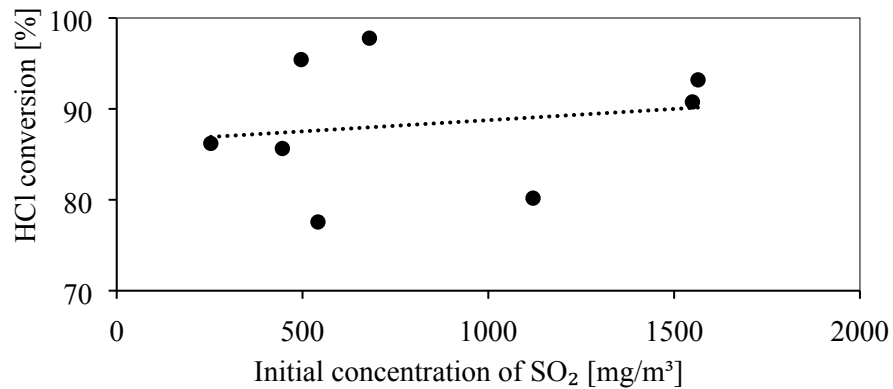


Figure S4. The influence of sorbent consumption on the pollutant conversions

The influence of initial concentration of SO₂ on HCl conversion



● Initial concentration of HCl at 113 mg/m³ ± 13 % for all values

Figure S5. The influence of the concentration of SO₂ in raw flue gas on the conversion of HCl