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APPENDICES

Appendix A   Concentration Time Data of MEA Oxidative Degradation Experiments

Table A1 Run No.1: 5 kmol/m^3 MEA, 100% O_2, 0.55 CO_2 loading and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.462
2	5.295
8	5.048
22	5.048
47	5.015
69	4.669
93	4.522
141	4.265

Table A2 Run No.2: 5.13 kmol/m^3 MEA, 100% O_2, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.130
1	5.147
3	5.149
9	5.012
23	4.799
54	4.297
76	3.992
96	3.689
144	2.975

Table A3 Run No.3: 5.06 kmol/m^3 MEA, 100% O_2, and 328 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.011
0.5	5.046
1	5.149
2	5.180
5	5.168
11	5.172
33	5.151
57	5.117
177	5.143

Table A4 Run No.4: 4.95 kmol/m^3 MEA, 100% O_2, and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	4.950
0.5	4.966
1	5.198
2	5.125
4	5.123
7	5.111
11.5	4.915
25	4.883
49	4.678
73	4.496
121	3.807
170	3.255

Table A5 Run No.5: 7 kmol/m^3 MEA, 100% O$_2$, 0.22 CO$_2$ loading and 328 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.169
1	7.092
7	7.261
24	7.152
72	7.064
95.5	7.132
144	7.065
192	6.976
265.5	6.761
334	6.678

Table A6 Run No.6: 3.2 kmol/m^3 MEA, 100% O$_2$, 0.22 CO$_2$ loading and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.121
1	3.162
5	3.127
24	2.991
48	2.880
74	2.791
97	2.637
120	2.573
168	2.411

Table A7 Run No.7: 3.18 kmol/m^3 MEA, 100% O_2, 0.42 CO_2 loading and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.155
2	3.153
4	3.118
25	2.981
73	2.794
120	2.644
164	2.569

Table A8 Run No.8: 6.85 kmol/m^3 MEA, 100% O_2, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	6.966
2	6.291
24	6.038
70.5	5.573
94.5	5.332
118.5	5.165
142.5	4.795

Table A9 Run No.9: 5.1 kmol/m^3 MEA, 6% O_2, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.156
20	5.135
44	5.104
68	5.089
117.5	5.105

Table A10 Run No.10: 5.1 kmol/m^3 MEA, 21% O_2, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
1	5.175
24	5.125
50	5.133
75	5.101
96	5.131
120	5.083
168	5.048

Table A11 Run No.11: 3 kmol/m^3 MEA, 6% O_2, 0.43 CO_2 loading and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.073
24	3.064
48	2.953
96	2.967
144	2.927
192	2.905
240	2.959
315.5	2.918

Table A12 Run No.12: 7.05 kmol/m^3 MEA, 21% O_2, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.333
2	7.375
4	7.274
8.5	7.278
95	7.233
140	7.221

Table A13 Run No.13: 3.25 kmol/m^3 MEA, 100% O_2, 0.52 CO_2 loading and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.354
1	3.362
24	3.285
48	3.164
72	3.098
96	3.074
120	2.994
164	2.983

Table A14 Run No.14: 3.15 kmol/m^3 MEA, 21% O_2, 0.28 CO_2 loading and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.091
3	3.099
22	3.109
46	3.054
94	3.017
119	3.058

Table A15 Run No.15: 4.95 kmol/m^3 MEA, 6 % O_2, 6 ppm SO_2, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.172
23	5.123
34.5	5.135
47.5	5.120
121.5	5.124
193	5.080
289	4.999

Table A16 Run No.16: 5.88 kmol/m^3 MEA, 6 % O$_2$, 6 ppm SO$_2$, and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	6.032
2	6.027
6	6.073
18	6.041
42	6.023
93	6.018
141	5.990

Table A17 Run No.17: 6.9 kmol/m^3 MEA, 6 % O$_2$, 11 ppm SO$_2$, and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.349
43	7.335
91	7.294
140	7.339
219.5	7.227

Table A18 Run No.18: 6.95 kmol/m^3 MEA, 6 % O$_2$, 11 ppm SO$_2$, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.171
24	7.183
48	7.113
77	7.086
120	7.099
168	7.034

Table A19 Run No.19: 6.91 kmol/m^3 MEA, 6 % O_2, 196 ppm SO_2, and 328 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.218
24	7.228
48	7.208
120	7.218
168	7.211
240	7.200
312	7.210

Table A20 Run No.20: 5 kmol/m^3 MEA, 6 % O_2, 196 ppm SO_2, 0.17 CO_2 loading, and 328 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.034
23	5.006
49	4.961
72	4.972
95	4.987
143	4.988

Table A21 Run No.21: 3 kmol/m^3 MEA, 6 % O_2, 196 ppm SO_2, 0.47 CO_2 loading, and 373 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.184
21	3.239
45	3.122
92	3.104
116	3.138
164	3.090
309	3.074

Table A22 Run No.22: 5 kmol/m^3 MEA, 6 % O$_2$, 6 ppm SO$_2$, 0.33 CO$_2$ loading, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.042
3	5.040
22.5	4.980
70.5	4.959
118.5	4.982
166.5	4.918
214.5	4.921
262.5	4.921
310.5	4.888

Table A23 Run No.23: 6.8 kmol/m^3 MEA, 6 % O$_2$, 11 ppm SO$_2$, 0.24 CO$_2$ loading, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.217
4	7.265
48	7.247
96	7.177
192	7.115

Table A24 Run No.24: 6.8 kmol/m^3 MEA, 6 % O$_2$, 196 ppm SO$_2$, 0.27 CO$_2$ loading, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	7.233
2	7.146
25	7.171
97	7.097
145	7.059
193	7.053
245	6.934
289	6.959

Table A25 Run No.25: 3.15 kmol/m^3 MEA, 6 % O$_2$, 11 ppm SO$_2$, 0.28 CO$_2$ loading, and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	3.115
16.5	3.098
41	3.095
87.25	3.069
112	3.073
160	3.082
184	3.049

Table A26 Run No.26: 5 kmol/m^3 MEA, 6 % O$_2$, 0.05 kmol/m^3 Inhibitor UR-A and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	4.891
1	4.891
23	4.874
47	4.895
71	4.867
95	4.887
119	4.879

Table A27 Run No.27: 5 kmol/m^3 MEA, 6 % O$_2$, 0.1 kmol/m^3 Inhibitor UR-A and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.246
2	5.216
7	5.172
18	5.199
24	5.197
48	5.166
75	5.149
96	5.167

Table A28 Run No.28: 5 kmol/m^3 MEA, 6 % O$_2$, 0.3 kmol/m^3 Inhibitor UR-A and
393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.301
1	5.153
2	5.139
24	5.154
48	5.067
97	5.063
144	5.015

Table A29 Run No.29: 7 kmol/m^3 MEA, 100 % O$_2$, 0.1 kmol/m^3 Inhibitor UR-A
and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	6.794
2	7.054
12	6.821
24	6.769
49	6.151
72	5.735
96	4.882
120	4.559
144	4.259

Table A30 Run No.30: 5 kmol/m^3 MEA, 6 % O$_2$, 6 ppm SO$_2$, 0.05 kmol/m^3 Inhibitor UR-A and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.038
24	5.018
48	5.024
72	5.042
96	4.991
122	5.018
144	5.001
168	5.017
216	4.996

Table A31 Run No.31: 5 kmol/m^3 MEA, 6 % O$_2$, 196 ppm SO$_2$, 0.05 kmol/m^3 Inhibitor UR-A and 393 K

Degradation time (h)	MEA concentration (kmol/m^3)
0	5.169
43	5.147
90	5.124
140	5.102
162	5.108
186	5.117
234	5.121

Appendix B   Experimental Rates and Model Predicted Rates using Power Law Model

Table B1 Kinetic Data for Power Law Model

| Temperature | MEA | O_2 | SO_2 | CO_2 | Degradation rate ($kmol/m^3.h$) | | %AAD |
(K)	($kmol/m^3$)	($kmol/m^3$)	($kmol/m^3$)	($kmol/m^3$)	Experimental	Model predicted	
393	5.03	0.00239	1E-11	2.77	0.00840	0.00851	1.28
393	5.13	0.00239	1E-11	1E-11	0.01835	0.01564	14.79
373	4.95	0.00222	1E-11	1E-11	0.01289	0.00819	36.50
328	7.00	0.00231	1E-11	1.54	0.00151	0.00187	24.00
373	3.20	0.00222	1E-11	0.70	0.00507	0.00436	14.01
373	3.18	0.00222	1E-11	1.34	0.00406	0.00429	5.67
393	6.85	0.00239	1E-11	1E-11	0.01894	0.01623	14.28
393	5.10	0.00073	1E-11	1E-11	0.00045	0.00033	27.77
393	5.10	0.00100	1E-11	1E-11	0.00065	0.00089	38.00
393	7.05	0.00100	1E-11	1E-11	0.00077	0.00093	21.46
373	3.25	0.00222	1E-11	1.69	0.00284	0.00428	50.75
393	3.15	0.00100	1E-11	0.88	0.00054	0.00047	13.50
373	5.88	0.00057	0.000094	1E-11	0.00036	0.00030	15.74
373	6.90	0.00057	0.000172	1E-11	0.00048	0.00032	33.18
393	6.95	0.00073	0.000172	1E-11	0.00082	0.00109	32.75
373	3.00	0.00057	0.003063	1.41	0.00042	0.00020	53.30
393	5.00	0.00073	0.000094	1.65	0.00044	0.00055	26.08
393	6.80	0.00073	0.000172	1.63	0.00070	0.00060	14.40
393	6.80	0.00073	0.003063	1.84	0.00088	0.00073	17.33
393	3.00	0.00073	0.003063	0.66	0.00074	0.00067	9.23

Appendix C Experimental Rates and Model Predicted Rates using Modified Power Law Model

Table C1 Kinetic Data for Modified Power Law Model

Temperature (K)	MEA ($kmol/m^3$)	O_2 ($kmol/m^3$)	SO_2 ($kmol/m^3$)	CO_2 ($kmol/m^3$)	Degradation rate ($kmol/m^3.h$) Experimental	Model predicted	%AAD
393	5.03	0.00239	0	2.77	0.00840	0.00835	0.57
393	5.13	0.00239	0	1E-11	0.01835	0.01842	0.36
373	4.95	0.00222	0	1E-11	0.01289	0.00916	28.93
328	7.00	0.00231	0	1.54	0.00151	0.00132	12.55
373	3.20	0.00222	0	0.70	0.00507	0.00431	14.85
373	3.18	0.00222	0	1.34	0.00406	0.00423	4.24
393	6.85	0.00239	0	1E-11	0.01894	0.01847	2.49
393	5.10	0.00073	0	1E-11	0.00045	0.00059	31.94
373	3.25	0.00222	0	1.69	0.00284	0.00420	48.08
393	3.15	0.00100	0	0.88	0.00054	0.00068	25.18
393	4.95	0.00073	0.000094	1E-11	0.00049	0.00059	21.00
373	5.88	0.00057	0.000094	1E-11	0.00036	0.00018	50.36
393	6.95	0.00073	0.000172	1E-11	0.00082	0.00060	27.20
328	5.00	0.00024	0.003063	0.85	0.00026	0.00010	62.65
373	3.00	0.00057	0.003063	1.41	0.00042	0.00042	1.25
393	5.00	0.00073	0.000094	1.65	0.00044	0.00027	37.37
393	6.80	0.00073	0.000172	1.63	0.00070	0.00027	60.72
393	6.80	0.00073	0.003063	1.84	0.00088	0.00081	8.12
393	3.00	0.00073	0.003063	0.66	0.00074	0.00083	12.09

Appendix D Experimental Rates and Model Predicted Rates using Split Model

Table D1 Kinetic Data for Split Model

Temperature (K)	MEA (kmol/m³)	O_2 (kmol/m³)	SO_2 (ppm)	CO_2 (kmol/m³)	Degradation rate (kmol/m³.h) Experimental	Model predicted	%AAD
393	5.03	0.00239	0	2.77	0.00840	0.00727	13.47
393	5.13	0.00239	0	0	0.01835	0.01762	4.00
373	4.95	0.00222	0	0	0.01289	0.01058	17.98
328	7.00	0.00231	0	1.54	0.00151	0.00270	78.55
373	3.20	0.00222	0	0.70	0.00507	0.00478	5.70
373	3.18	0.00222	0	1.34	0.00406	0.00443	9.12
393	6.85	0.00239	0	0	0.01894	0.01856	2.03
393	5.10	0.00073	0	0	0.00045	0.00050	12.00
393	7.05	0.00100	0	0	0.00077	0.00135	76.11
373	3.25	0.00222	0	1.69	0.00284	0.00432	52.26
393	3.15	0.00100	0	0.88	0.00054	0.00056	2.41
393	4.95	0.00073	6	0	0.00049	0.00073	47.83
373	5.88	0.00057	6	0	0.00036	0.00039	9.36
373	6.90	0.00057	11	0	0.00048	0.00046	5.26
393	6.95	0.00073	11	0	0.00082	0.00086	4.60
328	5.00	0.00024	196	0.85	0.00026	0.00027	3.73
373	3.00	0.00057	196	1.41	0.00042	0.00038	8.78
393	5.00	0.00073	6	1.65	0.00044	0.00045	2.30
393	6.80	0.00073	11	1.63	0.00070	0.00055	20.93
393	6.80	0.00073	196	1.84	0.00088	0.00087	1.98
393	3.00	0.00073	11	0.66	0.00074	0.00041	44.28

Appendix E   Experimental Rates and Model Predicted Rates using Combined Model

Table E1 Kinetic Data for Combined Model

Temperature	MEA	O_2	SO_2	CO_2	Degradation rate (kmol/m^3.h)		%AAD
(K)	(kmol/m^3)	(kmol/m^3)	(kmol/m^3)	(kmol/m^3)	Experimental	Model predicted	
393	5.03	0.00239	0	2.77	0.00840	0.00833	0.80
393	5.13	0.00239	0	0	0.01835	0.02015	9.80
373	4.95	0.00222	0	0	0.01289	0.00997	22.70
328	7.00	0.00231	0	1.54	0.00151	0.00135	10.50
373	3.20	0.00222	0	0.70	0.00507	0.00470	7.25
373	3.18	0.00222	0	1.34	0.00406	0.00441	8.76
393	6.85	0.00239	0	0	0.01894	0.02024	6.84
393	5.10	0.00073	0	0	0.00045	0.00064	42.66
373	3.25	0.00222	0	1.69	0.00284	0.00431	51.97
393	3.15	0.00100	0	0.88	0.00054	0.00073	33.95
393	4.95	0.00073	0.000094	0	0.00049	0.00064	30.80
373	5.88	0.00057	0.000094	0	0.00036	0.00019	46.69
373	6.90	0.00057	0.000172	0	0.00048	0.00019	60.21
393	6.95	0.00073	0.000172	0	0.00082	0.00065	21.17
373	3.00	0.00057	0.003063	1.41	0.00042	0.00041	2.04
393	5.00	0.00073	0.000094	1.65	0.00044	0.00028	35.87
393	6.80	0.00073	0.000172	1.63	0.00070	0.00028	59.68
393	6.80	0.00073	0.003063	1.84	0.00088	0.00080	9.13
393	3.00	0.00073	0.003063	0.66	0.00074	0.00088	18.38

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