APPENDIX B

Contains data from Hopewell Regional Wastewater Treatment Facility (HRWTF) respirometric and inhibition experiments.

Table B.1 (corresponds to Figure 3.1 Mixed liquor trends over 7_26_02 sampling cycle.)

Sample	Time	MLVSS	Avg MLVSS	MLVSS CONC (mg/L)	
	min	g	g	w/dilution	w/o dilution
#1	0	0.0136	0.0131	875.56	3502.22
#1		0.0134			
#1		0.0124			
#2	52	0.0131	0.0128	851.11	3404.44
#2		0.0126			
#2		0.0126			
#3	108	0.0126	0.0127	846.67	3386.67
#3		0.0129			
#3		0.0126			
#4	172	0.0126	0.0128	855.56	3422.22
#4		0.0129			
#4		0.0130			

Table B.2 (corresponds to Figure 3.2. Average mixed liquor concentration variations over time.)

Date	MLVSS Conc mg/L
6/19/2002	4053
7/2/2002	3767
7/9/2002	3840
7/12/2002	4022
7/16/2002	3253
7/19/2002	3606
7/23/2002	2831
7/26/2002	3429
8/13/2002	2831
8/16/2002	5531
9/25/2002	3156
9/26/2002	4342

Table B.3a (corresponds to Table B.1: Soluble COD averages and ranges over sampling period.)

Date	Honeywell Soluble AVG mg/L	Stdev	Honeywell Total AVG mg/L	Stdev	Hercules Soluble AVG mg/L	Stdev	Hercules Total AVG mg/L	StDev	Goldschmidt Soluble AVG mg/L	Stdev	Goldschmidt Total AVG mg/L	StDev
6/19/2002	391	62	341	27	4755	0	3981	80	3162	21	4000	54
7/2/2002	262	2	244	5	17226	1916	13355	821	1548		1355	1369
7/9/2002	309	4	329	30	16990	1770	15738	506				
7/12/2002	321	8	326	25	12566	0	12035	1752	44956	3755	25133	1752
7/16/2002	339	10	337	25	21883	254	20628	1522				
7/19/2002	283	4	327	0	17278	269	15000	1880	40823	2417	40063	1880
7/23/2002	1719	0	1755	0	19803	1028	20348	257				
7/26/2002	2400	0	1512	26	14977	258	15890	0	47671	0	58813	775
8/13/2002	909	39	905	0	17902	556	19279	835				
8/30/2002	557	11	573	39	10547	563	13134	281	41393	1407	43781	281
9/25/2002	126	2	352	5	20593	265	23401	530	24899	0	25835	265
9/26/2002	170	2	441	5	19215	0	21287	799	27692	1332	34851	266

Table B.3b (corresponds to Table B.1: Soluble COD averages and ranges over sampling period.)

Date	S.Stone Soluble AVG mg/L	StDev	S. Stone Total AVG mg/L	Stdev	Stone-Hap Soluble AVG mg/L	Stdev	Stone-Hap Total AVG mg/L	Stdev
6/19/2002	68	21	209	107			4853	1367
7/2/2002					29806	2190	21194	2053
7/9/2002					22355	1265	24322	1012
7/12/2002	11593	250	16726	0	33451	0	33451	0
7/16/2002	1901	0	2655	152	29238	507	26726	1015
7/19/2002	176	9	429	27	30190	806	30949	269
7/23/2002	272	8	429	46	23255	257	27252	771
7/26/2002	196	2	617	21	29041	1033	31781	775
8/13/2002	190	13	409	50	24197	556	30492	0
8/30/2002	245	2	470	6	28856	0	31841	844
9/25/2002								
9/26/2002	229	4	595	32	29765	1598	33532	

Table B.4 (corresponds to Figures 3.3 and 3.4: Industrial wastewater characteristics of July 2002 and wastewater total COD percentages contributing to HRWTF in July 2002.)

Industry	AVG Flow mgd	StDev	Avg COD mg/L	StDev	% of total COD kg
Honeywell	7.79	1.16	700	475	20.2
Hercules	1.54	0.32	4056	604	23.1
Goldschmidt	0.04	0.02	11219	4092	1.6
Smurfit-Stone	13.23	0.90	885	264	43.4
Stone-HAP	0.44	0.02	7111	308	11.6
Total	23.04		23971		

Table B.5 (corresponds to Figure 3.5: SOUR results from 7/26/02.)

Sample	OUR 2 mg O2/L.min	SOUR mg O2/g-MLVSS-hr	Avg SOUR mg O2/g-MLVSS-hr
Control (ML/FE)	0.1114	7.80	7.78
Control (ML/FE)	0.1110	7.77	
3ml Honeywell	0.1293	9.14	8.70
3ml Honeywell	0.1168	8.26	
5ml Honeywell	0.1378	9.81	9.74
5ml Honeywell	0.1358	9.67	
10ml Honeywell	0.1457	9.86	9.64
10ml Honeywell	0.1393	9.43	
3ml Hercules	0.1604	11.34	10.99
3ml Hercules	0.1506	10.65	
5ml Hercules	0.1055	7.51	9.85
5ml Hercules	0.1714	12.20	
10ml Hercules	0.1968	13.32	12.89
10ml Hercules	0.1842	12.46	
3ml Goldschmidt	0.1602	11.33	10.92
3ml Goldschmidt	0.1487	10.51	
5ml Goldschmidt	0.1180	8.40	8.02
5ml Goldschmidt	0.1074	7.64	
10ml Goldschmidt	0.0609	4.12	3.85
10ml Goldschmidt	0.0530	3.59	
3ml S.Stone	0.2148	15.19	14.92
3ml S.Stone	0.2074	14.66	
5ml S.Stone	0.2383	16.96	16.46
5ml S.Stone	0.2242	15.96	
10ml S.Stone	0.2790	18.88	18.34
10ml S.Stone	0.2630	17.79	
3ml Stone-HAP	0.3875	27.40	26.57
3ml Stone-HAP	0.3642	25.75	
5ml Stone-HAP	0.3947	28.09	26.70
5ml Stone-HAP	0.3555	25.30	
10ml Stone-HAP	0.3950	26.73	25.44
10ml Stone-HAP	0.3570	24.15	

Average dilution MLVSS conc = 848.65 mg/L

Example OUR to SOUR calculation:
e.g. Honeywell 3 ml (highlighted)

.1293 mg O_2	60 min	L	1000 mg
L-min	hour	848. 65 mg MLVSS	g

= 9.14 mg O_2/ g-MLVSS-hr

Table B.6 (corresponds to Figure 3.6. Endogenous variations over the sampling period.)

Date	SOUR-1	SOUR-2	Avg SOUR
	mg O2/g-MLVSS-hr		
6/19/2002	0.57	0.57	0.57
7/2/2002	5.39	5.90	5.64
7/9/2002	13.76	13.52	13.64
7/12/2002	6.77	7.14	6.95
7/16/2002	13.52	13.71	13.61
7/19/2002	17.73	19.33	18.53
7/23/2002	15.42	15.06	15.24
7/26/2002	7.78	7.80	7.79
8/13/2002	15.42	15.06	15.24
8/16/2002	5.35	5.72	5.54
9/25/2002	17.17	17.17	17.17
9/26/2002	12.80	12.80	12.80

Table B.7 (corresponds to Figure 3.7: Soluble COD variations in the Hercules wastewater over the sampling period.)

Date	Avg	StDev
	mg/L	
6/19/2002	4755	0
7/2/2002	17226	1916
7/9/2002	16990	1770
7/12/2002	12566	0
7/16/2002	21883	254
7/19/2002	17278	269
7/23/2002	19803	1028
7/26/2002	14977	258
8/13/2002	17902	556
8/16/2002	10547	563
9/25/2002	20593	265
9/26/2002	19215	0

Table B.8a (corresponds to Figures 3.8 and 3.9: COD normalized Honeywell SOUR experiments over sampling period.)

	(mg O_2/g-MLVSS-hr)			(mg/L)	(mg O_2/g-MLVSS-hr-mg sCOD			(mg O_2/g-MLVSS-hr)			
	SOUR			sCOD	SOUR/sCOD				SOUR/$SOUR_0$		
	3ml	5ml	10ml		3ml	5ml	10ml	$SOUR_0$	3ml	5ml	10ml
6/19/2002	1.55	1.70	1.27	391.28	1.32	0.87	0.32	0.57	2.71	2.96	2.22
7/2/2002	6.52	6.99	9.93	261.68	8.30	5.34	3.80	5.39	1.21	1.30	1.84
7/9/2002	15.67	16.75	15.82	309.03	16.90	10.84	5.12	13.76	1.14	1.22	1.15
7/12/2002	6.40	7.47	7.74	321.42	6.64	4.65	2.41	6.77	0.95	1.10	1.14
7/16/2002	20.48	21.32	22.32	338.65	20.16	12.59	6.59	13.52	1.51	1.58	1.65
7/19/2002	25.65	26.19	28.61	282.53	30.27	18.54	10.13	17.73	1.45	1.48	1.61
7/23/2002	15.03	12.12	5.90	1718.70	2.91	1.41	0.34	15.42	0.97	0.79	0.38
7/26/2002	8.70	9.74	9.64	2400.00	1.21	0.81	0.40	7.78	1.12	1.25	1.24
8/13/2002	15.03	12.12	5.90	908.85	5.51	2.67	0.65	15.42	0.97	0.79	0.38
8/16/2002	6.30	5.05	2.14	557.21	3.77	1.81	0.38	5.35	1.18	0.94	0.40
new dilutions	40ml	80ml	120ml								
9/25/2002	20.90	20.46	21.78	125.80	4.15	2.03	1.44	17.17	1.22	1.19	1.27
9/26/2002	2.43	2.62	2.89	170.30	0.36	0.19	0.14	12.80	0.19	0.20	0.23

values normalized to amount of wastewater added to BOD bottle (.003L, .005L, .01L)

Table B.8b (corresponds to Figure 3.8 and 3.9: COD normalized Honeywell SOUR experiments over sampling period.)

(L/mg sCOD)

	SOUR/$SOUR_0$/sCOD		
	3ml	5ml	10ml
6/19/2002	2.31	1.51	0.57
7/2/2002	1.54	0.99	0.70
7/9/2002	1.23	0.79	0.37
7/12/2002	0.98	0.69	0.36
7/16/2002	1.49	0.93	0.49
7/19/2002	1.71	1.05	0.57
7/23/2002	0.19	0.09	0.02
7/26/2002	0.16	0.10	0.05
8/13/2002	0.36	0.17	0.04
8/16/2002	0.70	0.34	0.07
new dilutions	40ml	80ml	120ml
9/25/2002	0.24	0.12	0.08
9/26/2002	0.03	0.02	0.01

Table B.9a (corresponds to Figure 3.10: Endogenous normalized Goldschmidt wastewater over sampling period.)

	(mg O_2/g-MLVSS-hr)			(mg/L)	(mg O_2/g-MLVSS-hr-mg sCOD			(mg O_2/g-MLVSS-hr)			
	SOUR			sCOD	SOUR/sCOD				SOUR/$SOUR_0$		
	3ml	5ml	10ml		3ml	5ml	10ml	$SOUR_0$	3ml	5ml	10ml
6/19/2002	1.59	1.91	1.66	3162.09	0.17	0.12	0.05	0.57	2.77	3.34	2.91
7/2/2002	9.97	10.80	11.12	1548.39	2.15	1.39	0.72	5.39	1.85	2.00	2.06
7/9/2002								13.76			
7/12/2002	8.80	7.84	5.06	44955.75	0.07	0.03	0.01	6.77	1.30	1.16	0.75
7/16/2002								13.52			
7/19/2002	29.97	22.90	13.38	40822.78	0.24	0.11	0.03	17.73	1.69	1.29	0.75
7/23/2002								15.42			
7/26/2002	10.92	8.02	3.85	47671.23	0.08	0.03	0.01	7.78	1.40	1.03	0.50
8/13/2002								15.42			
8/16/2002	1.06	1.07	1.60	41393.03	0.01	0.01	0.00	5.35	0.20	0.20	0.30
new dilutions	.10ml	.40ml	1.0ml								
9/25/2002	19.83	6.72	4.79	24898.60	7.96	0.68	0.19	17.17	1.15	0.39	0.28
9/26/2002	4.67	2.15	4.94	27692.31	1.69	0.19	0.18	12.80	0.36	0.17	0.39

Table B.9b (corresponds to Figure 3.10: Endogenous normalized Goldschmidt wastewater over sampling period.)

	(L/mg sCOD)		
	$SOUR/SOUR_0$/sCOD		
	3ml	5ml	10ml
6/19/2002	0.29	0.21	0.09
7/2/2002	0.40	0.26	0.13
7/9/2002			
7/12/2002	0.01	0.01	0.00
7/16/2002			
7/19/2002	0.01	0.01	0.00
7/23/2002			
7/26/2002	0.01	0.00	0.00
8/13/2002			
8/16/2002	0.00	0.00	0.00
new dilutions	.10ml	.40ml	1.0ml
9/25/2002	0.46	0.04	0.01
9/26/2002	0.13	0.02	0.01

Table B.10a (corresponds to Figure 3.11: Endogenous normalized Stone-HAP wastewater over sampling period.)

	(mg O_2/g-MLVSS-hr)			(mg/L)	(mg O_2/g-MLVSS-hr-mg sCOD			(mg O_2/g-MLVSS-hr)			
	SOUR			sCOD	SOUR/sCOD				SOUR/$SOUR_0$		
	3ml	5ml	10ml		3ml	5ml	10ml	$SOUR_0$	3ml	5ml	10ml
6/19/2002	2.23	2.19	2.22	4853.08	0.15	0.09	0.05	0.57	3.89	3.83	3.87
7/2/2002	2.76	1.78		29806.45	0.03	0.01		5.39	0.51	0.33	
7/9/2002	37.74	39.59	7.49	22354.69	0.56	0.35	0.03	13.76	2.74	2.88	0.54
7/12/2002	2.98	2.16	3.23	33451.33	0.03	0.01	0.01	6.77	0.44	0.32	0.48
7/16/2002	40.53	45.01	27.85	29237.67	0.46	0.31	0.10	13.52	3.00	3.33	2.06
7/19/2002	48.76	57.97	51.94	30189.87	0.54	0.38	0.17	17.73	2.75	3.27	2.93
7/23/2002	1.70	2.10	2.14	23255.11	0.02	0.02	0.01	15.42	0.11	0.14	0.14
7/26/2002	26.57	26.70	25.44	29041.10	0.31	0.18	0.09	7.78	3.41	3.43	3.27
8/13/2002	1.70	2.10	2.14	24196.72	0.02	0.02	0.01	15.42	0.11	0.14	0.14
8/16/2002	2.24	1.01		28855.72	0.03	0.01		5.35	0.42	0.19	
new dilutions	1ml	5ml	10ml								
9/25/2002								17.17			
9/26/2002	2.43	2.62	2.89	29764.52	0.08	0.02	0.01	12.80	0.19	0.20	0.23

Table B.10b (corresponds to Figure 3.11: Endogenous normalized Stone-HAP wastewater over sampling period.)

	(L/mg sCOD)		
	$SOUR/SOUR_0$/sCOD		
	3ml	5ml	10ml
6/19/2002	0.267501	0.1577	0.07977
7/2/2002	0.005727	0.00221	
7/9/2002	0.04089	0.02574	0.002434
7/12/2002	0.004387	0.00191	0.001428
7/16/2002	0.034171	0.02277	0.007044
7/19/2002	0.030364	0.02166	0.009704
7/23/2002	0.001584	0.00117	0.000597
7/26/2002	0.039187	0.02362	0.011255
8/13/2002	0.001523	0.00113	0.000574
8/16/2002	0.004843	0.0013	
new dilutions	1ml	5ml	10ml
9/25/2002			
9/26/2002	0.006378	0.00138	0.000758

Table B.11a (corresponds to Figure 3.12: Endogenous normalized Hercules wastewater over sampling period.)

	(mg O_2/g-MLVSS-hr)			(mg/L)	(mg O_2/g-MLVSS-hr-mg sCOD			(mg O_2/g-MLVSS-hr)			
	SOUR			sCOD	SOUR/sCOD				SOUR/$SOUR_0$		
	3ml	5ml	10ml		3ml	5ml	10ml	$SOUR_0$	3ml	5ml	10ml
6/19/2002		1.63	2.35	4754.50		0.07	0.05	0.57		2.85	4.10
7/2/2002	12.38	11.87	12.44	17225.81	0.24	0.14	0.07	5.39	2.30	2.20	2.31
7/9/2002	21.63	22.74	22.16	16989.57	0.42	0.27	0.13	13.76	1.57	1.65	1.61
7/12/2002	12.46	14.81	15.95	12566.37	0.33	0.24	0.13	6.77	1.84	2.19	2.36
7/16/2002	22.09	22.62	16.48	21883.41	0.34	0.21	0.08	13.52	1.63	1.67	1.22
7/19/2002	29.72	27.56	21.53	17278.48	0.57	0.32	0.12	17.73	1.68	1.55	1.21
7/23/2002	3.47	1.83	1.60	19803.18	0.06	0.02	0.01	15.42	0.23	0.12	0.10
7/26/2002	10.99	9.85	12.89	14977.17	0.24	0.13	0.09	7.78	1.41	1.27	1.66
8/13/2002	3.47	1.83	1.60	17901.64	0.06	0.02	0.01	15.42	0.23	0.12	0.10
8/16/2002	1.77	2.72	5.79	10547.26	0.06	0.05	0.05	5.35	0.33	0.51	1.08
new dilutions	5ml	16ml	30ml								
9/25/2002	19.15	13.77	4.24	20592.82	0.19	0.04	0.01	17.17	1.12	0.80	0.25
9/26/2002	18.88	10.01	21.39	19215.07	0.20	0.03	0.04	12.80	1.48	0.78	1.67

Table B.11b (corresponds to Figure 3.12: Endogenous normalized Hercules wastewater over sampling period.)

	(L/mg sCOD)		
	SOUR/$SOUR_0$/sCOD		
	3ml	5ml	10ml
6/19/2002		0.12	0.09
7/2/2002	0.04	0.03	0.01
7/9/2002	0.03	0.02	0.01
7/12/2002	0.05	0.03	0.02
7/16/2002	0.02	0.02	0.01
7/19/2002	0.03	0.02	0.01
7/23/2002	0.00	0.00	0.00
7/26/2002	0.03	0.02	0.01
8/13/2002	0.00	0.00	0.00
8/16/2002	0.01	0.01	0.01
new dilutions	5ml	16ml	30ml
9/25/2002	0.01	0.00	0.00
9/26/2002	0.02	0.00	0.00

Table B.12a (corresponds to Figure 3.13: Endogenous normalized Smurfit-Stone wastewater over sampling period.)

	(mg O_2/g-MLVSS-hr)			(mg/L)	(mg O_2/g-MLVSS-hr-mg sCOD			(mg O_2/g-MLVSS-hr)			
	SOUR			sCOD	SOUR/sCOD				SOUR/$SOUR_0$		
	3ml	5ml	10ml		3ml	5ml	10ml	$SOUR_0$	3ml	5ml	10ml
6/19/2002	1.30	1.53	1.62	68.25	6.36	4.48	2.38	0.57	2.28	2.67	2.84
7/2/2002								5.39			
7/9/2002	23.93	27.51	15.58					13.76	1.74	2.00	1.13
7/12/2002	11.90	14.40	17.82	11592.92	0.34	0.25	0.15	6.77	1.76	2.13	2.63
7/16/2002	43.38	45.98	46.81	1901.35	7.61	4.84	2.46	13.52	3.21	3.40	3.46
7/19/2002	0.63	0.60	1.98	176.20	1.18	0.68	1.12	17.73	0.04	0.03	0.11
7/23/2002	0.63	0.60	1.98	271.79	0.77	0.44	0.73	15.42	0.04	0.04	0.13
7/26/2002	14.92	16.46	18.34	195.80	25.41	16.81	9.36	7.78	1.92	2.11	2.36
8/13/2002	0.63	0.60	1.98	190.43	1.09	0.63	1.04	15.42	0.04	0.04	0.13
8/16/2002	1.36	0.96	1.29	245.17	1.85	0.78	0.52	5.35	0.25	0.18	0.24
new dilutions		120ml	160ml								
9/25/2002								17.17			
9/26/2002		6.73	20.68	229.07		0.24	0.56	12.80		0.53	1.62

Table B.12b (corresponds to Figure 3.13: Endogenous normalized Smurfit-Stone wastewater over sampling period.)

	(L/mg sCOD)		
	SOUR/$SOUR_0$/sCOD		
	3ml	5ml	10ml
6/19/2002	11.11	7.83	4.16
7/2/2002			
7/9/2002			
7/12/2002	0.05	0.04	0.02
7/16/2002	0.56	0.36	0.18
7/19/2002	0.07	0.04	0.06
7/23/2002	0.05	0.03	0.05
7/26/2002	3.26	2.16	1.20
8/13/2002	0.07	0.04	0.07
8/16/2002	0.35	0.15	0.10
new dilutions		120ml	160ml
9/25/2002			
9/26/2002		0.02	0.04

Table B.13 (corresponds to Figure 3.14: Stage-two results for 9/25/02.)

$SOUR/SOUR_0$	Honeywell 9/25/2002	Hercules 9/25/2002	Goldschmidt 9/25/2002
Low Volume	1.22	1.12	1.15
Avg. Volume	1.19	0.80	0.39
High Volume	1.27	0.25	0.28

Table B.14 (corresponds to Figure 3.15: Stage-two results for 9/26/02.)

$SOUR/SOUR_0$	Honeywell 9/26/2002	Hercules 9/26/2002	Goldschmidt 9/26/2002	S. Stone 9/26/2002	Stone-Hap 9/26/2002
Low Volume	1.22	1.12	1.15		0.19
Avg. Volume	1.19	0.80	0.39	0.53	0.20
High Volume	1.27	0.25	0.28	1.62	0.23

Table B.15 Flow and COD characteristics of HRWTF (values taken from HRWTF data for July 2002)

Average	Honeywell	Hercules	Goldschmdit	S.Stone	Stone-HAP
Flow (mgd)	7.79	1.54	0.038994	13.228	0.442
COD (mg/L)	700	4056	11219	885	7111

Total Flow into HRWTF is approximately 30 mgd

Example calculation for Goldschmidt:

$$\frac{11219 \text{ mg COD}}{\text{L}} \left| \frac{3.78\text{L}}{\text{gal}} \right| .038994\text{E06 gal} = 1{,}654 \text{ kg COD entering the headworks from Goldschmidt}$$

$$\frac{1{,}654\text{E06 mg COD}}{30\text{E06 gal tot. flow}} \left| \frac{1 \text{ gal}}{3.78 \text{ L}} \right. = 14.59 \text{ mg/L COD entering the headworks from Goldschmidt}$$

$$\frac{14.59 \text{ mg}}{\text{L}} \left| .3\text{L (vol of BOD bottle)} = \right. 4.377 \text{ mg COD added to BOD bottle from Goldschmidt if WW added was composite of all WW}$$

$$\frac{4.377 \text{ mg}}{} \left| \frac{\text{L}}{11219 \text{ mg}} \right| \frac{10\text{^3 ml}}{\text{L}} = .40 \text{ ml (rounded to nearest tenth)}$$

This is the avg. value calculated, .05 ml and 1.0 ml were chosen as additional volumes so a trend could be seen

These calculations were repeated for each industrial wastewater. The resulting volumes are listed below.

Table B.16 New dilution volmes

Volumes (ml)	Honeywell	Hercules	Goldschmdit	S.Stone	Stone-HAP
Low	40	5	0.05	70	1
Average	80	16	0.4	136	5
Hign	120	30	1	200	10