

Appendix A: Source Data for Chapter 2

Experiment 1: MAA/AE Cycling without Nutrient Limitation

1/13/99: Started the system

1/29/99: Started biomass wasting

End of AE phase (AE 3 hr)

Date	Day of Operation	MLSS (mg/L)	PHA (% TSS)	PHA Stdev.	PHA (mg/L)	PHV/PHA (%)	Inf COD (mg/L)	COD (mg/L)	Eff COD (mg/L)
1/19/99	6	1893	2.1	0.4	39.8	38.1	619.0	32	30
1/23/99	10	1980	8.8	0	174.2	59.1	598.0	35	28
1/28/99	15	2240	8.2*	0.4	183.7	52.4*	617.0	53	46
1/30/99	17	1885	9.1	0.3	171.5	45.1	610.0	45	39
2/5/99	23	1685	6.7	0.5	112.9	34.3	602.0	64	59
2/11/99	29	1430	4.9	0.4	70.1	28.6	614.0	54	55
2/17/99	35	1120	4.9	0.7	54.9	24.5	615.0	89	87
2/19/99	37	1095	2.2	0.2	24.1	27.3	608.0	145	149
2/23/99	41	995	3.7	0	36.8	29.7	610.0	289	290
3/4/99	50	900	1.9	0.2	17.1	26.3	612.0	299	287

*Results of AE 1 hr (failure was occurred during PHA analysis on the samples of AE 3 hr)

Experiment 2: MAA/AE Cycling with N&P Limitations

End of MAA Phase

Date	Day of operation	Day after N&P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
2/11/99	1	no limitation	1465	7.6	0.4	111.3	40.8	0.9	NM	NM	NM	NM	NM	NM
2/16/99	6	no limitation	1520	8.1	0.3	123.1	39.5	1.7	589	4.8	345	14.8	NM	NM
2/24/99	14	no limitation	1620	8.8	0	142.6	42	0	585	2.1	295	8.9	NM	NM
3/4/99	22	no limitation	1710	8.1	0.9	138.5	42	4.8	587	1.7	285	13.5	NM	NM
3/7/99	25	2	1700	22.7	0.5	385.9	42.3	0.8	565	0.8	390	5.6	NM	NM
3/10/99	28	5	1680	35	0.8	588.0	26.3	1.6	577	2.1	408	7.6	NM	NM
3/18/99	36	13	1600	41.2	1.7	659.2	19.4	0	580	9.6	325	4.2	NM	NM
3/25/99	43	20	1710	46.8	0.8	800.3	11.5	0.5	553	5.4	281	15.8	NM	NM
3/31/99	49	26	2100	37.8	0*	793.8	12.4	0*	585	2.5	382	12.5	NM	NM
4/8/99	57	34	1085	36.2	1.6	392.8	9.4	1.9	614	0.9	531	30.5	35.1	0.9
4/13/99	62	39	870	38.9	2.4	338.4	15.7	1.6	602	0.8	292	8.5	30.5	2.1
4/22/99	71	48	833	25.1	2.1	209.1	23.1	2.4	571	1.7	531	5.4	19.6	4.8
4/30/99	79	56	1588	25.3	0.5	401.8	24.9	6.8	598	2.1	530	10.7	18.3	2.3
5/3/99	82	59	1110	23.1	0.6	256.4	26.4	0.5	595	0	521	12.9	17.2	1.7
5/13/99	92	69	985	17.7	0	174.3	23.7	0.3	588	0.4	522	6.8	22.5	0.7

AE 2 hours

Date	Day of operation	Day after N&P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
2/11/99	1	no limitation	1500	6.9	0.6	103.5	39.1	0.8	NM	NM	NM	NM	NM	NM
2/16/99	6	no limitation	1650	7.9	2	130.4	39.2	2.1	75	6.8	68	5.4	NM	NM
2/24/99	14	no limitation	1698	9.8	0.3	166.4	42.9	0.3	65	2.5	62	2.1	NM	NM
3/4/99	22	no limitation	1750	7.5	0.8	131.3	40	0.9	67	6.9	58	0.2	NM	NM
3/7/99	25	2	1860	23	1.5	427.8	41.3	0	190	10.2	182	0.9	NM	NM
3/10/99	28	5	1860	42.9	0.3	797.9	26.6	4.2	155	8.9	147	0	NM	NM
3/18/99	36	13	1727	40.9	0*	706.3	19.1	0*	180	19.8	172	2.4	NM	NM
3/25/99	43	20	1848	48.4	0.4	894.4	13.2	1.1	148	10	150	0*	NM	NM
3/31/99	49	26	2250	43.2	1.4	972.0	13	0	210	2.5	202	9.8	NM	NM
4/8/99	57	34	1800	39.3	1.1	707.4	13.7	2.4	440	8.5	434	5.6	29	2
4/13/99	62	39	1009	39.1	0.4	394.5	26.1	0.7	572	6.3	562	2.1	26.1	1.1
4/22/99	71	48	1150	29.8	0*	342.7	24	0*	503	5.5	502	2.4	24	0.9
4/30/99	79	56	1790	24.9	1.5	445.7	23	1.7	475	0*	465	0.8	23	0.4
5/3/99	82	59	1407	22.1	2.1	310.9	23.3	0.8	440	23.6	429	2.1	23.3	0.6
5/13/99	92	69	1250	18.5	0.8	231.3	18.2	2	470	12.8	459	0.7	18.2	0

Note: Due to poor settleability, after 4/25/99 solids in the effluent were captured and returned back to the reactors.

* = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 3: AN/AE Cycling with N&P Limitations

End of Anaerobic Phase

Date	Day of operation	Day after N&P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
4/2/99	1	no limitation	1560	6.2	0*	96.7	38.7	0*	NM	NM	NM	NM	NM	NM
4/9/99	8	no limitation	1675	5.8	0.5	97.2	36.2	0.7	NM	NM	NM	NM	NM	NM
4/15/99	14	no limitation	1225	8.1	0.3	99.2	42	1.2	NM	NM	NM	NM	NM	NM
4/24/99	23	no limitation	1298	10.4	1.2	135.0	43.3	2.4	598	3.5	385	7.8	9.8	0.6
4/27/99	26	2	1350	30.4	0.4	410.4	32.2	0.8	585	5.6	416	8.9	17.5	0.7
4/30/99	29	5	1680	30.2	0	507.4	39.1	0.4	598	9.6	450	4.5	16.8	0.5
5/3/99	32	8	1470	30.8	0.3	452.8	41.9	0	559	2.7	382	12.5	16.7	0
5/11/99	40	16	2950	34.1	0.4	1006.0	32	5.2	554	11.9	404	21.1	13.5	0.8
5/13/99	43	19	2730	38.2	0.6	1042.9	38	2	545	7.4	434	6.5	20.3	0.4
5/16/99	46	22	2690	34.3	0.5	922.7	37	0.8	556	0.8	385	18.9	29.8	0.6
5/18/99	48	24	2515	39.6	0*	995.9	34.8	0*	560	5.4	350	5.2	20.5	0.3
5/23/99	53	29	2648	41.6	1.8	1101.6	37	1.2	575	5.6	390	6.3	20.8	0.9
5/27/99	57	33	2563	29.9	0.1	766.3	38.5	0.3	547	1.2	345	9.8	11.1	0.6
5/31/99	61	37	2085	28.6	0	596.3	41.6	0	570	15.6	365	8.1	13	0
6/2/99	63	39	1763	32.1	0*	565.9	42.4	0*	582	7.2	375	7.8	11.8	0.4
6/9/99	70	46	1075	30.6	0.7	329.0	41.8	5	575	5.4	385	8.5	9.8	1.2
6/11/99	72	48	980	17	0.6	166.6	36.5	1.1	585	8.9	395	9.8	9.6	0.9
6/16/99	77	53	950	12.2	1.7	115.9	39.3	0.7	570	12.1	365	21.8	8.8	0.9

Aerobic 2 hours

Date	Day of operation	Day after N&P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
4/2/99	1	no limitation	1585	6.6	0	104.6	37.9	1.1	NM	NM	NM	NM	NM	NM
4/9/99	8	no limitation	1700	5.6	0.4	95.2	37.5	0.3	NM	NM	NM	NM	NM	NM
4/15/99	14	no limitation	1325	8.5	1.1	112.6	42.4	0.4	NM	NM	NM	NM	NM	NM
4/24/99	23	no limitation	1385	10.6	0.5	146.8	40.6	0.8	76	15.2	58	2.4	10.2	0.2
4/27/99	26	2	1428	32	0.9	457.0	31.9	0.7	180	12.1	165	6.9	18.9	0.8
4/30/99	29	5	1790	29.9	0.2	535.2	40.1	2.1	250	5.8	225	3.5	17.2	0.6
5/3/99	32	8	1630	33	0.8	537.9	38.8	2.3	151	9.9	142	4.2	17	0.4
5/11/99	40	16	2960	30.7	1.2	908.7	30.6	1	128	5.2	120	0.8	17.7	0.9
5/13/99	43	19	3290	45.4	0.4	1493.7	37.7	0	92	4.5	86	5.9	24	1.2
5/16/99	46	22	2890	41.3	0.8	1193.6	35.6	2.9	120	6.2	110	6.4	24.5	0.5
5/18/99	48	24	2790	41.2	0*	1149.5	36.4	0*	95	4.5	87	0	20.8	0
5/23/99	53	29	2980	46.9	0.5	1397.6	36.5	3.2	126	18.7	121	13.2	17.8	0.4
5/27/99	57	33	2663	34.9	1.5	929.4	41	0.7	75	18.1	61	1.7	19.8	0.7
5/31/99	61	37	2348	30.2	0	709.1	39.7	0.8	78	11.4	74	0.6	13.5	0.3
6/2/99	63	39	1863	32.7	2.1	609.2	44.3	1.5	75	12.1	72	15.8	12.7	0.6
6/9/99	70	46	1210	31.4	0.4	379.9	42	1.6	125	11	89	12.4	10.5	0.8
6/11/99	72	48	1100	13.7	1.2	150.7	40.1	0.3	165	2.5	149	6.6	9.2	0.2
6/16/99	77	53	970	12.5	0.6	121.3	37.6	5.6	145	10.7	130	0*	9.1	1.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 4: MAA/AE Cycling with N Limitation

End of MAA Phase

Date	Day of operation	Day after N Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
4/27/99	2	no limitation	1450	5.9	1.5	85.6	35.6	3.6	NM	NM	NM	NM	NM	NM
5/5/99	10	no limitation	1500	6.7	0.4	100.5	37.3	1.1	NM	NM	NM	NM	NM	NM
5/13/99	18	no limitation	1620	8.3	0.9	134.5	42.2	0.9	596	2.3	310	12.6	10.8	0
5/18/99	23	3	1600	30.2	1.1	483.2	32.5	0.2	604	2.1	580	4.5	17.8	0.8
5/23/99	28	8	1480	32.5	0.6	481.0	32.3	0.8	615	0.8	550	6.3	16.8	1
5/27/99	31	11	1688	31.3	0	528.3	33.2	4.9	607	5.6	546	7.8	17.9	0.5
5/31/99	35	15	1750	33.1	0*	579.3	31.1	0*	610	0	410	1.5	13.2	0.3
6/2/99	37	17	1930	30.6	0.3	590.6	29.4	2.1	630	2.3	479	10.8	12.2	0.2
6/9/99	44	24	1500	31.9	4.2	478.5	32.9	0.3	615	10.5	450	18.7	12.1	1.9
6/11/99	46	26	1395	29	0.5	404.6	29	0.8	625	4.5	445	15.7	11.2	0.7
6/16/99	51	31	910	29.3	1.2	266.6	32.4	0	615	2.1	415	3.6	10.2	0.4

Aerobic 2 hours

Date	Day of operation	Day after N Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
4/27/99	2	no limitation	1585	7.4	1.5	117.29	39.2	1.8	NM	NM	NM	NM	NM	NM
5/5/99	10	no limitation	1610	7.7	0*	123.97	40.3	0*	NM	NM	NM	NM	NM	NM
5/13/99	18	no limitation	1700	8.5	0.9	144.5	40	1	88	13.2	65	2.3	9.7	0
5/18/99	23	3	1690	32.4	1.1	547.56	32.7	0.3	258	6.2	248	5.6	18.1	0.8
5/23/99	28	8	1700	32.7	0.6	555.9	31.5	0.5	250	5.6	241	3	16.8	1
5/27/99	31	11	1875	38.6	0	723.75	32.1	0.9	266	9.5	252	0.7	12.9	0.5
5/31/99	35	15	1998	31.6	0.5	631.368	31	0	115	10.1	110	0.9	13.1	0.3
6/2/99	37	17	2225	34.8	0.3	774.3	29.6	1.9	38	6.5	32	10	12.4	0.2
6/9/99	44	24	1700	31.2	0.8	530.4	31.4	2.5	70	4.5	65	2.1	12.4	1.9
6/11/99	46	26	1656	32.3	0.5	534.888	31.6	2	120	12.2	112	0.4	12.1	0.7
6/16/99	51	31	1038	34.2	1.2	354.996	33.3	3.6	70	6.3	64	0	11.4	0.4

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 5: MAA/AE Cycling with P limitation

End of MAA Phase

Date	Day of operation	Day after P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
9/10/99	2	no limitation	2080	2.8	0.4	57.2	27.3	0.9	604	6.4	318	8.5	7.8	0.8
9/15/99	7	no limitation	1968	2.2	0.2	42.3	25.6	0.8	600	2.8	322	4.9	8.1	0.2
9/18/99	10	no limitation	1760	3.2	0.6	56.3	32.8	0.8	618	3.5	336	5.7	7.1	0.2
9/21/99	13	no limitation	1840	3.2	0*	58.9	31.3	0*	597	10.6	338	3.5	6.7	0.2
9/24/99	16	no limitation	1768	5.4	0.1	95.5	32.4	0.5	610	1.4	318	10.6	7.2	0.4
9/28/99	20	2	1800	8.7	0.5	155.7	43.4	1.6	590	11.3	330	10.6	6.5	0.8
10/1/99	23	5	1605	17.2	0.4	275.3	45.5	2.6	589	16.3	266	12.0	6.7	0.3
10/5/99	27	9	1670	26.6	1.6	444.2	50.8	0.2	610	11.3	225	19.1	6.1	0.3
10/9/99	31	13	1575	34.0	0*	535.5	49.7	0*	594	26.2	279	4.9	8.0	1.2
10/14/99	36	18	1253	40.8	0.3	511.2	53.6	0.2	602	10.6	324	32.5	6.2	0.4
10/17/99	39	21	1085	45.3	1.0	491.5	48.2	0.9	613	2.8	292	4.2	8.9	0.9
10/19/99	41	23	1008	50.0	2.1	504.0	48.7	0.1	614	5.7	329	4.9	8.9	0.8
10/21/99	43	25	956	58.2	0.6	555.9	48.3	1.2	602	10.6	338	7.1	13.3	0.2
10/23/99	45	27	885	56.7	0.2	501.4	48.3	1.6	608	8.5	341	2.1	16.3	1.3
10/26/99	48	30	805	58.0	0.1	466.9	44.0	1.4	609	2.8	378	5.7	23.4	0.8
11/2/99	55	37	788	49.0	2.3	386.1	43.8	0.4	606	2.8	358	3.5	21.5	1.5
11/4/99	57	39	850	47.2	0*	401.2	42.4	0*	610	1.4	393	4.2	21.0	1.1
11/9/99	62	44	900	36.5	1.3	328.1	30.2	1.5	610	2.8	406	5.7	19.8	2.9
11/11/99	64	46	821	30.4	1.4	249.6	27.8	0.8	597	11.3	466	2.8	22.0	0.4
11/16/99	69	51	765	22.3	0.1	170.2	29.0	0.2	614	3.5	380	11.3	19.9	1.3
11/21/99	74	56	633	15.9	1.0	100.6	22.0	0.5	625	14.1	392	3.5	20.9	1.2
11/23/99	76	58	585	15.9	0*	93.0	23.3	0*	617	4.2	489	12.7	22.2	0.6

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 5: MAA/AE Cycling with P limitation (Continued)

End of AE Phase

Date	Day of operation	Day after P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
9/10/99	2	no limitation	2407	3.0	0.1	72.2	33.3	3.2	21.5	3.5	NM	NM	9.5	1.0
9/15/99	7	no limitation	2085	2.9	0.2	59.4	29.8	0.3	20.5	3.5	NM	NM	7.7	1.6
9/18/99	10	no limitation	1841	3.1	0.1	56.2	36.1	0.8	24.5	0.7	NM	NM	7.6	1.6
9/21/99	13	no limitation	2017	4.3	0.4	86.7	38.4	2.2	25.5	4.9	23	0.7	9.5	0.8
9/24/99	16	no limitation	1833	5.3	0.4	97.1	30.2	0.3	16.0	4.2	16	0.0	9.0	1.1
9/28/99	20	2	1800	9.6	0.8	172.8	40.6	0.8	22.5	0.7	18	0.7	9.2	1.3
10/1/99	23	5	1830	16.9	2.4	309.3	44.4	2.1	31.5	6.4	25	0.0	11.7	0.2
10/5/99	27	9	1850	32.4	2.1	599.4	52.1	2.8	29.0	1.4	28	0.7	7.2	0.5
10/9/99	31	13	1745	43.3	0.6	754.7	52.5	0.9	29.5	0.7	30	0.7	9.2	0.9
10/14/99	36	18	1420	48.5	0.4	688.0	50.4	1.0	27.0	1.4	29	3.5	7.4	0.6
10/17/99	39	21	1350	47.2	1.6	637.2	46.9	0.1	32.5	3.5	32	0.7	9.2	0.4
10/19/99	41	23	1120	52.2	3.0	584.6	49.6	1.2	27.0	1.4	25	0.7	10.7	0.0
10/21/99	43	25	1147	55.5	1.5	636.0	49.5	1.2	15.5	0.7	17	1.4	13.2	0.0
10/23/99	45	27	1135	56.1	1.3	636.2	48.8	0.0	36.0	4.2	31	2.8	16.9	0.5
10/26/99	48	30	985	62.1	2.3	611.2	43.3	0.4	30.0	2.8	31	1.4	24.6	1.3
11/2/99	55	37	955	50.2	2.1	479.4	44.5	1.4	30.5	2.1	28	1.4	22.0	2.1
11/4/99	57	39	1013	47.5	2.2	480.7	42.2	0.7	50.5	2.1	42	3.5	19.9	2.3
11/9/99	62	44	1075	32.7	0.0	351.5	29.1	0*	142.5	9.2	135	4.2	22.1	0.3
11/11/99	64	46	967	28.9	0.9	279.0	26.3	0.8	223.5	2.1	209	1.4	19.1	0.2
11/16/99	69	51	854	25.1	0.8	213.9	28.5	0.5	256.0	5.7	224	3.5	16.9	0.9
11/21/99	74	56	735	16.4	1.1	120.2	22.9	0.2	259.5	0.7	268	5.7	18.1	0.6
11/23/99	76	58	670	17.4	0.8	116.6	19.8	0.6	260.5	10.6	265	4.2	19.1	0.6

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 6: AN/AE Cycling with P limitation

End of Anaerobic Phase

Date	Day of operation	Day after P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
9/10/99	2	no limitation	2333	2.6	0.1	60.7	23.1	1.3	617	9.9	174	5.7	8.8	2.8
9/15/99	7	no limitation	2250	3.0	0.3	67.5	20.0	1.9	609	4.9	171	2.1	10.8	0.6
9/18/99	10	no limitation	2060	3.3	0.0	68.0	30.3	0.0	613	17.0	177	4.2	8.9	1.9
9/21/99	13	no limitation	2040	2.6	0.3	53.0	25.0	0.0	597	10.6	162	10.6	8.3	0.9
9/24/99	16	no limitation	1980	3.2	0.1	62.4	28.6	0.6	610	1.4	156	5.7	9.4	1.1
9/28/99	20	2	1880	7.3	0.0	137.2	42.5	0.0	590	11.3	272	5.7	11.0	0.3
10/1/99	23	5	1750	12.8	0.4	223.1	44.3	0.4	589	16.3	281	21.9	11.6	0.1
10/5/99	27	9	1630	23.5	0.0	383.1	52.8	3.0	610	11.3	247	4.9	11.0	0.3
10/9/99	31	13	1540	37.6	0.8	579.0	57.8	0.4	613	2.1	278	3.5	12.4	0.0
10/14/99	36	18	1354	51.8	0.6	701.4	49.7	0.7	602	10.6	317	21.9	10.8	0.1
10/17/99	39	21	1200	54.4	0.4	652.2	44.0	0.5	614	6.4	299	1.4	13.6	1.7
10/19/99	41	23	1125	59.2	0.8	665.4	48.7	1.4	611	5.7	327	16.3	14.5	1.3
10/21/99	43	25	895	57.6	2.3	515.1	45.7	0.4	602	10.6	278	13.4	21.9	0.8
10/23/99	45	27	870	62.0	2.5	539.0	41.9	1.0	584	7.1	295	7.8	20.9	1.9
10/26/99	48	30	885	52.1	1.1	460.6	43.6	0.1	607	7.8	291	14.8	14.9	1.2
11/2/99	55	37	790	55.0	1.6	434.1	44.8	0.4	606	2.8	329	6.4	15.4	1.2
11/4/99	57	39	750	41.2	0.4	308.6	45.4	1.0	610	1.4	322	4.9	13.9	1.9
11/9/99	62	44	860	37.4	0.6	321.6	40.1	0.3	610	2.8	340	0.0	13.4	0.3
11/11/99	64	46	854	31.8	0.4	271.6	31.1	0.1	597	11.3	383	4.2	11.1	0.6
11/16/99	69	51	740	32.1	0.6	237.5	24.4	1.2	612	3.5	356	8.5	13.0	1.3
11/21/99	74	56	625	29.7	1.3	185.3	21.8	0.1	584	7.1	376	5.7	11.9	0.3
11/23/99	76	58	524	22.9	0.9	120.1	22.9	0.9	609	15.6	369	9.2	11.3	0.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 6: AN/AE Cycling with P limitation (Continued)

End of AE Phase

Date	Day of operation	Day after P Limit	MLSS (mg/L)	PHA (%TSS)	Stdev	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev
9/10/99	2	no limitation	2400	2.7	0.4	63.6	29.0	1.4	29	1.4	NM	NM	10.1	0.4
9/15/99	7	no limitation	2356	3.2	0.2	74.2	26.5	2.1	27	2.1	NM	NM	9.2	0.9
9/18/99	10	no limitation	2120	2.7	0.1	56.2	27.0	1.4	27	1.4	NM	NM	8.3	0.6
9/21/99	13	no limitation	2100	2.8	0.3	58.8	12.0	1.4	12	1.4	21.0	0.0	8.2	0.9
9/24/99	16	no limitation	2080	3.3	0.4	67.6	23.5	2.1	24	2.1	16.0	4.2	11.0	0.6
9/28/99	20	2	1950	7.8	0.1	152.1	31.0	0.0	31	0.0	25.0	9.9	11.5	1.3
10/1/99	23	5	1798	12.6	0.1	225.6	26.0	1.4	26	1.4	23.5	4.9	14.5	0.2
10/5/99	27	9	1702	24.4	0.9	414.4	18.0	1.4	18	1.4	20.5	2.1	9.6	0.3
10/9/99	31	13	1620	37.3	0.4	604.3	24.0	1.4	24	1.4	27.0	1.4	9.3	1.3
10/14/99	36	18	1410	50.8	1.0	716.3	31.5	0.7	32	0.7	26.0	1.4	8.2	0.4
10/17/99	39	21	1280	56.3	0.4	720.0	27.0	2.8	27	2.8	34.5	3.5	11.4	1.6
10/19/99	41	23	1140	58.7	0.7	669.2	31.5	3.5	32	3.5	26.0	1.4	15.1	0.0
10/21/99	43	25	990	58.6	0.0	580.1	56.0	2.8	56	2.8	64.0	5.7	17.7	0.8
10/23/99	45	27	920	61.0	1.4	561.2	51.5	4.9	52	4.9	47.5	3.5	21.5	1.3
10/26/99	48	30	925	60.0	0.1	555.0	42.4	0.3	51	3.5	28.0	2.8	25.5	1.5
11/2/99	55	37	820	51.4	1.6	421.1	44.6	0.5	40	0.0	30.0	2.8	23.8	2.4
11/4/99	57	39	787	53.3	0.6	419.1	45.0	0.1	44	6.4	38.0	2.8	17.2	2.3
11/9/99	62	44	720	44.1	0.1	317.2	41.7	0.1	70	2.1	67.5	3.5	18.2	0.4
11/11/99	64	46	860	35.2	1.3	302.7	32.7	0.8	151	9.9	118.0	2.8	16.6	1.7
11/16/99	69	51	756	33.2	1.6	251.0	27.2	0.6	151	3.5	140.0	2.8	12.8	0.4
11/21/99	74	56	645	35.0	0.9	225.4	22.7	0.0	145	12.0	150.0	2.8	11.6	1.3
11/23/99	76	58	550	29.6	0.8	162.8	22.5	0.1	147	1.4	145.0	5.7	13.6	0.6

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 7: Fully AE with P limitation

AE 2 hours

Date	Day of operation	Day after P limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
12/12/99	3	no limitation	2235	6	0.7	134.1	72	2.8	565	0.7	38	0.7	8.3	0.1
12/15/99	5	no limitation	2613	8	0.7	209.0	69	0.7	585	2.8	41	1.1	7.8	0.2
12/18/99	8	no limitation	2308	10	0*	230.8	74	0*	589	11.0	32	2.1	8.6	0.2
12/21/99	11	no limitation	2120	6	0.0	127.2	74	1.4	606	0.4	36	0.7	7.6	0.9
12/25/99	15	no limitation	1908	8	0.7	152.6	70	0.7	604	3.5	35	0.7	10.2	0.1
12/29/99	19	no limitation	1865	8	1.4	149.2	72	2.8	599	8.7	42	0*	9.7	0.2
1/2/00	23	no limitation	1820	10	0.4	182.0	75	0.0	585	0.4	37	0.4	7.8	0.2
1/5/00	26	2	2810	21	2.8	590.1	66	0.7	615	1.4	285	4.0	9.7	0.1
1/7/00	28	4	2040	24	1.4	489.6	65	2.1	590	2.1	42	0.0	11.2	0.5
1/10/00	31	7	1620	27	2.8	437.4	65	0.0	613	0.8	38	0.0	9.5	0.5
1/13/00	34	10	1440	31	0*	446.4	63	0*	604	15.4	20	8.0	13.0	0.6
1/17/00	38	14	1173	32	1.4	375.4	69	1.4	587	11.2	39	2.1	11.1	0.8
1/20/00	41	17	773	36	0.7	278.3	64	2.8	599	0.4	70	2.8	14.2	1.0
1/25/00	46	22	727	42	1.4	305.3	66	0.7	630	0.8	69	0.0	18.8	1.4
1/27/00	48	24	720	53	0.0	381.6	60	0.7	610	0.0	149	0.7	22.2	1.3

End of AE Phase

Date	Day of operation	Day after N limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
12/12/99	3	no limitation	2310	8	2.1	184.8	70	2.8	40	0.7	38	4.0	10.7	0.6
12/15/99	5	no limitation	2717	5	0*	135.9	76	0*	39	0*	32	1.4	8.6	0.5
12/18/99	8	no limitation	2370	9	1.4	213.3	75	0.7	32	0.8	28	6.0	7.9	0.0
12/21/99	11	no limitation	2208	6	0.4	132.5	72	2.1	42	12.4	29	0.0	8.4	0.2
12/25/99	15	no limitation	1995	10	2.8	199.5	76	0.7	36	10.8	30	0.0	9.7	0.1
12/29/99	19	no limitation	1904	6	0*	114.2	69	0*	34	0.4	25	2.1	9.5	0.1
1/2/00	23	no limitation	2193	6	0.4	131.6	79	1.1	37	0.4	36	0.7	8.4	0.3
1/5/00	26	2	2910	26	0.7	756.6	65	0.7	52	5.4	38	0.4	9.3	0.0
1/7/00	28	4	2050	23	2.8	471.5	64	0.4	41	0.4	29	0*	11.8	1.3
1/10/00	31	7	1680	24	0.7	403.2	66	1.4	23	3.5	21	2.1	10.8	0.6
1/13/00	34	10	1453	28	2.1	406.8	64	1.4	42	2.1	26	1.1	10.8	0.8
1/17/00	38	14	1210	30	0.7	363.0	65	0.7	36	9.9	25	0.7	11.5	0*
1/20/00	41	17	913	29	0.7	264.8	66	0.7	55	6.4	36	4.0	13.3	0.5
1/25/00	46	22	754	40	1.1	301.6	64	1.1	47	7.5	31	0.4	19.8	1.0
1/27/00	48	24	765	52	0.0	397.8	57	0.7	59	0.4	35	0.0	23.7	0.8

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 8: Fully AE with N&P limitations

AE 2 hours

Date	Day of operation	Day after N&P limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
12/12/99	3	no limitation	2220	6	0.7	133.2	72	1.1	621	21.0	32	2.0	8.6	0.1
12/15/99	5	no limitation	2608	8	2.1	208.6	74	1.4	601	2.4	41	1.2	7.9	0.1
12/18/99	8	no limitation	2295	8	0.7	183.6	71	2.1	589	0.7	38	0.7	10.8	1.3
12/21/99	11	no limitation	1998	10	2.1	199.8	69	0.7	602	3.5	34	0.4	11.1	0.2
12/25/99	15	no limitation	2020	7	0.7	141.4	72	1.4	579	2.1	39	8.0	9.2	1.4
12/29/99	19	no limitation	2144	8	2.1	171.5	74	1.4	601	0.4	36	4.0	7.9	0.0
1/2/00	23	no limitation	2167	7	1.1	151.7	75	0.7	585	2.7	26	2.1	9.6	0.9
1/5/00	26	2	3280	47	0*	1541.6	56	0*	599	8.9	450	7.0	7.4	0.1
1/7/00	28	4	3620	54	0.7	1954.8	45	2.8	589	5.7	31	2.1	11.6	0.0
1/10/00	31	7	3240	56	1.1	1814.4	40	0.7	614	6.3	419	1.4	12.6	0.4
1/13/00	34	10	2907	43	0.0	1250.0	38	1.4	610	4.5	409	0.7	13.4	0.3
1/17/00	38	14	2153	39	2.1	839.7	39	0.7	624	6.3	418	0.4	24.3	1.3
1/20/00	41	17	1727	37	0.7	639.0	38	1.4	589	0.7	463	2.1	28.5	1.2
1/25/00	46	22	1213	27	1.4	327.5	39	0.4	595	0.4	514	2.8	31.8	1.3
1/27/00	48	24	1033	22	0.0	227.3	40	0.0	601	0.4	654	10.6	25.9	2.4

End of AE Phase

Date	Day of operation	Day after N&P limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
12/12/99	3	no limitation	2298	7	1.1	160.9	69	0.0	38	1.2	32	0.4	8.4	0.2
12/15/99	5	no limitation	2656	5	0*	132.8	75	0.4	42	1.2	34	0.7	7.6	0.5
12/18/99	8	no limitation	2310	6	1.1	138.6	72	1.4	32	2.4	30	0.0	10.2	0.1
12/21/99	11	no limitation	2040	8	0.7	163.2	74	1.4	31	0.7	27	2.1	9.1	0.6
12/25/99	15	no limitation	2165	6	0.4	129.9	73	0.7	29	0.7	24	5.2	10.2	1.8
12/29/99	19	no limitation	2220	8	0.4	177.6	68	0.7	37	0.4	27	0.7	8.7	0.1
1/2/00	23	no limitation	2260	7	0.7	158.2	69	0*	34	5.0	24	3.5	9.5	0.4
1/5/00	26	2	3560	46	0.7	1637.6	55	0*	253	8.0	54	0.4	7.3	0.0
1/7/00	28	4	3750	53	0.0	1987.5	45	0.4	33	2.4	53	0.4	12.3	0.3
1/10/00	31	7	3250	57	0.0	1852.5	41	2.8	271	4.2	210	2.1	12.6	0.1
1/13/00	34	10	2953	42	1.4	1240.3	40	1.4	421	3.8	280	1.4	15.6	0.5
1/17/00	38	14	2212	37	2.8	818.4	42	2.8	314	1.4	265	0.4	26.8	0.6
1/20/00	41	17	2047	35	1.4	716.5	41	0.7	468	2.9	345	0.0	27.6	0.0
1/25/00	46	22	1267	27	0.4	342.1	40	0.7	448	8.4	320	2.1	31.7	2.5
1/27/00	48	24	1175	25	0.0	293.8	39	0.0	599	12.0	388	0.4	23.1	0.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 9: Fully AE with N limitation

AE 2 hours

Date	Day of operation	Day after N limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
2/7/00	3	no limitation	NM	NM	NM	NM	NM	NM	591	0.0	NM	NM	NM	NM
2/9/00	5	no limitation	4693	1.0	0.4	46.9	69.5	4.9	597	8.5	12	0.0	9.2	0.1
2/14/00	10	no limitation	3373	2.9	1.6	96.1	76.5	0.7	572	0.0	21	1.4	15.3	0.4
2/16/00	12	no limitation	2700	6.8	0*	183.6	67.0	0*	583	0.0	23	0.7	11.2	0.1
2/21/00	17	no limitation	2280	7.8	0.8	177.8	76.0	0.0	628	10.6	22	1.4	10.5	0.6
2/23/00	19	no limitation	2080	7.4	0*	153.9	68.5	0*	650	4.9	31	0.0	8.0	0.7
2/27/00	23	no limitation	2090	8.5	0.4	177.7	68.0	2.8	602	4.9	28	2.8	8.4	0.1
2/28/00	24	no limitation	2233	10.1	0.4	225.5	61.6	0.0	613	22.6	24	4.9	9.4	1.3
2/29/00	25	no limitation	2200	10.5	0.1	231.0	64.1	2.5	600	2.8	30	0.7	9.5	0.1
3/2/00	27	1	2180	13.3	0*	289.9	53.7	0*	585	21.9	25	2.8	9.8	0.1
3/3/00	28	2	2321	20.9	0.4	485.1	41.9	1.6	594	3.5	19	0.7	10.7	0.3
3/4/00	29	3	2338	31.1	0.6	725.9	41.4	1.6	617	0.0	19	0.7	10.6	0.5
3/7/00	32	6	3200	26.6	3.5	849.6	41.4	2.3	576	11.3	287	7.1	10.3	0.6
3/9/00	34	8	3000	41.7	2.3	1249.5	36.7	36.8	592	0.0	380	0.7	10.0	1.3
3/13/00	38	12	3040	35.9	36.0	1091.4	33.9	33.9	593	11.3	417	4.2	18.1	0.8
3/14/00	39	13	3000	33.1	0.2	991.5	34.7	0.3	634	11.3	386	7.8	18.2	0.2
3/19/00	44	18	3107	22.2	0*	689.8	30.1	0*	599	5.7	365	0*	23.5	0.6
3/21/00	46	20	2653	21.0	0*	557.1	27.8	0*	586	8.5	391	2.8	23.8	0.3
3/23/200	48	22	2300	21.5	2.4	494.5	30.2	0.9	604	8.5	399	15.6	21.8	0*

End of AE Phase

Date	Day of operation	Day after N limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
2/7/00	3	no limitation	6007	1.6	0.4	93.1	76.0	1.4	23	7.8	26	2.1	8.8	0.3
2/9/00	5	no limitation	4690	0.8	0*	37.5	80.5	0*	8	3.5	17	2.1	9.1	0.4
2/14/00	10	no limitation	3140	1.3	0.2	39.3	74.5	3.5	15	2.8	23	5.7	11.7	0.6
2/16/00	12	no limitation	2787	4.4	0.6	122.6	74.0	0.8	22	2.1	16	0.0	11.0	0.6
2/21/00	17	no limitation	2253	6.8	0*	153.2	75.7	0*	21	3.5	23	0.7	10.7	0.0
2/23/00	19	no limitation	2133	6.1	0.4	130.1	75.1	3.5	35	0.7	19	1.4	8.0	0.4
2/27/00	23	no limitation	2107	8.1	1.1	169.6	73.6	0.8	21	0.7	29	1.4	8.3	0.0
2/28/00	24	no limitation	2250	8.7	0.6	194.6	74.6	0.5	31	0.0	36	2.1	8.3	0.2
2/29/00	25	no limitation	2180	7.7	0.2	166.8	73.0	1.3	18	2.8	26	2.1	8.9	0.1
3/2/00	27	1	2253	11.1	0.4	250.1	51.6	1.6	13	0*	25	0.7	9.7	0.1
3/3/00	28	2	2673	21.1	0.8	564.0	41.6	2.2	20	6.4	21	4.2	11.0	0.9
3/4/00	29	3	2443	32.1	2.3	784.2	39.0	2.3	20	0.7	19	1.4	11.8	0.6
3/7/00	32	6	3287	27.6	0.0	907.2	40.3	0.8	159	0.7	153	4.2	10.1	0.5
3/9/00	34	8	3040	40.7	0*	1237.3	36.1	0*	296	2.1	302	0.0	9.7	0.3
3/13/00	38	12	2887	37.9	0.4	1094.2	36.7	2.5	368	0.0	329	11.3	18.0	0.5
3/14/00	39	13	2764	34.9	0.6	964.6	34.4	1.3	352	11.3	312	4.9	18.4	0.1
3/19/00	44	18	3200	24.8	0*	793.6	31.2	0*	371	2.1	357	16.3	20.5	0*
3/21/00	46	20	3173	23.0	1.4	729.8	29.8	1.0	375	7.8	346	8.5	19.7	0*
3/23/200	48	22	2313	20.4	0.1	471.9	26.7	0.2	392	4.2	366	5.7	22.1	0*

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Experiment 10: Fully AE with partial N&P limitations

AE 2 hours

Date	Day of operation	Day after partial N&P limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
2/7/00	3	no limitation	NM	NM	NM	NM	NM	NM	591.0	0.0	NM	NM	NM	NM
2/9/00	5	no limitation	4000	1.6	0.4	64.0	75.5	1.3	597.0	8.5	17.0	4.2	9.9	0.8
2/14/00	10	no limitation	3113	1.2	0.4	35.8	84.5	4.2	572.0	0.0	14.0	4.2	11.4	7.8
2/16/00	12	no limitation	2453	4.8	1.7	117.7	77.3	1.3	583.0	0.0	20.0	4.2	9.9	0.9
2/21/00	17	no limitation	2153	8.7	0.1	186.2	72.2	0.2	627.5	10.6	22.0	2.8	8.1	0.6
2/23/00	19	no limitation	2160	10.1	0*	218.2	59.6*	0*	649.5	4.9	29.0	0.0	8.5	0.4
2/27/00	23	no limitation	2210	9.4	0.6	207.7	53.2	1.1	601.5	4.9	20.0	0.7	8.8	0.1
2/28/00	24	no limitation	2233	9.1	0.2	202.1	51.8	0.1	613.0	22.6	26.0	0.0	10.9	0.8
2/29/00	25	no limitation	2289	9.3	0.7	212.9	53.2	1.3	600.0	2.8	18.0	0.7	10.5	0.5
3/2/00	27	1	2653	6.3	2.5	165.8	51.2	1.7	588.0	4.2	21.0	0*	9.9	1.1
3/3/00	28	2	2740	10.1	0.5	275.4	52.7	0.8	589.5	6.4	16.0	4.2	12.3	0.8
3/4/00	29	3	2898	11.8	0.4	340.5	51.2	0.3	574.5	16.3	18.0	2.8	11.3	1.6
3/7/00	32	6	3600	13.0	1.3	468.0	55.9	0.4	596.0	5.7	24.0	4.9	11.8	0.5
3/9/00	34	8	3113	22.2	3.7	689.5	53.5	1.3	577.5	4.9	16.0	5.7	9.5	0.1
3/13/00	38	12	2533	25.0	2.1	633.3	54.2	1.8	591.0	4.2	15.0	0*	12.5	1.1
3/14/00	39	13	2420	40.5	2.8	980.1	54.8	1.9	615.5	4.9	21.0	6.4	16.8	1.1
3/19/00	44	18	1220	22	0.8	268.4	58.7	0.2	601.0	1.4	25.0	0.0	28.9	0*
3/21/00	46	20	1200	18.2	2.3	218.4	55.7	0.0	589.5	3.5	16.5	2.1	24.6	0*
3/23/200	48	22	1550	18.2	0*	282.1	55.2	0*	588.0	2.8	19.0	1.4	27.4	0*

End of AE Phase

Date	Day of operation	Day after partial N&P limit	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
2/7/00	3	no limitation	4993	2.4	0.1	117.3	74.5	1.9	24.0	1.4	29.0	9.9	9.6	0.8
2/9/00	5	no limitation	4220	1.6	0.1	65.4	73.7	2.5	18.0	0.7	19.0	1.4	9.7	0.5
2/14/00	10	no limitation	3193	2.2	0.3	70.2	83.8	0.8	15.0	2.1	15.5	0.7	11.4	0.6
2/16/00	12	no limitation	2573	3.3	0.1	84.9	73.7	1.0	10.0	2.1	16.5	3.5	9.2	1.0
2/21/00	17	no limitation	2253	5.5	1.5	122.8	71.8	0.5	19.0	3.5	24.5	2.1	9.7	0.3
2/23/00	19	no limitation	2173	8.2	0*	178.2	64.0	0*	29.0	2.8	22.0	1.4	9.9	1.9
2/27/00	23	no limitation	2267	5.8	0.5	130.4	54.7	0.5	28.0	0*	25.5	0.7	9.6	0.4
2/28/00	24	no limitation	2287	6.3	1.2	142.9	50.3	2.8	22.0	2.1	26.5	0.7	10.6	0.6
2/29/00	25	no limitation	2306	6.9	0.1	159.1	52.8	0.5	25.0	1.4	21.0	4.2	10.8	1.0
3/2/00	27	1	2513	6.1	0.2	152.0	50.6	0.5	13.0	0*	22.5	4.9	9.8	0.4
3/3/00	28	2	2813	11.5	0.1	322.1	55.5	0.6	16.0	0.0	19.0	1.4	12.7	1.1
3/4/00	29	3	3080	15.9	1.6	488.2	51.8	1.8	22.0	0.0	15.0	1.4	11.1	0.1
3/7/00	32	6	3567	13.5	0*	481.5	57.4	0*	12.0	2.1	20.5	0.7	13.1	0.6
3/9/00	34	8	3000	21.1	2.5	631.5	51.9	1.8	14.0	5.7	18.0	0.0	11.8	0.6
3/13/00	38	12	2493	25.5	0*	635.7	52.4*	0*	13.0	3.5	14.5	2.1	11.6	0.8
3/14/00	39	13	2353	43.0	0.8	1010.6	55.5	0.8	18.0	2.8	17.0	2.8	17.2	0.8
3/19/00	44	18	1250	24.5	0*	306.3	55.1	0*	24.0	1.4	20.0	0.0	27.8	0*
3/21/00	46	20	1200	18.6	0.8	223.2	54.7	2.6	20.0	2.8	14.0	1.4	26.0	0*
3/23/200	48	22	1580	17.9	0.3	282.0	48.9	2.3	20.0	2.8	17.0	4.2	28.8	0*

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Reproducibility Phase

System 1: Fully AE with N&P limitation

End of AE Phase

Date	Day of Operation	Day after N&P limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PH A (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
8/25/00*	1	No limitation	3060	0.5	0.1	13.8	41.2	1.4	NM	NM	NM	NM	11.8	0.2	NM	NM
8/28/00	4	No limitation	3313	6.4	0.5	210.4	70.9	1.0	605	4	11	0.4	10.1	0.1	2.7	0*
8/30/00	6	No limitation	3833	6.2	1.8	237.6	70.1	0.0	582	2	42	1.4	10.4	0.4	2.1	0*
9/2/00	9	No limitation	3347	4.8	0.2	159.0	66.5	4.7	586	1	34	0.7	10.1	0.8	1.9	0.1
9/6/00	13	No limitation	3300	1.2	0.6	39.6	58.5	0.8	595	0	24	0*	7.6	0.2	2.1	0.1
9/10/00	17	No limitation	2873	2.2	0.2	61.8	71.8	4.3	595	0*	19	0*	9.9	0.4	2.7	0.2
9/15/00	22	No limitation	3204	2.4	0.4	76.9	69.9	0.5	611	5.7	24	2.1	10.8	0.3	4.7	0.6
9/18/00	25	2	3271	9.2	1.8	299.3	53.5	1.8	NS	NS	35	6.4	9.6	0.0	2.2	0.2
9/20/00	27	4	3604	29.6	2.8	1066.8	51.9	0.1	589	19	14	0.0	9.3	0.6	1.3	0.0
9/23/00	30	7	3934	46.4	1.0	1826.9	43.1	0.0	559	11.3	62	2.1	9.3	0.1	0.6	0.1
9/25/00	32	9	4467	40.0	3.9	1784.4	42.2	1.1	610	5.7	19	1.4	10.4	0.1	0.7	0.0
9/26/00	33	10	4247	42.8	0.3	1817.7	42.5	0.3	607	9.9	21	6.4	12.8	2.1	0.9	0.2
9/27/00	34	11	4697	32.1	0.7	1507.6	46.5	0.6	578	4.2	67	2.8	11.7	1.0	0.8	0.1
9/28/00	35	12	4539	21.5	0.5	973.6	48.0	0.1	586	4.2	32	2.8	12.8	0.8	2.6	0.1
9/29/00	36	13	3527	10.4	0*	366.8	45	0*	595	0*	18	2.1	11.5	0.8	3.3	0*
9/30/00	37	No limitation	3620	10.7	0*	387.3	48	0*	615	1.4	NM	NM	NM	NM	NM	NM
10/2/00	39	2	3540	24.9	0.1	879.7	53.3	1.3	599	1.4	NM	NM	NM	NM	NM	NM
10/4/00	41	4	3506	42.6	0.7	1493.6	50.5	0.6	597	7.8	NM	NM	NM	NM	NM	NM
10/5/00	42	No limitation	3510	25.0	2.3	875.7	53.4	2.0	589	2.1	19	0.7	9.8	0.3	3.1	0.1
10/7/00	44	No limitation	1573	7.3	1.5	114.0	60.3	0.1	619	0*	39	0.7	10.2	0.5	3.2	0.1
10/9/00	46	No limitation	1777	11.1	2.2	196.3	58.4	0.6	594	3.5	32	2.8	7.8	0.1	2.9	0.1
10/10/00	47	1	2019	27.9	0*	563.2	59	0*	611	1.4	18	2.1	9.5	0.5	2.3	0.1
10/11/00	48	2	2217	37.2	0.1	823.4	57.2	0.6	612	4.9	16	0.7	8.8	0.3	2.5	0.4
10/12/00	49	3	2676	48.9	1.1	1307.2	55.5	0.1	588	4.2	27	1.4	9.3	0.4	2.0	0.4
10/13/00	50	4	2891	43.1	1.3	1246.0	50.0	0.8	593	2.8	16	1.4	6.1	0.1	1.0	0.1
10/14/00	51	5	3238	70.0	1.1	2264.6	50.3	0.4	600	0*	31	1.4	8.9	1.1	0.9	0.0
10/15/00	52	6	2755	59.6	0.4	1642.0	45.1	1.1	609	4.9	19	0.7	9.7	0.4	1.3	0.1
10/16/00	53	7	2795	55.1	4.5	1540.0	41.8	1.6	600	2.8	29	2.1	10.1	0.1	1.1	0.1
10/17/00	54	8	2807	52.3	0.3	1467.8	42.2	1.1	592	2.8	43	3.5	10.4	0.3	1.0	0.3
10/18/00	55	9	2688	51.7	2.1	1389.7	42.0	0.7	609	4.9	47	2.1	10.1	0.1	1.3	0.1
10/19/00	56	10	2540	51.6	2.9	1309.4	42.0	1.3	597	4.9	53	1.4	10.2	0.3	1.4	0.0
10/20/00	57	11	2399	45.0	1.2	1078.4	43.3	0.6	589	5.7	51	2.1	10.1	0*	1.7	0*

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

10/1/00 to 10/4/00 Wrong influent was fed to the system, i.e., intend to operate the system under growth phase but feed was prepared without the additions of N and P

Reproducibility Phase:

System 2: Fully AE with N&P limitations

End of AE Phase

Date	Day of Operation	Day after N&P limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
11/13/00	2	No limitation	4460	2.4	0.1	104.8	56.1	3.0	NM	NM	NM	NM	NM	NM	NM	NM
11/16/00	5	No limitation	3970	2.9	0.2	113.1	58.8	2.4	595	8	36	0	10.8	0.4	2.5	0.1
11/18/00	7	No limitation	3845	2.5	0.3	96.1	56.1	3.0	589	5	27	3	10.6	0.4	2.5	0.2
11/20/00	9	No limitation	3405	2.8	0.1	95.3	63.4	1.3	580	3	29	1	10.0	0.2	2.8	0.3
11/24/00	13	No limitation	3182	3.7	0.0	117.7	67.4	2.3	603	6	23	1	9.2	0.0	1.8	0.2
11/27/00	16	No limitation	2740	4.1	0.2	111.0	63.0	0.6	609	5	30	3	10.3	0.6	1.8	0.2
11/30/00	19	No limitation	2720	4.4	0.2	118.3	62.7	0.1	594	12	40	8	11.2	0.0	1.9	0.2
12/1/00	21	No limitation	2738	3.9	0.2	105.4	61.2	1.1	581	8	28	3	9.1	0.0	2.0	0.4
12/2/00	22	1	2745	11.7	0.3	321.2	69.9	0.9	605	6	26	1	10.0	0.1	2.1	0.1
12/3/00	23	2	2963	17.7	0*	524.4	67.3	0*	582	6	39	4	10.2	0.1	1.6	0.2
12/4/00	24	3	3169	25.1	1.1	795.4	62.9	1.2	602	0	44	2	9.9	0.0	1.4	0.1
12/5/00	25	4	3507	31.6	1.7	1108.1	56.3	3.7	611	13	35	1	10.0	0.1	1.2	0.1
12/6/00	26	5	3563	38.3	0.4	1364.6	54.0	1.4	587	3	43	4	9.8	0.1	1.1	0.1
12/7/00	27	6	4115	41.3	0*	1699.5	50.1	0*	578	0*	37	2	11.7	0.1	1.1	0.1
12/8/00	28	7	4119	43.4	0*	1787.6	47.1	0*	595	8	28	4	12.2	0.1	1.1	0.1
12/9/00	29	8	4276	46.7	0.7	1996.7	42.6	0.1	598	3	34	6	14.4	0.4	1.2	0.3
12/10/00	30	9	4469	54.4	0*	2431.1	35.9	0*	581	8	39	5	15.2	0.4	0.7	0.1
12/11/00	31	10	4186	54.2	0*	2268.5	36.7	0*	596	4	33	1	17.7	1.1	0.8	0.0
12/13/00	33	12	3604	35.5	0.6	1279.2	36.2	0.3	583	4	25	0	16.3	0.6	0.8	0.1
12/14/00	34	13	3688	34.1	1.5	1256.2	37.4	0.3	615	4	34	2	16.7	0.2	0.9	0.0
12/15/00	35	14	3700	31.1	1.6	1148.9	35.8	0.6	587	0*	30	0	15.5	0.1	1.0	0.1
12/16/00	36	15	3793	31.1	1.9	1177.7	33.6	0.4	619	8	33	6	16.3	0.5	0.7	0.1
12/18/00	38	No limitation	2657	10.5	0.8	278.9	38.2	2.1	605	0	27	1	14.9	1.1	1.1	0.1
12/19/00	39	No limitation	2513	6.2	0.1	155.8	44.0	1.6	578	4	43	4	14.5	0.2	1.3	0.1
12/20/00	40	No limitation	2338	7.8	0.9	181.2	52.5	2.4	593	11	22	3	10.5	0.0	1.3	0.0
12/21/00	41	1	2503	21.0	0.8	524.4	55.3	0.2	616	6	29	1	12.8	0.5	1.2	0.1
12/22/00	42	2	2645	31.5	0.5	831.9	52.7	0.4	605	0*	29	1	12.0	0.2	1.1	0.0
12/23/00	43	3	2883	40.5	1.0	1167.4	48.0	0.8	582	4	32	0	12.1	0.4	0.9	0.1
12/24/00	44	4	2910	51.8	1.9	1505.9	46.9	0.5	586	8	36	6	11.0	0.2	0.8	0.0
12/25/00	45	5	2865	67.0	0.3	1919.2	44.8	0.6	609	6	36	1	10.9	0.2	0.7	0.1
12/26/00	46	6	2625	53.1	0.9	1392.6	45.5	0.4	582	10	44	2	10.4	0.4	0.7	0.0
12/27/00	47	7	2465	42.4	1.0	1045.2	43.0	0.2	581	2	46	6	11.7	0.6	0.8	0.1
12/28/00	48	No limitation	1891	11.9	0.4	224.0	46.3	0.6	577	3	42	0*	12.5	0.5	1.2	0.1
12/29/00	49	No limitation	1848	10.5	0.4	194.0	48.8	0.4	591	2	32	4	12.2	0.6	1.1	0.0
12/30/00	50	No limitation	1930	8.1	0.2	155.4	51.8	0.8	593	5	25	5	11.4	0.8	1.2	0.1
12/31/00	51	No limitation	2080	9.2	0.1	190.3	53.1	0.4	602	0*	31	1	11.3	0.1	1.3	0.0
1/1/01	52	1	2171	14.7	0.5	318.1	59.8	0.4	596	4	37	1	20.9	0.6	1.2	0.0
1/2/01	53	2	1901	16.4	1.5	310.7	58.3	0.8	594	12	42	0*	22.1	0.3	1.0	0.1
1/3/01	54	3	1838	28.4	0.7	522.0	55.6	1.7	610	3	36	6	23.3	0.8	0.8	0.0
1/4/01	55	4	2244	26.9	0.6	603.6	45.6	1.3	607	2	39	1	23.4	0.1	0.6	0.0
1/5/01	56	5	1994	22.9	0.6	455.6	44.1	0.1	593	5	59	12	24.0	0.2	0.7	0.1
1/6/01	57	6	1810	19.5	0.8	353.0	44.6	0.3	589	10	66	1	25.9	0.1	0.6	0.1
1/9/01	60	9	1481	14.7	1.1	217.0	44.0	0.2	582	6	69	1	26.4	0.2	0.7	0.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Appendix B: Source Data for Chapter 3

One-Stage PHA Production under Fully AE with P Limitation

End of AE Phase

Date	Day of Operation	Day after P limitation	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Eff. COD (mg/L)	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
7/15/00	2	No limitation	5790	1.0	0.1	57.9	64.5	0.7	602	18	11.5	0.0	NM	NM
7/16/00	3	1	5150	0.5	0.2	23.2	73.7	0.7	591	14	13.3	0.4	NM	NM
7/17/00	4	2	5167	0.6	0.1	31.0	76.0	0.0	614	19	11.7	0.0	NM	NM
7/18/00	5	3	4700	1.2	1.0	56.4	75.0	1.4	586	15	12.8	0.2	NM	NM
7/19/00	6	4	4787	0.6	0.1	28.7	79.0	0.0	621	20	11.2	0.0	1.4	0.1
7/20/00	7	5	3933	2.4	0.2	92.4	79.2	3.5	584	18	13.1	0.1	1.4	0.1
7/22/00	9	7	3720	5.8	0.0	215.8	80.2	2.8	620	22	12.0	0.0	1.2	0.0
7/24/00	11	9	3592	6.8	0.9	242.5	80.2	2.1	620	13	10.0	0.0	1.0	0.1
7/26/00	13	11	2947	22.0	0.0	648.3	76.5	2.1	573	16	12.4	0.0	1.4	0.2
7/29/00	16	14	2593	19.1	0.7	495.3	80.4	1.1	604	21	10.9	0.0	0.9	0.1
8/1/00	19	17	2236	21.9	0*	489.7	75	0*	596	24	8.5	0.1	0.78	0*
8/6/00	24	22	2371	20.0	0*	474.2	68	0*	612	19	9.5	0.4	0.84	0*

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

One-Stage PHA Production under Fully AE with N&P Limitations

End of AE Phase

Date	Day of Operation	Day after P limitation	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	COD (mg/L)	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
7/15/00	2	No limitation	5450	1.4	0.1	76.3	70	0.7	602	21	12.6	0.0	NM	NM
7/16/00	3	1	4767	3.5	0.4	166.8	74	1.4	637	24	12.7	0.3	NM	NM
7/17/00	4	2	5153	16.1	2.1	827.1	70	1	614	15	13.6	0.4	NM	NM
7/18/00	5	3	5480	19.3	1.6	1054.9	64	3	591	15	11.8	0.0	NM	NM
7/19/00	6	4	5067	25.2	1.4	1276.9	58	1	589	20	9.5	0.0	1.2	0.1
7/20/00	7	5	5107	22.2	0.4	1131.2	52	2	594	24	5.8	0.1	0.8	0.1
7/22/00	9	7	4567	33.0	0.6	1504.8	51	0	623	20	11.9	0.0	1.3	0.1
7/24/00	11	9	3608	28.0	1.1	1008.4	60	2	596	29	11.8	0.2	0.9	0.1
7/26/00	13	11	3353	26.5	0*	888.5	53*	0*	576	16	13.2	0.1	1.3	0.0
7/29/00	16	14	3300	24.5	2.1	808.5	61	0	596	12	13.8	0.1	1.0	0.1
8/1/00	19	17	3031	26.9	4.3	813.8	59	1	620	15	14.6	0.0	1.0	0.0
8/6/00	24	22	2450	27.9	1.1	683.6	52	1	585	14	14.0	0.1	0.9	0.0

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Two-Stage PHA Production under Fully AE with N&P Limitations

End of AE Phase

Date	Day of Operation	Day after N&P limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PH A (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
8/25/00*	1	No limitation	3060	0.5	0.1	13.8	41.2	1.4	NM	NM	NM	NM	11.8	0.2	NM	NM
8/28/00	4	No limitation	3313	6.4	0.5	210.4	70.9	1.0	605	4	11	0.4	10.1	0.1	2.7	0*
8/30/00	6	No limitation	3833	6.2	1.8	237.6	70.1	0.0	582	2	42	1.4	10.4	0.4	2.1	0*
9/2/00	9	No limitation	3347	4.8	0.2	159.0	66.5	4.7	586	1	34	0.7	10.1	0.8	1.9	0.1
9/6/00	13	No limitation	3300	1.2	0.6	39.6	58.5	0.8	595	0	24	0*	7.6	0.2	2.1	0.1
9/10/00	17	No limitation	2873	2.2	0.2	61.8	71.8	4.3	595	0*	19	0*	9.9	0.4	2.7	0.2
9/15/00	22	No limitation	3204	2.4	0.4	76.9	69.9	0.5	611	5.7	24	2.1	10.8	0.3	4.7	0.6
9/18/00	25	2	3271	9.2	1.8	299.3	53.5	1.8	NS	NS	35	6.4	9.6	0.0	2.2	0.2
9/20/00	27	4	3604	29.6	2.8	1066.8	51.9	0.1	589	19	14	0.0	9.3	0.6	1.3	0.0
9/23/00	30	7	3934	46.4	1.0	1826.9	43.1	0.0	559	11.3	62	2.1	9.3	0.1	0.6	0.1
9/25/00	32	9	4467	40.0	3.9	1784.4	42.2	1.1	610	5.7	19	1.4	10.4	0.1	0.7	0.0
9/26/00	33	10	4247	42.8	0.3	1817.7	42.5	0.3	607	9.9	21	6.4	12.8	2.1	0.9	0.2
9/27/00	34	11	4697	32.1	0.7	1507.6	46.5	0.6	578	4.2	67	2.8	11.7	1.0	0.8	0.1
9/28/00	35	12	4539	21.5	0.5	973.6	48.0	0.1	586	4.2	32	2.8	12.8	0.8	2.6	0.1
9/29/00	36	13	3527	10.4	0*	366.8	45	0*	595	0*	18	2.1	11.5	0.8	3.3	0*
9/30/00	37	No limitation	3620	10.7	0*	387.3	48	0*	615	1.4	NM	NM	NM	NM	NM	NM
10/2/00	39	2	3540	24.9	0.1	879.7	53.3	1.3	599	1.4	NM	NM	NM	NM	NM	NM
10/4/00	41	4	3506	42.6	0.7	1493.6	50.5	0.6	597	7.8	NM	NM	NM	NM	NM	NM
10/5/00	42	No limitation	3510	25.0	2.3	875.7	53.4	2.0	589	2.1	19	0.7	9.8	0.3	3.1	0.1
10/7/00	44	No limitation	1573	7.3	1.5	114.0	60.3	0.1	619	0*	39	0.7	10.2	0.5	3.2	0.1
10/9/00	46	No limitation	1777	11.1	2.2	196.3	58.4	0.6	594	3.5	32	2.8	7.8	0.1	2.9	0.1
10/10/00	47	1	2019	27.9	0*	563.2	59	0*	611	1.4	18	2.1	9.5	0.5	2.3	0.1
10/11/00	48	2	2217	37.2	0.1	823.4	57.2	0.6	612	4.9	16	0.7	8.8	0.3	2.5	0.4
10/12/00	49	3	2676	48.9	1.1	1307.2	55.5	0.1	588	4.2	27	1.4	9.3	0.4	2.0	0.4
10/13/00	50	4	2891	43.1	1.3	1246.0	50.0	0.8	593	2.8	16	1.4	6.1	0.1	1.0	0.1
10/14/00	51	5	3238	70.0	1.1	2264.6	50.3	0.4	600	0*	31	1.4	8.9	1.1	0.9	0.0
10/15/00	52	6	2755	59.6	0.4	1642.0	45.1	1.1	609	4.9	19	0.7	9.7	0.4	1.3	0.1
10/16/00	53	7	2795	55.1	4.5	1540.0	41.8	1.6	600	2.8	29	2.1	10.1	0.1	1.1	0.1
10/17/00	54	8	2807	52.3	0.3	1467.8	42.2	1.1	592	2.8	43	3.5	10.4	0.3	1.0	0.3
10/18/00	55	9	2688	51.7	2.1	1389.7	42.0	0.7	609	4.9	47	2.1	10.1	0.1	1.3	0.1
10/19/00	56	10	2540	51.6	2.9	1309.4	42.0	1.3	597	4.9	53	1.4	10.2	0.3	1.4	0.0
10/20/00	57	11	2399	45.0	1.2	1078.4	43.3	0.6	589	5.7	51	2.1	10.1	0*	1.7	0*

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

10/1/00 to 10/4/00 Wrong influent was fed to the system, i.e., intend to operate the system under growth phase but feed was prepared without the additions of N and P

Two-Stage PHA Production under AN/AE with N&P Limitations

8/25/00: Started the system (sludge was obtained from a BNR pilot system)

10/4/00: Started second N&P limitations

10/19/00: Switched to operate under fully aerobic growth phase because AN/AE conditions did not stimulate massive PHA production.

11/1/00: Started first N&P limitations under fully aerobic conditions

11/15/00: Started second N&P limitations under fully aerobic conditions

End of AE Phase

Date	Day of Operation	Day after NP limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
8/25/00	1	No limitation	4533	0.2	0.0	7.3	17.4	0.5	NM	NM	NM	NM	11.8	2.1	2.0	0*
8/28/00	4	3	3807	12.7	2.9	481.6	52.6	0.8	614	6	21	4	23.2	0.2	2.4	0*
8/30/00	6	5	3653	19.6	1.8	716.0	49.6	2.2	598	4	294	6	19.1	0.4	1.4	0*
9/2/00	9	8	3346	17.1	1.2	570.5	45.2	2.3	595	11	307	5	21.8	0.7	1.6	0.1
9/6/00	13	12	3527	15.3	4.5	537.9	50.0	3.3	605	7	136	4	16.8	0.6	1.3	0.2
9/10/00	17	16	3594	20.7	1.9	742.2	66.9	1.1	588	4	40	0*	25.6	3.3	1.2	0.1
9/15/00	22	21	4020	14.6	0.4	584.9	76.0	2.8	579	5	22	4.9	36.3	0.0	1.1	0.0
9/18/00	25	24	4717	14.5	2.9	681.5	51.2	2.0	616	8	57	0*	38.7	1.6	1.2	0.1
9/20/00	27	No limitation	4627	2.4	1.1	111.0	64.3	2.8	622	3	45	3	27.5	0.0	1.8	0.0
9/23/00	30	No limitation	3844	2.3	0.2	88.0	65.2	2.6	590	6	42	1	23.2	1.3	1.8	0.1
9/25/00	32	No limitation	3701	5.4	0.1	199.8	75.0	1.2	594	6	37	2	19.6	2.2	1.5	0.0
9/28/00	35	No limitation	3860	14.0	0.7	540.4	55.7	0.6	619	1	27	2	20.8	0.8	1.8	0*
9/29/00	36	No limitation	4215	6.7	1.2	280.3	57.2	0.6	580	8	24	1	21.8	0.4	1.9	0.1
10/1/00	38	No limitation	4600	3.7	1.3	170.2	56.5	1.6	576	3	31	2	23.8	1.6	2.0	0.1
10/3/00	40	No limitation	4737	4.5	0.7	213.1	69.8	2.4	593	11	22	0	20.6	3.0	2.5	0.1
10/5/00	42	1	4940	5.1	1.8	249.5	63.4	1.5	607	7	21	1	21.7	0.9	2.4	0*
10/6/00	43	2	4905	6.7	0.8	328.6	45.2	0.7	610	0	29	1	24.5	0.3	2.3	0.2
10/7/00	44	3	4850	8.9	0.2	429.2	44.9	1.8	589	5	32	4	27.4	0.8	2.0	0*
10/8/00	45	4	4993	14.7	0.1	731.4	52.4	0.0	616	6	36	1	26.4	0.2	2.0	0.2
10/9/00	46	5	5104	11.1	2.7	566.5	44.2	2.9	608	6	28	4	28.1	3.6	1.7	0.1
10/10/00	47	6	4864	14	0	671.2	43	0*	597	2	21	1	22.8	0.4	1.4	0.1
10/11/00	48	7	4790	19.9	0.8	953.2	47.8	2.2	601	4	18	3	21.8	0*	1.1	0*
10/12/00	49	8	4806	15	0	730.5	41.6	0*	616	6	17	1	22.7	0.3	1.2	0.0
10/13/00	50	9	4989	21.8	0.3	1087.6	48.1	0.1	582	5	18	0	24.4	0*	1.0	0*
10/14/00	51	10	4788	17.9	1.7	857.0	43.4	1.5	586	8	20	3	26.0	0.5	1.0	0.1
10/15/00	52	11	4631	20.0	0	926.2	47	0*	588	11	19	1	26.3	0*	0.8	0.1
10/16/00	53	12	4660	14.9	0.6	694.3	39.9	0.5	615	8	48	4	27.7	0.4	0.7	0.1
10/17/00	54	13	4680	8.1	2.9	376.7	35.8	2.9	617	10	63	1	25.6	0*	0.7	0*
10/18/00	55	14	4580	13.2	0.6	602.3	29.2	0.8	619	12	70	3	29.9	0.4	0.8	0.1
10/19/00	56	15	4667	10.2	0.6	476.0	34.7	3.0	595	8	80	3	31.9	0.4	0.9	0.0

10/20/00	57	No limitation	4953	4.8	2.3	237.7	41.1	3.8	599	5	52	3	33.1	0.1	1.1	0.2
10/21/00	58	No limitation	4080	1.5	0.5	59.2	44.3	2.5	582	6	31	4	35.2	0.6	1.3	0.1
10/23/00	60	No limitation	3233	2.2	0.2	69.5	43.0	2.1	622	0*	29	5	38.7	0*	1.5	0.1
10/24/00	61	No limitation	3365	1.5	0.5	48.8	36.2	0.2	632	12	35	4	32.5	0.5	1.4	0.1
10/25/00	62	No limitation	3290	2.1	0.3	69.1	34.3	2.0	611	10	38	3	27.0	0.2	1.6	0.2
10/27/00	64	No limitation	3377	2.7	0.0	91.2	40.8	0*	589	4	33	1	24.5	2.0	1.7	0.1
10/28/00	65	No limitation	3258	4.3	0.1	140.1	39.0	3.0	603	1	29	2	24.4	0.4	1.8	0.2
10/30/00	67	No limitation	3285	3.8	0.4	124.8	42.1	5.5	600	6	26	1	23.4	0.2	1.9	0.1
10/31/00	68	No limitation	3290	4.2	0.1	136.5	41.0	1.4	599	19	23	4	22.7	0.2	1.7	0.1
11/1/00	69	1	3365	7.0	0.2	233.8	51.5	6.2	610	8	19	1	22.3	0.0	1.3	0.0
11/2/00	70	2	3195	9.4	0	300.3	55.2	0*	597	11	18	0	34.3	2.3	1.1	0.1
11/3/00	71	3	3100	15.0	0.8	465.0	51.5	0.0	584	20	21	1	26.1	0.8	0.9	0.0
11/4/00	72	4	3565	19.8	1.3	705.9	49.2	2.3	591	6	17	1	24.6	0.4	0.7	0*
11/5/00	73	5	3265	22.2	2.3	723.2	49.4	0.8	591	6	19	6	28.0	0.4	0.8	0.1
11/6/00	74	6	3500	20.7	0.6	724.5	44.0	1.3	598	4	23	2	33.4	0.1	0.7	0.0
11/7/00	75	7	3515	23.7	1.6	833.1	41.6	6.0	581	7	26	3	28.5	0.1	0.7	0.1
11/8/00	76	8	3565	29.5	0.7	1051.7	44.1	0.5	578	4	29	4	22.8	0.8	0.8	0.1
11/9/00	77	9	3464	24.6	2.7	852.1	36.0	0.8	605	12	36	1	24.1	0.3	0.7	0.2
11/10/00	78	10	3589	28.7	0	1030.0	35.3	0*	607	10	31	2	22.7	0.4	0.5	0.0
11/12/00	80	No limitation	3777	6.6	0.6	249.2	41.6	0.9	580	6	49	5	22.3	0.8	0.4	0.1
11/13/00	81	No limitation	2683	5.4	1.1	144.9	49.4	0.3	584	8	38	4	22.6	0.6	0.6	0.1
11/14/00	82	No limitation	2415	8.4	1.8	202.9	52.8	3.1	590	5	30	2	21.5	0.2	0.5	0.1
11/15/00	83	1	2370	12.4	2.8	292.7	56.3	0.3	618	6	26	0*	25.1	0.8	0.5	0*
11/16/00	84	2	2483	21.8	1.6	539.9	54.5	0.5	619	0*	35	5	26.9	0.0	1.3	0.2
11/17/00	85	3	2645	27.2	1.3	719.4	50.4	0.5	593	11	43	4	25.7	0.6	0.6	0.1
11/18/00	86	4	2892	32.0	2.8	924.0	47.3	1.6	581	8	31	2	28.0	0.8	0.7	0.1
11/19/00	87	5	3375	29.8	0.8	1005.8	40.9	0.7	579	16	27	3	26.3	0.3	0.6	0.1
11/20/00	88	6	3790	33.9	0.6	1284.8	41.1	0.2	607	11	44	2	29.7	0.8	0.6	0.0
11/21/00	89	7	3945	32.0	0.4	1260.4	36.4	0.4	620	0	45	4	28.1	0.4	0.7	0.1
11/22/00	90	8	3940	28.9	0.6	1138.7	37.0	0.6	598	2	35	1	26.8	0.4	0.8	0.1
11/23/00	91	9	4145	26.8	0.1	1110.9	36.2	1.2	608	11	33	4	24.8	0.4	0.8	0.0
11/24/00	92	10	3995	21.6	0.6	862.9	35.2	0.1	619	8	50	6	25.6	0.1	0.7	0.1
11/25/00	93	11	3255	16.8	0.4	546.8	33.5	0.6	617	10	53	1	28.1	0.4	0.6	0.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Two-Stage PHA Production under Fully AE with P Limitation (Long Growth Phase Operation)

AE 2 hours

Date	Day of Operation	Day after P limitation	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
5/22/00	7	No limitation	5120	6.8	0*	348.2	69	0*	598	10.6	15	0*	14.9	0.8
5/25/00	10	No limitation	3985	5.4	0*	215.2	72	0*	593	9.9	20	0*	12.8	0.4
5/31/00	16	No limitation	3220	5.2	0*	167.4	73	0*	639	5.7	21	1.4	8.9	0.8
6/5/00	21	No limitation	2847	5.1	0*	145.2	65	0*	601	2.1	27	1.4	7.9	0.4
6/7/00	23	No limitation	2660	6.2	0*	164.9	69	0*	597	4.9	27	1.4	9.9	1.0
6/12/00	28	No limitation	2833	5.1	0.4	144.5	70	0*	604	12.7	29	1.4	9.5	0.7
6/14/00	30	No limitation	2400	5.1	0.6	121.2	70	1.2	617	26.9	32	2.1	9.9	0.5
6/19/00	35	No limitation	2216	6.0	0.2	131.9	70	1.4	592	11.3	30	0.7	9.4	0.2
6/20/00	36	1	2427	4.6	0.5	110.4	70	0.6	602	11.3	35	5.7	9.5	0.1
6/21/00	37	2	2313	4.0	0.0	92.5	71	2.3	597	5.7	32	2.8	10.1	1.1
6/22/00	38	3	2020	3.0	0.3	60.6	69	0.1	612	27.6	35	3.5	10.0	0.2
6/23/00	39	4	2096	4.0	0.2	82.8	67	1.8	589	4.9	33	4.2	11.6	0.6
6/24/00	40	5	1988	5.0	0.4	98.4	68	0.8	612	4.2	33	3.5	11.1	0.2

End of AE Phase

Date	Day of Operation	Day after P limitation	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff. COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
5/22/00	7	No limitation	5020	5.9	0	296.2	72	0*	15	0*	14	0*	12.1	0.6
5/25/00	10	No limitation	4088	6.3	0	257.5	69	0*	18	0*	16	0*	10.2	0.4
5/31/00	16	No limitation	3180	4.9	0	155.8	71	0*	16	2.8	21	2.1	9.8	0.6
6/5/00	21	No limitation	2643	5.2	0	137.4	70	0*	30	2.1	29	3.5	9.3	0.6
6/7/00	23	No limitation	2647	4.8	0	127.1	73	0*	28	4.2	25	1.4	8.1	0.7
6/12/00	28	No limitation	2760	5.7	0.3	157.3	70	1.8	19	1.4	18	2.8	9.2	0.8
6/14/00	30	No limitation	2413	5.3	0.1	127.9	72	1.0	35	0.7	29	2.1	9.4	0.1
6/19/00	35	No limitation	2225	6.6	0.2	145.7	68	2.8	34	4.2	34	2.1	9.7	0.7
6/20/00	36	1	2290	4.1	0.0	93.9	70	2.2	34	3.5	39	3.5	9.9	0.3
6/21/00	37	2	2300	2.0	0.1	46.0	74	3.3	33	5.7	27	1.4	10.3	0.6
6/22/00	38	3	2023	3.7	0*	74.9	68	0*	36	0.7	31	0.7	9.7	0.6
6/23/00	39	4	2190	3.4	0.1	74.5	69	1.8	31	0.7	28	0.7	11.7	0.7
6/24/00	40	5	2076	3.8	0.1	77.9	69	0.1	18	0*	26	2.1	11.7	0.2

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Two-Stage PHA Production under Fully AE with N&P Limitations (Long Growth Phase Operation)

AE 2 hours

Date	Day of Operation	Day after N&P limitation	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
5/22/00	7	No limitation	4910	5.9	0*	289.7	73	0*	621	21.9	12	0*	13.3	0.0
5/25/00	10	No limitation	3288	6.1	0*	200.6	72	0*	593	9.9	27	0*	12.2	0.3
5/31/00	16	No limitation	2733	4.1	0*	112.1	71	0*	639	5.7	23	1.4	9.7	0.2
6/5/00	21	No limitation	2207	5.4	0*	119.2	68	0*	601	2.1	36	1.4	7.0	0.0
6/7/00	23	No limitation	2493	5.9	0*	147.1	74	0*	597	4.9	35	0.7	9.0	0.6
6/12/00	28	No limitation	2260	5.1	0*	115.3	72	0*	604	12.7	26	2.1	9.6	0.4
6/14/00	30	No limitation	2090	6.0	0.3	125.4	70	1.8	617	26.9	22	0.0	9.9	0.1
6/19/00	35	No limitation	2050	7.8	0.0	159.9	70	3.0	592	11.3	27	2.1	9.4	0.1
6/20/00	36	1	2020	13.8	0.1	277.8	67	0.5	579	0.0	48	9.9	12.0	0.8
6/21/00	37	2	2250	19.4	3.2	435.4	61	0.5	609	33.2	26	2.8	9.5	0.1
6/22/00	38	3	2178	28.4	1.1	617.5	54	0.8	595	7.8	29	1.4	8.4	0.2
6/23/00	39	4	2460	32.2	0.9	790.9	47	0.8	595	2.8	132	4.9	11.7	0.2
6/24/00	40	5	2488	35.7	1.1	887.0	44	0.8	587	1.4	225	0*	12.2	0.1
6/25/00	41	6	2236	34.5	0.4	770.3	36	0.4	602	7.1	293	7.8	13.4	0.2
6/26/00	42	7	2260	33.3	0.4	752.6	38	0.8	607	12.7	325	7.8	12.1	0.6
6/27/00	43	8	1780	31.9	0.2	566.9	38	0.7	591	0.0	348	2.8	12.6	0.1

End of AE Phase

Date	Day of Operation	Day after N&P limitation	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	COD (mg/L)	Stdev.	Eff COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.
5/22/00	7	No limitation	4727	5.4	0	255.3	72	0*	12	0*	22	0*	11.6	0.5
5/25/00	10	No limitation	3396	6.2	0	210.6	70	0*	25	0*	20	0*	11.4	0.6
5/31/00	16	No limitation	2700	4.3	0	116.1	68	0*	28	3.5	24	2.1	8.8	0.6
6/5/00	21	No limitation	2571	4.8	0	123.4	70	0*	39	3.5	26	3.5	8.6	0.3
6/7/00	23	No limitation	2340	6.1	0	142.7	71	0*	24	2.1	29	0.7	8.2	0.0
6/12/00	28	No limitation	2187	5.6	0	122.5	73	0*	24	0.7	21	0.7	9.7	0.0
6/14/00	30	No limitation	2187	7.2	0.6	157.5	70	1.6	27	2.8	25	1.4	9.5	0.2
6/19/00	35	No limitation	2093	9.0	0.7	188.4	69	0.8	33	1.4	40	2.8	9.5	0.2
6/20/00	36	1	2110	13.1	0.6	276.4	67	0.4	31	0.7	31	0.7	10.9	0.6
6/21/00	37	2	2217	21.2	1.7	470.0	62	0.3	32	0.7	27	3.5	10.9	0.6
6/22/00	38	3	2200	28.9	2.3	635.8	55	0.1	25	2.8	29	1.4	7.9	0.1
6/23/00	39	4	2458	33.7	0.1	827.1	48	1.1	106	12.0	95	0.7	11.4	1.0
6/24/00	40	5	2550	34.7	1.7	884.9	42	0.1	241	11.3	228	0.0	12.3	0.0
6/25/00	41	6	2242	35.8	0.1	801.5	40	0.4	286	30.4	261	0.7	13.9	0.0
6/26/00	42	7	2258	34.6	0.7	781.3	37	0.3	309	18.4	325	3.5	13.0	0.0
6/27/00	43	8	1792	32.3	1.1	578.8	37	0.8	368	2.1	353	4.2	12.8	0.2

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

Appendix C: Source Data for Chapter 4

System 1: Fully AE with 2-stage Bioprocess

9/27/00: Started the system (HRT = 10 hours)

10/11/00: Added more biomass due to bulking problem, increased HRT to 20 hours, and added defoamer to control foaming problem

10/19/00: Started N, P and K limitations

End of AE Phase

Date	Day of Operation	Day after limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	COD (mg/L)	CHO (%TSS)	Stdev.	TP (mg/L)	TP (%TSS)
9/27/00	1	no limitations	3377	2.0	0.4	65.8	0.5	0.2	1788	NM	17.4	0.4	90.8	2.7
9/29/00	2	no limitations	4253	2.7	0.4	114.8	1.4	0.2	1725	361	15.2	1.0	81.9	1.9
10/1/00	4	no limitations	4904	4.1	0.0	201.0	2.2	0*	1823	78	16.8	0.4	118.2	2.4
10/2/00	5	no limitations	4637	4.5	0.5	206.3	2.3	0.0	1756	125	16.5	0.2	78.4	1.7
10/3/00	6	no limitations	3248	5.6	0.0	181.9	2.4	0*	1720	227	14.9	0.5	91.9	2.0
10/5/00	8	no limitations	2747	7.7	1.5	210.1	3.1	0.3	1784	325	16.1	1.2	39.1	1.4
10/7/00	10	no limitations	2507	6.5	0.2	161.7	2.9	0.2	1830	345	16.5	0.4	42.5	1.7
10/9/00	12	no limitations	2756	8.2	0.1	226.0	3.6	0.0	1810	124	15.0	0.3	50.1	1.8
10/10/00	13	no limitations	3238	8.4	1.0	272.0	3.6	0.2	1799	251	16.7	0.2	48.7	1.5
10/11/00	14	no limitations	3344	2.7	0.3	90.3	2.7	0.3	1727	125	17.1	0.0	91.7	2.7
10/12/00	15	no limitations	3745	5.2	1.6	192.9	2.8	0.6	1850	112	15.8	0.4	78.6	2.1
10/13/00	16	no limitations	4221	7.0	1.0	295.4	2.5	0.1	1820	108	13.2	0.0	104.4	2.5
10/14/00	17	no limitations	4310	10.6	0.2	454.7	1.8	0.1	1780	106	12.6	0.5	75.6	1.8
10/15/00	18	no limitations	4411	7.2	0.8	315.4	2.3	0.4	1775	115	13.4	0.0	79.4	1.8
10/16/00	19	no limitations	4330	6.7	1.0	290.1	2.5	0.1	1810	87	12.7	0.3	80.5	1.9
10/17/00	20	no limitations	4202	6.4	0.1	268.9	2.8	0.4	1872	68	12.0	0.0	89.1	2.1
10/18/00	21	no limitations	4198	10.7	1.9	447.1	1.8	0.1	1800	92	11.6	0.3	74.2	1.8
10/19/00	22	no limitations	4200	4.9	1.1	205.8	2.5	0.1	1720	75	12.1	0.4	84.6	2.0
10/20/00	23	1	4100	11.3	0.8	461.3	1.6	0.2	1812	254	21.1	0.0	109.2	2.7
10/21/00	24	2	4250	17.8	1.1	756.5	1.8	0.3	1790	335	20.6	1.0	79.5	1.9
10/22/00	25	3	4020	15.5	0.0	623.1	2.4	0.2	1745	356	20.9	0.1	65.2	1.6
10/23/00	26	4	3570	16.5	0.0	589.1	1.8	0.1	1742	300	15.3	0.0	25.3	0.7
10/24/00	27	5	3230	15.0	0.0	484.5	1.7	0*	1801	258	17.7	0.4	39.8	1.2
10/25/00	28	6	3010	14.6	0.0	439.5	1.6	0*	1760	421	17.0	0.2	45.6	1.5
10/27/00	29	7	2560	15.7	0.0	401.9	2.0	0.4	1832	454	16.0	0.8	44.9	1.8
10/28/00	30	8	1870	12.5	0.4	232.8	1.6	0.1	1805	462	15.3	0.4	38.8	2.1
10/30/00	32	10	1650	11.6	0.6	190.6	2.0	0.2	1810	485	16.2	0.1	34.2	2.1
10/31/00	33	11	1250	9.2	0.1	114.4	2.4	0.1	1818	585	15.3	0.3	24.2	1.9
11/1/00	34	12	856	10.5	0.4	89.9	2.7	0.2	1807	690	15.4	0.4	20.0	2.3

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

System 2: Fully AE with 1-stage Bioprocess

9/27/00: Started the system (HRT = 10 hours)

10/11/00: Restarted the system due to bulking problem and added defoamer to control foaming problem (increased the HRT to 20 hours)

10/31/00: Operated the system under normal operation

11/6/00: Started second limitations by feeding original Celanese wastewater w/o N, P, K supplements

End of AE Phase

Date	Day of Operation	Day after limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	COD (mg/L)	CHO (%TSS)	Stdev.	TP (mg/L)	TP (%TSS)
9/27/00	1	1	2627	4.0	0.4	103.8	2.0	0.6	1805	NM	16.7	0.6	72.2	2.8
9/29/00	2	2	4092	9.9	0*	405.1	2.2	0*	1762	666	12.1	0.5	74.8	1.8
10/1/00	4	4	5127	26.7	0.1	1368.8	1.8	0.6	1835	643	12.9	0.7	86.8	1.9
10/2/00	5	5	5037	29.2	1.2	1468.3	1.8	0.1	1745	585	13.5	0.4	78.6	1.6
10/3/00	6	6	4914	14.8	1.1	727.2	1.3	0.1	1790	808	13.7	0.1	96.2	2.0
10/5/00	8	8	2410	16.3	1.6	392.8	2.7	0.2	1788	825	17.3	0.6	56.8	2.4
10/7/00	10	10	1200	12.3	0.1	147.0	2.4	0.1	1803	788	16.6	0.5	28.5	2.4
10/9/00	12	12	870	11.2	3.7	97.4	2.5	0.3	1833	1002	17.4	0*	18.4	2.1
10/10/00	13	13	540	13.8	0.6	74.3	2.5	0.1	1812	1120	15.1	0*	16.5	3.1
10/11/00	0	restarted system	3995	4.6	1.8	183.8	2.3	0.8	1936	52	15.6	0*	77.0	1.9
10/12/00	1	1	3377	2.0	0.4	65.8	0.5	0.2	1805	78	17.4	0.4	90.8	2.7
10/13/00	2	2	5064	26.0	0.0	1316.6	1.9	0*	1872	108	13.0	0*	75.8	1.5
10/14/00	3	3	5389	28.7	0.4	1546.6	1.0	0.1	1832	205	13.5	0.1	64.7	1.1
10/15/00	4	4	5766	40.1	0.6	2309.3	2.1	0.6	1807	329	13.3	0*	48.8	0.9
10/16/00	5	5	5690	31.9	0.8	1812.3	2.0	0.5	1840	330	13.8	0.2	46.5	0.8
10/17/00	6	6	5643	32.2	0.0	1817.0	1.7	0*	1867	414	13.8	0*	45.1	0.8
10/18/00	7	7	5554	13.2	1.1	730.4	2.4	0.8	1820	328	14.4	0.3	55.4	1.0
10/19/00	8	8	5463	17.1	1.3	934.2	1.7	0.1	1798	404	15.4	0.4	62.8	1.2
10/20/00	9	9	5314	16.9	2.1	895.3	2.2	0.3	1845	504	15.3	0*	75.4	1.4
10/21/00	10	10	5570	8.3	1.1	459.5	1.3	0.1	1818	448	15.8	0.1	81.2	1.5
10/23/00	12	12	5980	13.7	0.8	816.3	1.9	0.3	1798	459	16.6	0*	88.7	1.5
10/24/00	13	13	5848	19.9	1.6	1160.8	2.2	0.4	1788	480	16.8	0.4	80.4	1.4
10/27/00	16	16	5980	11.9	0.0	711.6	2.7	0*	1824	552	19.9	0.5	70.3	1.2
10/28/00	17	17	5495	13.8	0	758.3	3.7	0*	1818	602	20.3	0.6	78.5	1.4
10/30/00	19	19	5050	13.6	1.8	684.3	3.3	0.1	1847	744	22.3	0.6	74.2	1.5
10/31/00	20	20	4855	7.0	0.7	339.9	3.2	1.0	1830	765	23.9	0.5	65.2	1.3
11/1/00	21	no limitation	5020	7.6	1.0	381.5	3.4	0.3	1848	338	19.8	0.4	88.4	1.8
11/2/00	22	no limitation	5220	6.7	0.1	349.7	3.2	1.1	1824	400	17.8	0.8	82.1	1.6
11/3/00	23	no limitation	5310	7.9	0.8	419.5	3.6	0.1	1826	298	16.6	0.6	100.9	1.9
11/4/00	24	no limitation	5410	5.0	0.7	270.5	3.5	0.4	1812	225	17.7	0.6	94.1	1.7
11/6/00	26	no limitation	4535	4.2	1.4	190.5	4.2	1.2	1820	200	14.5	0.4	80.3	1.8
11/7/00	27	1	4120	4.9	0.4	199.8	3.9	0.6	1796	545	13.7	0.2	98.1	2.4
11/8/00	28	2	3610	7.9	0.8	283.4	2.9	0.4	1848	769	13.9	0.8	53.4	1.5
11/9/00	29	3	2515	12.3	1.2	308.1	2.1	0.1	1823	880	14.4	0.3	45.5	1.8
11/10/00	30	4	1500	10.5	0.4	157.5	1.7	0.0	1810	1200	14.6	0.5	30.1	2.0

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

System 3: Fully AE with N&P limitations (1-stage Bioprocess – HRT = 20 hours)

End of AE Phase

Date	Day of Operation	Day after limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PHA (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
1/22/01	1	1	3260	1.3	0.1	40.8	3.3	0.2	2649	23	NM	NM	16.0	0.3	2.4	0.3
1/23/01	2	2	3737	15.3	0.6	571.7	1.4	0.1	2704	1	374	4	18.0	0.7	2.1	0.2
1/24/01	3	3	4540	25.3	0.7	1148.6	1.2	0.1	2661	16	345	14	15.4	0.1	1.6	0.1
1/25/01	4	4	5115	28.6	0.5	1460.3	0.9	0.1	2536	16	332	3	14.2	0.2	1.4	0.1
1/26/01	5	5	5840	25.1	0.6	1462.9	0.8	0.1	2644	23	271	10	16.9	0.2	1.5	0.1
1/27/01	6	6	6615	23.9	1.1	1581.0	0.6	0.1	2738	15	267	6	18.9	0.3	1.7	0.2
1/28/01	7	7	7065	16.1	0.4	1137.5	0.5	0.1	2424	8	404	7	25.2	0.7	1.7	0.1
1/29/01	8	8	6450	11.0	1.2	706.3	0.8	0.2	2867	11	453	6	30.2	0.1	1.5	0.1
1/30/01	9	9	6170	12.2	0.4	749.7	0.6	0.1	2644	15	473	8	34.0	0.0	1.4	0.2
1/31/01	10	10	5660	11.2	0.1	631.1	0.9	0.1	2421	8	466	13	36.6	0.6	1.6	0.1
2/1/01	11	no limitation	4580	9.0	0.1	409.9	0.9	0.1	2496	9	256	6	29.1	0.5	1.8	0.1
2/2/01	12	no limitation	3820	6.2	0.4	236.8	0.7	0.1	2606	10	198	4	27.5	0.6	1.9	0.1
2/3/01	13	no limitation	3240	5.4	0.4	175.0	1.0	0.1	2685	10	190	7	25.8	0.5	2.0	0.1
2/4/01	14	no limitation	2730	4.4	0.1	120.1	1.2	0.1	2439	16	210	6	24.5	0.4	1.8	0.1
2/5/01	15	no limitation	2475	3.9	0.1	95.3	0.6	0.1	2396	6	221	0*	25.6	1.2	2.0	0.1
2/6/01	16	1	2425	6.5	0.1	156.4	0.4	0.1	2362	0*	183	0*	18.7	0.6	1.8	0.1
2/7/01	17	2	2478	9.7	0.6	239.1	0.4	0.0	2461	7	261	7	18.5	0.5	1.6	0.1
2/8/01	18	3	2500	8.2	0.8	203.8	0.4	0.0	2333	0*	320	0*	24.7	0.9	1.8	0.1
2/9/01	19	4	2560	7.1	0.5	180.5	0.4	0.0	2562	22	327	6	22.2	0.4	1.9	0.0
2/10/01	20	5	2333	7.1	0.2	164.5	0.5	0.1	2689	15	390	4	21.3	1.2	2.2	0.2
2/11/01	21	6	2100	7.4	0.4	154.4	0.4	0.0	2453	0*	457	8	21.5	0.6	2.1	0.1
2/12/01	22	7	1890	5.2	0.2	97.3	0.5	0.1	2338	25	507	7	21.6	0.6	2.3	0.2
2/13/01	23	8	1540	5.2	0.1	80.1	0.5	0.1	2463	10	561	4	22.4	0.3	2.5	0.0
2/14/01	24	9	1210	4.7	0.1	56.9	0.5	0.0	2621	29	621	13	21.2	0.6	2.4	0.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured

System 4: Fully AE with P limitation (1-stage Bioprocess – HRT = 20 hours)

End of AE Phase

Date	Day of Operation	Day after limitations	MLSS (mg/L)	PHA (%TSS)	Stdev.	PHA (mg/L)	PHV/PH A (%)	Stdev.	Inf. COD (mg/L)	Stdev.	COD (mg/L)	Stdev.	CHO (%TSS)	Stdev.	TP (%TSS)	Stdev.
1/22/01	1	1	3195	1.5	0.2	46.3	3.0	0.1	2636	6	NM	NM	16.4	0.2	2.4	0.1
1/23/01	2	2	3860	19.0	0.8	733.4	1.2	0.1	2592	16	334	13	18.6	0.5	2.2	0.3
1/24/01	3	3	4455	26.4	0.3	1176.1	1.4	0.3	2701	4	447	6	13.9	0.3	1.9	0.1
1/25/01	4	4	4975	22.3	1.5	1106.9	1.5	0.1	2484	7	478	8	12.6	0.7	2.0	0.1
1/26/01	5	5	5075	17.1	0.1	867.8	1.1	0.1	2494	8	439	9	14.1	0.4	2.2	0.1
1/27/01	6	6	4010	10.5	0.7	421.1	0.8	0.1	2528	14	356	8	17.9	0.6	2.4	0.2
1/28/01	7	7	3385	5.7	0.5	191.3	1.0	0.2	2450	0*	442	11	24.3	0.0	2.5	0.1
1/29/01	8	8	2940	3.8	0.1	111.7	1.1	0.2	2548	11	658	6	22.8	0.4	1.9	0.1
1/30/01	9	9	2355	3.1	0*	73.0	1.0	0*	2589	0*	657	0*	25.9	0.0	1.9	0.0
1/31/01	10	10	2194	2.7	0.3	59.2	1.0	0.2	2438	18	653	4	22.8	0.4	2.0	0.1
2/1/01	11	no limitation	2420	2.3	0.2	54.5	0.9	0.0	2517	10	672	5	27.0	0.1	1.8	0.1
2/2/01	12	no limitation	2415	2.0	0.1	48.3	1.0	0.2	2633	10	696	8	30.0	0.2	1.9	0.1
2/3/01	13	no limitation	2478	2.9	0.1	71.8	1.2	0.2	2550	14	678	11	29.5	0.5	1.6	0.1
2/4/01	14	no limitation	2400	2.6	0.2	61.2	1.3	0.1	2475	8	654	6	31.6	0.5	1.7	0.1
2/5/01	15	no limitation	2385	2.3	0.2	53.7	1.3	0.2	2400	0*	666	8	32.2	0.4	1.6	0.0
2/6/01	16	1	2285	2.6	0.2	58.3	2.1	0.3	2654	8	574	6	34.6	0.4	1.3	0.0
2/7/01	17	2	2128	2.1	0*	44.7	1.2	0*	2392	11	438	11	29.2	0.4	1.9	0.1
2/8/01	18	3	2045	2.9	0.1	59.3	1.3	0.1	2543	8	402	4	26.3	0.6	2.5	0.1
2/9/01	19	4	1893	1.7	0.1	31.2	1.6	0.1	2482	9	422	23	22.2	0.4	2.4	0.1
2/10/01	20	5	1777	2.1	0.2	36.4	1.3	0.1	2400	14	540	0*	19.0	0.4	2.2	0.1
2/11/01	21	6	1480	1.9	0.3	28.1	1.0	0.1	2409	16	657	4	17.7	0.0	2.1	0.1
2/12/01	22	7	1055	3.1	0.2	32.2	1.6	0.2	2406	6	699	4	18.8	0.2	2.2	0.0
2/13/01	23	8	878	3.1	0.1	27.2	1.5	0.1	2504	6	828	11	17.5	0.0	2.2	0.1
2/14/01	24	9	554	2.8	0.2	15.2	1.3	0.1	2729	13	1002	5	17.3	0.6	2.3	0.1

Note: * = single measurement (one of duplicate samples was failed during analysis), NM = not measured