Appendix

Data: sequences of isolated bacterial species

Accession No.	Species Name	sequence
KX158859	*Bacillus* sp. S1	GGGGGCTATAATGCAGTCGAGCGAACTGATTAGAAGCTTGCTTCTATGACGTTAGCGGCGACGGGTGAGTA ACACGTGGGCAACCTGCCTGTAAGACTGGGATAACTTCGGGAAACCAAGCTAATACCGGATAGGATCTTCT CCTTCATGGGAGATGATTGAAAGATGGTTTCGGCTATCACTTACAGATGGGCCCGCGGTGCATTAGCTAGTT GGTGAGGTAACGGCTCACCAAGGCAACGATGCATAGCCGACCTGAGAGGGTGATCGGCCACACTGGGACT GAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGACGAAAGTCTGACGGA GCAACGCCGCGTGAGTGATGAAGGCTTTCGGGTCGTAAAACTCTGTTGTTAGGGAAGAACAAGTACGAGAG TAACTGCTCGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATA CGTAGGTGGCAAGCGTTATCCGGAATTATTGGGCGTAAAGCGCGCGCAGGCGGTTTCTTAAGTCTGATGTG AAAGCCCACGGCTCAACCGTGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGAAAAGCGGAA TTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGCTTTTTGGTCTGT AACTGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAAC GATGAGTGCTAAGTGTTAGAGGGTTTCCGCCCTTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGG AGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTA ATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAACTCTAGAGATAGAGCGTTCCCCT TCGGGGGACAGAGTGACAGGTGGTGCATGGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCG CAACGAGCGCAACCCTTGATCTTAGTTGCCAGCATTTAGTTGGGCACTCTAAGGTGACTGCCGGTGACAAAC CGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGA TGGTACAAAGGGCTGCAAGACCGCGAGGTCAAGCCAATCCCATAAAACCATTCTCAGTTCGGATTGTAGGC TGCAACTCGCCTACATGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCG GGCCTTGTACACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGGAGTAACCGTAAGGA GCTAACGCTATAAGGTGGCACAGAG
KX158860	*Bacillus* sp. S2	AGCCGTGCGGTGCTATAATGCAGTCGAGCGAACTGATTAGAAGCTTGCTTCTATGACGTTAGCGGCGGACGG GTGAGTAACACGTGGGCAACCTGCCTGTAAGACTGGGATAACTTCGGGAAACCGAAGCTAATACCGGATAGG ATCTTCTCCTTCATGGGAGATGATTGAAAGATGGTTTCGGCTATCACTTACAGATGGGCCCGCGGTGCATTAG CTAGTTGGTGAGGTAACGGCTCACCAAGGCAACGATGCATAGCCGACCTGAGAGGGTGATCGGCCACACTGG GACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGACGAAAGTCTGAC GGAGCAACGCCGCGTGAGTGATGAAGGCTTTCGGGTCGTAAAACTCTGTTGTTAGGGAAGAACAAGTACGAG AGTAACTGCTCGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAAT ACGTAGGTGGCAAGCGTTATCCGGAATTATTGGGCGTAAAGCGCGCGCAGGCGGTTTCTTAAGTCTGATGTG AAAGCCCACGGCTCAACCGTGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGAAAAGCGGAAT TCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGCTTTTTGGTCTGTAA CTGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGAT GAGTGCTAAGTGTTAGAGGGTTTCCGCCCTTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTA CGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTAATTCGA AGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAACTCTAGAGATAGAGCGTTCCCCTTCGGGG GACAGAGTGACAGGTGGTGCATGGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAG CGCAACCCTTGATCTTAGTTGCCAGCATTTAGTTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGA AGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGATGGTACAA AGGGCTGCAAGACCGCGAGGTCAAGCCAATCCCATAAAACCATTCTCAGTTCGGATTGTAGGCTGCAACTCG CCTACATGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTAC ACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGGAGTAACCGTAAGGAGCTAGCCGCGT AAGGTGACAAAATTT
KX158862	*Bacillus* sp. S4	GNGGANTNGGCGGCTGCTATACATGCAGTCGAGCGAACTGATTAGAAGCTTGCTTCTATGACGTTAGCGGCG GACGGGTGAGTAACACGTGGGCAACCTGCCTGTAAGACTGGGATAACTTCGGGAAACCGAAGCTAATACCG GATAGGATCTTCTCCTTCATGGGAGATGATTGAAAGATGGTTTCGGCTATCACTTACAGATGGGCCCGCGGTG CATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCAACGATGCATAGCCGACCTGAGAGGGTGATCGGCCA CACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGACGAAAG TCTGACGGAGCAACGCCGCGTGAGTGATGAAGGCTTTCGGGTCGTAAAACTCTGTTGTTAGGGAAGAACAAG TACAAGAGTAACTGCTTGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGC GGTAATACGTAGGTGGCAAGCGTTATCCGGAATTATTGGGCGTAAAGCGCGCGCAGGCGGTTTCTTAAGTCT GATGTGAAAGCCCACGGCTCAACCGTGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGAAAAG CGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAANGCGGCTTTTTGGT CTGTAACTGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTA AACGATGAGTGCTAAGTGTTAGAGGGTTTCCGCCCTTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCCTGG GGAGTACGGTCGCAAGACTGAAACTCAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTA ATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACACTCTAGAGATAGAGCGTTCCCCTTC GGGGGACAGAGTGACAGGTGGTGCATGGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAGTCCCGCACG AGCGCACCCTGATCTAGTGCCAGCATTAAGTGGGCACTCTAGTGACTGCGGTGACACGAAGAGGTGGGATGA CGTCATCATCATGCCTATAGCACTGGCCTACACTACCGGTGGCCTACACAATGA

Data: Performance evaluation of continuous operation of bioreactor

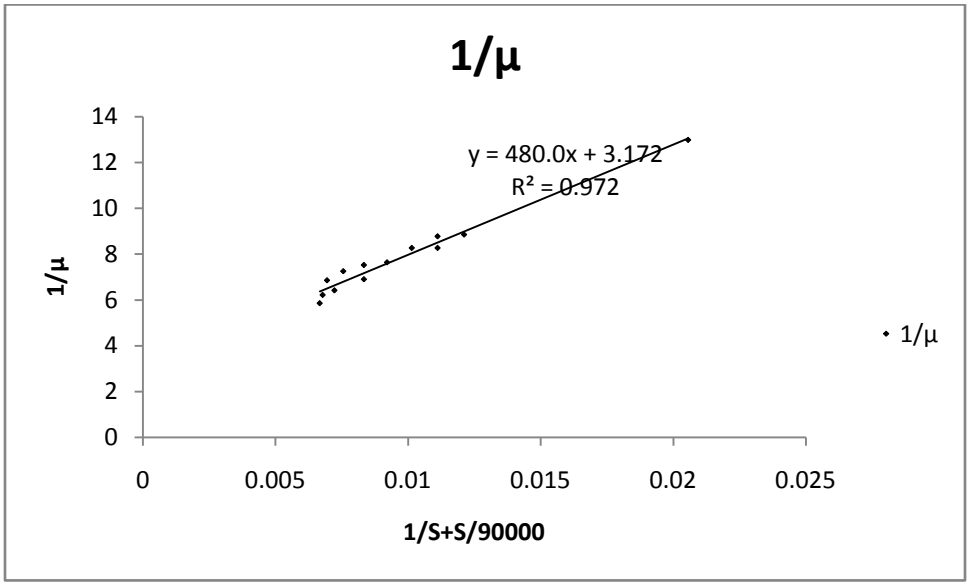
	CONC	RE	inlet loading rate	EC
0	300	-	-	-
1	300	-	-	-
2	298	-	-	-
3	300	-	-	-
4	300	-	-	-
5	300	-	-	-
6	298	-	-	-
7	297	-	-	-
8	300	-	-	-
9	299	-	-	-
10	300	-	-	-
11	297	-	-	-
12	298	-	-	-
13	300	-	-	-
14	299	-	-	-
15	300	-	-	-
16	240	20	36	24
17	200	33.33333	36	16.2
18	165	45	36	19.2
19	140	53.33333	36	21.6
20	120	60	36	25.2
21	90	70	36	27.6
22	70	76.66667	36	28.8
23	60	80	36	31.2
24	40	86.66667	36	31.8
25	35	88.33333	36	33.48
26	21	93	36	33.24
27	23	92.33333	36	33.48
28	21	93	36	33.48
29	21	93	36	25.92
30	84	72	72	55.2
31	70	76.66667	72	58.8
32	55	81.66667	72	61.92
33	42	86	72	64.08
34	33	89	72	65.52
35	27	91	72	66.24
36	24	92	72	66.24
37	24	92	72	66.24
38	24	92	72	51.36

39	86	71.33333	108	82.08
40	72	76	108	88.2
41	55	81.66667	108	92.88
42	42	86	108	96.12
43	33	89	108	98.64
44	26	91.33333	108	98.64
45	26	91.33333	108	98.64
46	26	91.33333	108	97.92
47	96	68	144	103.68
48	84	72	144	113.28
49	64	78.66667	144	120
50	50	83.33333	144	122.88
51	44	85.33333	144	128.64
52	32	89.33333	144	131.04
53	27	91	144	131.04
54	27	91	144	131.04
55	27	91	144	90
56	150	50	180	103.2
57	128	57.33333	180	117.6
58	104	65.33333	180	126
59	90	70	180	138
60	70	76.66667	180	144
60	60	80	180	144
62	60	80	180	144
63	60	80	180	91.8
64	147	51	216	115.2
65	140	53.33333	216	124.56
66	127	57.66667	216	129.6
67	120	60	216	133.2
68	115	61.66667	216	136.8
69	110	63.33333	216	142.56
70	102	66	216	145.44
71	98	67.33333	216	145.44
72	98	67.33333	216	145.44
73	98	67.33333	216	145.44
74	98	67.33333	216	145.44
75	98	67.33333	216	145.44
AVG	79	73.66667	120.9836	88.174
MAX	300	93	216	145.44
MIN	21	0	36	7.2
std deviation	55.85398	18.61799	67.36035	44.89367
std error	7.210717	2.403572	8.696183	5.795748

EC mg/L/h	Flow rate	Loading rate	EC mg/L/day	RE
1.395	5	36	33.48	93
2.76	10	72	66.24	92
4.11	15	108	98.64	91.33
5.46	20	144	131.04	91
6	25	180	144	80
6.06	30	216	145.44	67.33

Data: Growth inhibition kinetic data for Malathion biodegradation

s	μ	1/s+s/90000	1/μ
50	0.077	0.020556	12.98701
100	0.121	0.011111	8.264463
150	0.145	0.008333	6.896552
200	0.156	0.007222	6.410256
250	0.161	0.006778	6.21118
300	0.171	0.006667	5.847953
400	0.146	0.006944	6.849315
500	0.138	0.007556	7.246377
600	0.133	0.008333	7.518797
700	0.131	0.009206	7.633588
800	0.121	0.010139	8.264463
900	0.114	0.011111	8.77193
1000	0.113	0.012111	8.849558



s	μ Observed	μ Andrew-Haldane Model fitted
0	0	0
50	0.077	0.076634
100	0.121	0.117479
150	0.145	0.139318
200	0.156	0.150511
250	0.161	0.155508
300	0.171	0.156809
400	0.146	0.153595
500	0.138	0.146968
600	0.133	0.139317
700	0.131	0.131626
800	0.121	0.124297
900	0.114	0.117477
1000	0.113	0.111201

Data: Treatment of mixtures of the pesticides in integrated aerobic treatment plant

TIME (h)	COD (mg/L) Reactor 1	% RE Reactor 1	pH	Redox Potential (mV)	DO (mg/L)	DO5	BOD5/COD	BOD (mg/L)
0	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
36	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-
72	-	-	-	-	-	-	-	-
84	-	-	-	-	-	-	-	-
96	-	-	-	-	-	-	-	-
108	-	-	-	-	-	-	-	-
120	-	-	-	-	-	-	-	-
132	-	-	-	-	-	-	-	-
144	-	-	-	-	-	-	-	-
156	-	-	-	-	-	-	-	-
168	-	-	-	-	-	-	-	-
180	-	-	-	-	-	-	-	-
192	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	-
216	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	-
240	1232	0	7	52.5	5.52	4.21	0.021266	26.2
252	1200	2.597403	6.16	-43.3	5.31	4.12	0.019833	23.8
264	1186	3.733766	7.06	45.3	5.13	3.83	0.021922	26
276	1136	7.792208	6.33	-74	4.02	3.14	0.015493	17.6
288	1120	9.090909	7.67	121.4	4.61	3.22	0.024821	27.8
300	1021	17.12662	6.71	-61.5	5.01	4.21	0.015671	16
312	1015	17.61364	7.31	166.3	4.7	3.94	0.014975	15.2
324	814.4	33.8961	7.14	52.1	4.29	3.57	0.017682	14.4
336	1011	17.93831	8.04	222.12	5.11	4.58	0.010485	10.6
348	992	19.48052	7.91	122.1	4.84	4.14	0.014113	14
360	874	29.05844	7.12	163.4	4.98	3.84	0.026087	22.8
372	740	39.93506	7.35	63.2	4.5	3.52	0.026486	19.6
384	702	43.01948	7.6	142.42	4.21	2.8	0.040171	28.2
396	688	44.15584	7.82	63.9	3.53	2.63	0.026163	18
408	632	48.7013	7.33	113.4	3.82	2.44	0.043671	27.6
420	707	42.61364	7.29	148	2.72	1.85	0.024611	17.4
432	752	38.96104	7.23	50.2	2.94	2.17	0.020479	15.4

444	740	39.93506	7.58	120.3	3.43	2.42	0.027297	20.2
456	721	41.47727	7.36	88	3.11	1.83	0.035506	25.6
468	650	47.24026	7.93	132	2.62	1.42	0.036923	24
480	512	58.44156	7.12	86.2	2.48	1.32	0.045313	23.2
492	864	29.87013	8.1	177.3	3.01	1.64	0.031713	27.4
504	768	37.66234	7.2	6.3	3.21	2.51	0.018229	14
516	570	53.73377	7.43	17.9	3.64	2.44	0.042105	24
528	464	62.33766	7.97	200.3	3.1	2.34	0.032759	15.2
540	435	64.69156	8.11	214.8	2.81	1.71	0.050575	22
552	410	66.72078	7.9	232.5	2.54	1.43	0.054146	22.2
564	385	68.75	7.92	186.2	3.12	2.27	0.044156	17
576	316	74.35065	7.68	158	3.51	2.69	0.051899	16.4
588	259	78.97727	8.02	95.5	2.72	1.67	0.081081	21
600	240	80.51948	7.85	121.5	2.43	1.55	0.073333	17.6
612	356	71.1039	7.89	186.2	2.35	1.23	0.062921	22.4
624	320	74.02597	8.06	212.3	2.54	1.49	0.065625	21
636	290	76.46104	7.62	125.8	2.62	1.74	0.06069	17.6
648	272	77.92208	7.35	72.4	2.15	1.36	0.058088	15.8
660	257	79.13961	7.1	55.4	2.32	1.47	0.066148	17
672	232	81.16883	7.22	80.4	2.62	1.51	0.09569	22.2
684	205	83.36039	7.13	72	2.41	1.32	0.106341	21.8
696	198	83.92857	7.19	56	2.82	1.65	0.118182	23.4
708	165	86.60714	7.22	125.3	2.24	1.42	0.099394	16.4
720	154	87.5	7.14	42	2.14	1.08	0.137662	21.2
Min	154	0	6.16	-74	2.14	1.08	0.010485	10.6
Max	1232	87.5	8.11	232.5	5.52	4.58	0.137662	28.2
Avg	624.522	49.30828	7.442927	102.7351	3.443415		0.045846	
SD	331.6863	26.92259	0.461656	74.78793	1.033234		0.030968	

Data: coupling of UV Fenton and bioreactor in series for the treatment of atrazine

concentration (mg/L)	COD (mg/L)	% RE	Operating Time
300	8740	0	0
210	5462	30	30
105	3059	65	60
105	3059	65	60
105	3059	65	90
105	3059	65	120
	Bioreactor feed		
105	3059	65	0
108	3146.4	64	1
99	2884.2	67	2
78	2272.4	74	3
87	2534.6	71	4
63	1835.4	79	5
45	1311	85	6
39	1136.2	87	7
27	786.6	91	8
21	611.8	93	9
21	611.8	93	10
21	611.8	93	11
21	611.8	93	12