APPENDIX A

EXPERIMENTAL DATA OF ANAEROBIC FOOD WASTE DIGESTION

Table A.1 Anaerobic digestion of food waste at operating pH 5

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
5	3.80	ND	10,687.2	13,000	11,221.6	0	62.9
9	4.61	3,440.0	22,481.4	34,782	6,155.6	0	65.9
12	5.26	2,415.0	23,270.8	30,000	2,748.4	0	91.5
16	5.20	3,376.3	19,999.6	33,000	3,072.0	0	68.8
21	5.66	4,779.5	20,952.1	37,795	1,064.8	0	64.8
24	5.61	6,345.0	24,121.3	34,016	1,116.7	0	56.1
40	5.14	4,510.4	24,472.8	41,090	3,230.0	0	26.5
45	5.17	4,092.9	22,222.4	46,100	2,975.2	0	29.1
55	5.13	5,372.0	24,133.7	44,530	3,286.5	0	19.2

Table A.2 Anaerobic digestion of food waste at operating pH 6

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
5	5.80	4,357.5	17,788.6	18,000	854.9	0.0	86.3
9	5.73	14,407.5	30,261.0	35,636	1,080.5	0.0	89.0
12	5.71	6,705.0	30,896.0	34,200	994.1	0.0	91.5
16	5.80	6,168.5	24,582.9	33,000	809.8	0.0	68.8
21	6.14	6,596.5	25,664.9	32,913	264.6	3.7	64.2
24	6.18	5,546.0	27,755.9	34,016	218.1	8.6	62.0
40	5.95	10,959.3	27,953.3	29,940	512.1	4.7	60.8
45	6.37	8,087.9	28,051.7	33,020	145.7	7.3	56.5
55	5.94	7,386.5	30,551.7	35,440	537.7	6.4	64.2

Table A.3 Anaerobic digestion of food waste at operating pH 7 (day 21-55)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
5	5.70	3,956.2	16,532.8	22,500.0	1,612.0	0.0	90.2
9	5.66	13,628.3	33,187.0	40,909.1	1,277.6	1.2	84.0
12	5.60	6,457.5	31,172.5	38,560.0	1,610.7	1.3	82.4
16	5.75	6,119.8	30,168.7	34,562.5	1,116.4	7.9	84.9
21	7.45	7,900.0	30,203.2	32,932.0	13.5	12.0	88.7
24	6.51	10,904.0	31,915.3	33,259.8	94.9	15.0	62.6
40	6.78	9,999.6	33,276.0	34,920.0	69.9	17.7	50.9
45	6.76	9,654.6	34,869.5	35,400.0	72.9	20.9	58.2
55	6.82	8,670.3	30,066.8	34,400.0	94.1	14.7	54.3

Remark: Incomplete pH adjustment for pH 7 during day 0-16

Table A.4 iVFA of food waste at different pH

pH	Day	Concentration (mg/l)				
		AA	PA	BA	iBA	VA
5	5	3,740.9	2,780.4	3,420.6	284.0	2,102.6
	9	3,210.9	2,004.2	3,258.4	336.1	1,258.9
	12	3,335.7	2,022.5	3,857.3	323.5	974.4
	16	3,493.2	2,200.1	3,420.0	221.7	1,323.3
	21	2,643.9	1,404.8	3,380.7	271.9	920.7
	24	2,525.5	1,614.4	3,047.0	178.7	799.3
	40	3,088.2	1,763.0	3,939.8	214.0	1,154.0
	45	3,246.8	1,789.7	3,164.7	541.0	1,096.0
	55	3,167.1	1,715.3	4,033.2	319.5	940.0
6	5	2,312.4	2,159.7	2,568.7	519.8	1,603.5
	9	2,941.8	2,241.6	3,234.0	455.8	1,170.8
	12	2,733.8	1,796.6	3,085.3	481.9	784.1
	16	2,568.9	1,829.1	2,794.4	479.0	1,040.7
	21	1,720.5	998.8	2,151.9	415.9	629.4
	24	1,472.5	1,164.8	1,983.1	144.4	532.0
	40	2,251.6	1,242.2	2,879.9	357.3	856.1
	45	1,630.4	905.9	1,932.4	372.5	596.5
	55	2,345.2	1,296.7	2,963.1	422.7	765.6
7	5	4,000.6	3,192.5	4,234.0	564.5	2,112.5
	9	2,800.1	2,582.1	3,133.5	602.9	1,133.2
	12	3,448.7	2,330.7	4,181.9	547.9	1,009.9
	16	3,187.5	2,351.0	3,498.6	539.9	1,242.0
	21	1,720.5	998.8	2,151.9	415.9	629.4
	24	1,331.0	873.7	1,767.7	347.3	508.9
	40	2,060.4	1,060.3	2,568.5	173.3	753.5
	45	2,133.3	1,113.1	2,378.5	279.2	687.5
	55	2,969.4	1,747.8	3,679.7	434.4	881.5

Remark: Incomplete pH adjustment for pH 7 during day 0-16

Table A.5 Performance of control reactor (FC)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	5.80	1,542.6	3,882.9	-	-	-	-
1	4.71	803.7	8,063.5	27,100	1,752.3	3.1	51.3
2	4.41	722.4	8,356.5	25,620	2,556.0	3.1	77.2
3	4.11	506.4	9,097.6	27,740	-	3.1	72.4
4	3.86	ND	10,808.5	27,404	-	3.1	62.9
5	3.91	ND	11,245.9	26,504	-	3.1	59.4
6	3.97	ND	10,285.8	27,752	-	3.1	52.0
7	3.87	ND	11,904.0	26,992	5,830.5	2.4	50.1
9	3.79	ND	10,248.5	25,720	-	1.5	43.8
11	3.82	ND	11,223.7	26,668	6,101.3	1.0	41.8
12	3.80	ND	10,751.7	24,912	-	0.6	42.2
13	3.74	ND	10,741.9	25,228	-	0.8	38.4
14	3.73	ND	11,365.4	25,540	6,145.8	0.9	42.3
15	3.79	ND	11,973.9	24,788	-	0.2	45.0
17	3.77	ND	12,074.4	24,360	7,984.0	0.2	45.9
18	3.70	ND	12,493.1	22,804	-	0.2	55.6
21	3.73	ND	12,751.0	24,008	-	0.1	72.7
22	3.72	ND	12,282.2	-	-	0.1	80.3
23	3.72	ND	12,199.2	-	-	0.7	74.6
24	3.81	ND	13,701.5	23,772	-	0.6	80.6
25	3.84	ND	12,228.5	-	7,824.4	0.9	86.2

Note: ND = not detected

Table A.6 Performance of dilution reactor (F1)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	5.82	1,610.2	3,492.9	-	-	-	-
1	4.43	297.1	6,307.6	16,040	1,924.5	3.1	77.0
2	3.97	ND	6,412.3	17,690	1,802.6	3.1	80.7
3	4.12	291.2	6,007.2	19,360	-	3.1	79.9
4	4.45	418.1	8,320.0	19,652	3,065.5	3.1	78.3
5	4.00	ND	8,632.7	24,808	-	3.1	73.9
6	3.91	ND	8,934.6	21,248	-	3.1	72.4
7	3.85	ND	7,689.2	18,792	4,488.7	2.3	70.8
9	3.98	ND	7,302.2	18,980	-	1.4	68.4
11	3.75	ND	7,951.3	18,924	-	1.0	67.9
12	3.81	ND	7,723.8	18,252	-	0.6	64.4
13	3.73	ND	9,749.6	18,012	4,995.8	0.7	64.3
14	3.81	ND	9,075.3	17,304	6,868.3	0.9	39.2
14*	3.85	ND	6751.4	14,160	-	-	-
15	3.85	ND	6,039.8	14,080	2,621.9	0.1	45.9
17	4.18	153.5	8,482.5	14,120	-	0.1	38.4
18	3.98	130.7	11,397.5	14,320	1,672.3	0.1	40.5
21	4.48	626.7	8,446.7	13,896	1,520.3	0.1	65.9
22	4.35	816.8	7,276.1	14,036	1,965.5	0.1	69.7
23	4.87	1122.1	6,777.7	13,736	1,224.5	0.7	55.9
23*	5.00	939.5	5,115.5	12,484	-	-	-
24	5.22	936.8	4,542.6	8,300	701.8	0.6	56.8
25	5.01	713.5	5,345.8	10,320	-	0.9	64.7
26	4.98	896.2	5,712.2	11,166	837.1	0.9	56.4
27	4.81	843.0	7,388.1	11,173	-	1.0	58.3
28	4.64	819.9	7,838.0	12,036	1,399.1	1.3	51.0
29	4.65	904.4	7,139.8	12,558	-	1.3	53.3
30	4.50	687.0	8,442.4	12,432	1,681.9	1.3	51.9
31	4.60	747.7	10,552.8	13,095	-	2.2	55.4
32	4.60	773.1	8,653.3	13,887	1,782.8	0.7	53.3
33	4.58	827.1	8,961.5	14,157	2,135.0	0.7	51.9
33*	4.93	853.3	7,189.3	11,897	-	-	-
34	4.63	869.3	7,974.5	12,297	1,988.8	0.7	34.7
35	4.60	749.7	7,841.4	11,292	1,957.9	0.7	38.4
36	4.55	616.4	8,638.1	11,061	-	6.2	36.4
37	4.61	743.5	9,083.4	11,898	1,773.9	2.7	36.9
38	4.78	635.3	7,559.3	11,415	-	0.6	37.2
39	4.46	630.6	7,165.7	11,742	1,833.1	-	-
44	4.69	852.4	6,892.2	12,492	-	0.6	33.6
46	4.51	565.3	7,280.8	12,534	1,890.7	0.8	35.5
51	4.45	733.1	8,155.1	12,840	2,537.0	0.8	27.8
67	4.52	564.7	7,847.0	13,332	2,328.4	-	-

Note: ND = not detected, * = analyzed within 1 hr after leachate dilution

Table A.7 Performance of neutral pH reactor (F2)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	6.95	8,563.2	3,492.9	-	-	-	-
1	7.08	8,989.7	9,868.4	22,880	27.0	3.6	74.3
2	7.06	8,681.6	15,689.7	23,105	16.1	4.5	93.6
3	7.11	8,279.5	20,257.6	26,744	14.3	6.1	93.7
4	6.77	9,237.0	27,472.2	35,444	28.3	8.7	95.5
5	6.31	9,631.7	31,234.8	34,080	85.8	9.7	90.2
6	6.41	9,661.3	32,943.2	34,964	-	10.8	89.0
7	6.49	10,245.4	31,460.1	31,964	51.3	14.0	90.3
9	6.78	11,014.4	30,497.9	30,648	-	16.0	64.0
11	6.58	11,688.5	31,328.4	32,228	-	20.8	74.0
12	6.70	12,118.6	33,926.4	34,872	-	22.4	69.4
13	6.63	11,975.1	33,995.6	35,608	-	23.2	66.5
14	6.60	12,596.3	32,060.5	34,780	40.6	25.5	59.0
15	7.19	10,917.3	33,467.8	34,372	-	28.7	57.5
17	6.95	13,021.3	33,697.6	35,392	18.6	30.1	42.8
18	7.32	13,180.1	36,437.5	37,100	-	34.0	42.5
21	6.63	13,201.0	36,063.9	38,964	-	47.7	32.3
22	7.16	13,286.4	35,235.5	37,676	-	47.4	28.8
23	7.06	12,963.0	34,870.8	-	-	46.8	32.7
24	6.92	12,656.7	34,705.4	37,120	25.2	46.4	30.0
25	6.91	12,365.4	35,412.4	-	-	53.0	32.3
27	6.82	13,530.5	34,933.3	37,783	-	60.2	32.8
30	6.72	12,780.1	36,536.7	38,020	-	57.8	28.4
31	6.77	13,391.8	36,759.5	-	-	55.3	27.7
34	6.76	13,078.0	36,059.2	39,804	37.8	53.3	25.0
44	7.14	12,945.4	34,954.6	38,680	9.9	56.9	21.9
51	6.74	12,513.9	34,485.3	36,824	22.2	58.2	20.7
67	7.09	12,857.1	33,924.9	36,040	10.3	-	-

Table A.8 Performance of neutral pH along with dilution reactor (F3)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	6.99	6,956.2	3,492.9	-	-	-	-
1	7.14	7,284.7	11,903.0	21,680	17.0	3.7	75.3
2	6.83	6,836.9	20,621.7	25,400	43.8	6.2	92.6
3	6.17	7,684.5	27,482.9	28,080	149.4	7.4	99.0
4	6.71	7,316.4	31,799.0	31,872	48.3	9.4	96.2
5	6.50	8,506.3	31,823.7	31,924	-	10.4	94.4
6	6.61	7,323.5	26,651.8	30,184	28.2	13.1	92.3
7	6.50	9,111.2	29,074.3	31,580	60.2	19.3	90.6
9	6.58	9,541.6	26,855.1	29,684	29.5	14.0	67.3
11	6.56	9,579.7	26,527.0	31,684	-	16.6	76.2
12	6.58	10,427.6	29,609.0	31,540	-	15.2	67.0
13	6.66	10,392.7	29,675.1	31,052	33.0	23.8	70.2
14	6.59	11,069.1	28,735.7	30,100	53.5	17.8	53.9
14*	7.33	8,968.3	21,514.4	24,704	-	-	-
15	6.80	5,763.1	18,764.4	20,796	30.6	28.6	49.7
17	6.71	6,907.2	19,317.9	20,560	-	35.9	36.1
18	7.41	6,903.9	19,686.9	19,892	-	47.2	37.0
21	6.89	7,320.5	18,522.0	19,732	-	63.2	22.2
22	6.73	7,677.8	16,878.8	20,064	16.0	76.0	22.3
23	7.18	7,596.9	17,165.2	17,936	12.4	77.4	15.4
23*	6.68	6,536.5	13,853.8	14,436	-	-	-
24	7.20	5,578.4	10,856.0	10,912	11.1	82.6	17.9
25	7.17	5,377.9	10,778.4	10,904	-	79.9	17.6
26	7.23	5,746.2	9,843.0	10,021	4.4	84.1	19.0
27	7.14	5,510.0	9,384.0	-	-	84.3	19.3
28	7.13	5,975.0	7,320.0	9,497.1	12.4	76.1	17.4
29	7.19	5,907.7	6,517.9	8,815.4	-	82.1	26.0
30	7.18	5,806.8	6,111.0	7,751.5	5.5	77.0	16.5
31	7.17	6,141.8	5,499.0	6,140.1	-	80.0	18.3
32	7.17	6,291.9	5,367.0	6,653.3	6.1	77.6	16.6
33	7.23	6,233.7	5,187.0	6,279.4	9.3	79.9	18.3
33*	7.11	5,236.5	4,049.6	5,236.5	-	-	-
34	7.22	5,472.5	4,113.0	5,231.6	10.5	75.5	13.0
35	7.23	3,945.3	3,381.0	3,858.7	4.4	73.0	16.5
36	7.25	4,128.6	3,204.0	3,873.6	-	74.2	17.3
37	7.29	4,239.9	2,958.0	3,865.3	3.3	75.9	22.8
38	7.17	5,092.9	3,312.7	3,710	-	68.3	20.2
39	6.98	4,633.8	4,641.4	4,749	6.6	-	-
44	7.14	4,274.9	3,029.2	3,407	-	67.7	21.2
46	7.08	4,308.9	2,454.3	2,549	5.2	68.9	21.6
51	7.03	4,398.8	1,454.7	1,641	5.5	70.7	20.1
67	6.92	4,578.1	1,285.3	1,592	6.7	-	-

Note: ND = not detected, * analyzed within 1 hr after leachate dilution

Table A.9 Performance of stepwise increasing pH 4.5-6.5 reactor (F4)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	TCOD (mg/l)	$SCOD/TCOD_{(d0)}$ (%)	UA (mg/l)	Cum.gas vol. (l)	CH_4 (%)	CO_2 (%)
0	5.63	55.9	5,646.0	19,952	47,700	41.8	283.8	0	-	-
1	3.77	NA	7,463.0	26,208	34,620	54.9	2,062.6	1.47	0	52.9
2	5.79	1,715.2	6,406.1	22,050	-	46.2	-	3.71	-	-
3	4.81	1,381.8	7,916.2	25,773	-	54.0	1,584.1	4.76	0	61.5
4	4.57	1,176.7	7,419.0	25,940	-	54.4	-	8.26	-	-
5	4.93	1,669.3	9,057.9	27,940	-	58.6	3,099.7	11.34	0	63.1
6	5.14	2,268.2	10,837.5	24,048	-	50.4	-	15.96	-	-
7	5.35	3,442.9	13,724.7	24,928	-	52.3	4,557.4	18.27	0	65.0
8	5.36	3,524.6	14,869.3	27,792	-	58.3	-	18.27	-	-
10	5.34	4,043.6	17,008.0	27,432	-	57.5	3,296.8	18.27	0	70.6
11	5.13	4,069.3	21,182.6	27,148	-	56.9	2,874.8	18.27	0	67.3
12	5.30	4,247.1	20,422.4	26,768	-	56.1	-	18.27	-	-
13	5.25	4,413.5	19,378.4	27,280	-	57.2	2,757.5	18.34	0	69.9
14	5.45	5,002.1	18,933.9	27,128	-	56.9	-	18.41	-	-
15	5.55	5,439.8	21,824.6	27,284	-	57.2	1,492.5	19.39	0	75.9
16	5.55	5,458.4	21,323.6	27,000	-	56.6	-	19.60	-	-
17	5.59	5,358.0	20,399.2	27,105	-	56.8	443.4	19.60	0	77.1
19	6.25	8,051.2	21,815.5	28,700	-	60.2	134.9	19.60	3.7	82.9
21	6.39	7,396.0	22,103.8	30,060	-	63.0	129.4	19.67	3.9	80.7
24	6.87	7,831.6	25,161.1	28,555	-	59.9	-	19.67	4.9	81.4
25	6.32	8,125.9	25,288.3	28,772	-	60.3	138.1	19.67	5.9	82.3
27	6.40	8,135.9	26,535.1	31,084	-	65.2	137.9	19.67	8.0	74.7
29	6.48	8,261.3	26,382.9	31,283	-	65.6	65.4	19.95	12.3	75.4
31	6.47	8,378.9	27,710.9	31,875	-	66.8	52.4	20.37	19.7	64.8
33	7.24	8,391.9	25,299.5	30,280	-	63.5	22.5	20.37	35.4	52.0
35	7.32	8,697.6	27,256.7	29,428	-	61.7	11.7	20.37	48.4	39.4
37	7.18	9,286.5	22,087.1	30,912	-	64.8	16.5	20.37	55.8	30.5
39	7.38	9,099.0	24,340.7	29,412	-	61.7	12.9	20.37	56.8	30.0
41	7.74	9,666.9	23,482.7	29,316	-	61.5	3.9	20.37	57.2	31.2
44	7.82	9,399.2	22,303.1	31,612	-	66.3	3.3	20.65	52.6	33.8
46	7.76	9,328.5	23,706.4	32,092	-	67.3	3.2	20.65	46.5	38.9
54	7.61	9,393.7	26,906.5	31,024	-	65.0	9.2	20.65	42.2	44.6
61	7.50	9,330.9	28,107.2	34,668	-	72.7	13.5	20.65	42.8	38.3
70	6.86	9,782.8	30,814.1	35,228	-	73.9	43.4	20.65	43.7	42.8
76	6.78	9,547.8	30,680.5	36,404	41,940	76.3	39.2	20.65	44.0	37.0
84	7.21	9,669.4	29,667.2	35,530	39,918	74.5	7.8	20.65	56.0	33.9
90	7.48	9,990.5	28,453.1	32,685	40,640	68.5	3.6	20.65	65.2	27.5
96	7.38	9,789.4	28,272.9	31,345	39,130	65.7	5.4	20.65	69.9	22.6
100	7.48	9,861.5	27,750.4	30,600	36,575	64.2	4.8	20.65	70.5	20.4
103	7.54	10,053.1	27,389.7	30,310	41,060	63.5	4.7	20.65	71.6	19.4
108	7.69	10,443.1	26,090.3	27,275	35,448	57.2	1.3	20.72	72.5	19.1
111	7.82	10,275.5	23,450.2	26,790	33,890	56.2	1.3	22.12	69.6	18.7
117	7.95	10,207.6	23,293.4	27,665	35,100	58.0	0.8	25.90	77.5	16.1
119	7.98	10,259.9	22,755.3	24,700	30,472	51.8	0.8	26.04	77.6	15.7
122	7.95	10,403.3	20,802.7	24,008	33,768	50.3	0.8	28.07	71.1	18.4
127	8.01	10,453.8	20,107.9	22,712	29,128	47.6	0.7	30.80	75.7	17.2
131	8.11	10,691.4	19,937.4	21,772	35,836	45.6	0.6	31.99	74.7	15.2
135	8.16	10,605.0	17,488.8	19,726	-	41.4	0.5	33.67	72.0	17.8
139	8.05	10,951.4	16,317.4	19,656	26,632	41.2	0.7	35.35	73.0	18.2
142	8.01	10,706.3	14,562.5	19,544	24,368	41.0	0.7	36.75	72.9	19.5
145	8.02	11,228.4	13,728.0	19,232	24,808	40.3	0.7	38.08	72.1	20.0
149	8.01	11,293.5	14,603.7	18,096	24,884	37.9	0.8	40.04	71.1	21.9
153	7.96	11,328.2	13,375.2	17,944	22,744	37.6	0.8	42.35	69.2	23.0
157	8.14	11,039.9	14,813.3	18,840	24,492	39.5	0.5	44.87	67.9	22.6
164	8.15	11,007.9	13,634.7	17,576	25,344	36.8	0.5	49.98	67.8	24.7
171	8.10	11,056.8	13,081.2	16,016	21,114	33.6	0.5	57.54	69.7	23.4
178	8.14	11,390.8	11,577.2	14,676	19,372	30.8	0.5	62.79	70.1	21.6
185	8.14	11,612.3	8,147.4	13,104	19,360	27.5	0.5	66.92	67.2	21.5

Table A.9 Performance of stepwise increasing pH 4.5-6.5 reactor (Cont')

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	TCOD (mg/l)	$SCOD/TCOD_{(d0)}$ (%)	UA (mg/l)	Cum. gas vol. (l)	CH_4 (%)	CO_2 (%)
192	8.21	12,292.3	8,026.3	10,804	16,812	22.6	0.5	69.02	67.3	20.5
200	8.25	12,238.9	5,236.4	8,704	14,336	18.2	0.4	69.02	65.2	19.5
207	8.23	12,281.2	4,162.5	7,520	12,344	15.8	0.5	69.02	70.8	20.7
209	8.09	12,647.4	5,521.6	6,712	12,997	14.1	0.6	69.16	70.6	21.4
210	8.32	11,821.4	3,639.0	7,084	13,220	14.9	0.3	69.23	70.4	21.6

Table A.10 Performance of acid digester of two phase treating food waste (15%TS)

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	TCOD (mg/l)	$SCOD/TCOD_{(d0)}$ (%)	UA (mg/l)	Cum.gas vol. (l)	CH_4 (%)	CO_2 (%)
0	5.16	1,123.5	8,862.3	25,440	67,417	37.7	2,093.3	-	-	-
1	3.68	NA	7,463.0	24,724	50,150	36.7	1,844..0	2.24	0.0	60.1
2	4.75	1,065.2	6,459.2	22,336	-	33.1	-	6.65	-	-
3	4.05	165.8	10,087.3	27,591	-	40.9	2,073.4	8.26	0.0	60.8
4	4.39	1,294.3	10,485.6	34,508	-	51.2	-	8.68	-	-
5	4.51	1,540.9	12,298.0	35,805	-	53.1	2,001.9	11.13	0.0	40.4
6	4.56	1,825.4	12,574.2	32,032	-	47.5	-	11.27	-	-
7	4.97	2,821.6	14,774.7	34,836	-	51.7	3,217.5	12.53	0.0	30.8
8	5.48	5,721.1	17,037.0	38,960	-	57.8	-	12.53	-	-
10	5.70	5,207.1	23,478.4	41,059	-	60.9	1,726.2	23.03	0.0	87.1
11	5.49	6,534.3	25,080.2	39,940	-	59.2	1,648.3	23.03	0.0	78.6
12	5.52	6,590.9	23,600.0	42,105	-	62.5	-	23.03	-	-
13	5.50	7,046.4	26,851.2	42,395	-	62.9	2,044.5	23.03	0.0	70.9
14	5.47	7,041.3	28,572.9	42,405	-	62.9	-	23.03	-	-
15	5.46	7,154.3	29,817.5	42,425	-	62.9	1,818.7	23.03	0.0	73.2
16	5.49	7,418.7	29,792.3	47,135	-	69.9	-	23.03	-	-
17	5.49	7,521.8	28,324.8	42,318	-	62.8	1,517.9	23.03	0.0	78.5
19	5.98	9,157.8	29,654.3	47,946	-	71.1	486.0	23.03	0.0	85.1
21	6.38	9,869.6	29,142.9	47,406	-	70.3	254.1	23.24	4.3	82.4
24	6.30	10,299.6	33,357.7	46,350	-	68.8	-	23.66	3.6	83.3
25	6.66	10,579.8	33,905.0	46,062	-	68.3	95.6	23.66	3.7	82.1
27	6.43	10,587.8	35,217.5	49,026	-	72.7	231.80	23.66	3.8	77.8
29	6.37	10,326.2	33,288.7	48,018	-	71.2	189.1	23.87	4.0	80.3
31	6.74	10,809.3	34,594.5	49,446	-	73.3	88.6	23.94	4.7	80.1
33	6.46	10,507.3	34,332.5	49,188	-	73.0	213.96	24.01	9.0	80.8
35	6.82	10,825.1	35,930.4	52,686	-	78.1	76.5	24.08	12.4	73.8
36	6.37	10,677.2	33,826.6	45,366	-	67.3	182.5	24.08	-	-
37	6.37	10,776.1	30,389.0	44,196	43,596	65.6	183.1	24.15	13.9	65.7
38	6.41	10,164.1	32,220.6	40,926	-	60.7	224.6	24.15	-	-
39	6.40	9,741.3	33,515.3	44,034	-	65.3	176.6	24.15	17.1	61.1
41	6.32	10,154.4	34,572.9	41,628	-	61.7	184.9	24.15	-	-
41	6.32	11,449.9	37,392.4	42,324	-	62.8	-	24.15	-	-
42	6.48	9,140.7	28,809.9	44,910	-	66.6	123.8	24.15	18.3	57.7
43	6.32	9,165.5	29,101.3	40,248	-	59.7		24.15	-	-
44	6.37	8,753.4	29,276.4	40,764	-	60.5	229.7	24.22	19.5	57.2
45	6.15	8,258.0	25,347.8	40,860	-	60.6		24.22	-	
46	6.22	8,609.9	28,857.0	40,746	-	60.4	199.0	24.57	18.8	54.1
48	6.31	8,465.0	29,384.4	39,006	-	57.9	-	24.57	-	-
49	7.02	9,449.1	30,910.0	44,568	-	66.1	29.4	24.71	15.3	69.1
50	6.54	9,727.9	29,994.2	36,906	-	54.7	-	24.71	-	-
51	7.06	9,403.6	28,666.9	41,760	-	61.9	24.9	24.71	15.2	67.6
54	6.54	10,036.2	32,082.8	41,274	-	61.2	102.2	24.85	15.3	59.8
61	6.43	10,051.6	33,145.3	37,506	55,391	55.6	205.2	24.85	16.0	48.6
62	6.62	10,093.6	32,212.1	36,282	-	53.8	167.7	24.92	19.7	61.8
63	6.55	9,602.7	30,237.7	41,436	-	61.5	143.0	24.92	20.3	63.5
64	6.53	9,300.4	30,069.9	40,572	-	60.2	82.8	24.99	20.6	63.5
65	6.55	8,215.0	25,365.3	34,512	56,406	51.2	73.2	24.99	21.5	62.5
66	6.70	7,897.9	22,587.3	32,034	38,682	47.5	32.9	25.13	22.8	58.0

Table A.10 Performance of acid digester of two phase treating food waste (15%TS) (Cont')

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	TCOD (mg/l)	$SCOD/TCOD_{(d0)}$ (%)	UA (mg/l)	Cum.gas vol. (l)	CH_4 (%)	CO_2 (%)
67	6.76	7,581.7	20,822.7	28,476	35,700	42.2	24.9	25.20	26.6	57.6
68	6.89	7,247.0	18,603.1	24,900	30,744	36.9	16.3	25.27	30.0	55.8
68	6.89	7,247.0	18,603.1	24,900	30,744	-	-	25.27	-	-
69	6.89	7,131.2	14,687.6	21,126	30,457	31.3	16.2	25.48	33.2	52.6
70	7.16	6,899.5	14,895.7	20,094	31,948	29.8	10.8	25.62	36.5	49.3
71	6.95	6,667.8	12,732.0	19,374	22,246	28.7	14.8	25.90	39.2	48.0
72	7.10	6,686.3	13,531.2	17,106	24,395	25.4	8.3	25.90	-	-
72	7.19	6,577.7	12,775.2	15,228	23,359	22.6	6.0	26.18	38.5	42.8
73	7.12	6,384.6	11,676.8	13,970	16,841	20.7	6.4	26.67	40.8	44.7
74	7.21	6,412.9	10,745.2	12,726	18,333	18.9	4.8	26.67	-	-
74	7.25	6,334.0	8,817.0	14,868	17,227	22.1	5.4	27.09	41.8	42.3
75	7.31	6,354.3	9,697.4	11,700	15,778	17.4	3.5	27.72	42.0	44.8
76	7.38	6,279.6	10,255.2	12,036	18,928	17.9	3.4	28.21	43.0	46.9
77	7.48	6,167.5	11,414.1	11,862	17,213	17.6	2.4	28.63	42.7	46.6
78	7.28	6,313.2	11,112.8	11,778	17,955	17.5	3.7	28.77	44.0	45.3
80	7.23	6,447.9	10,580.4	12,042	17,017	17.9	3.9	29.05	45.9	43.4
82	7.23	6,445.3	11,422.5	11,676	16,660	17.3	3.8	29.47	47.4	39.3
84	7.28	6,459.5	11,850.1	12,018	19,747	17.8	3.3	30.17	52.7	36.4
87	7.44	6,374.7	11,660.1	11,962	18,410	17.7	3.6	31.71	62.5	31.2
90	7.52	6,695.4	9,906.0	10,920	18,067	16.2	2.0	34.30	67.4	26.4
93	7.55	6,865.3	8,982.2	10,140	16,688	15.0	3.2	36.89	68.4	26.2
96	7.93	7,088.9	9,207.3	10,816	16,360	16.0	0.8	40.18	69.2	25.0
100	7.72	7,029.2	7,198.9	8,604	14,444	12.8	1.9	45.50	70.3	23.7
103	7.73	7,131.2	6,342.9	8,028	14,920	11.9	2.0	50.19	72.0	24.5
108	7.80	7,528.4	5,133.3	5,832	12,788	8.7	1.1	59.71	68.0	23.4
111	7.93	7,871.7	4,646.1	4,920	12,248	7.3	0.9	66.57	66.4	24.2
117	8.04	7,867.4	3,213.9	3,780	11,892	5.6	0.6	80.15	71.4	23.4
119	8.00	8,059.3	2,968.1	3,070	11,340	4.6	0.9	82.74	71.5	22.6
122	7.91	7,915.9	2,751.5	2,965	12,480	4.4	0.9	89.74	65.7	25.0
127	7.92	8,097.1	2,258.6	2,559	12,048	3.8	1.0	101.36	69.7	25.7
131	8.00	7,883.9	2,113.6	2,453	13,052	3.6	0.8	107.59	69.0	24.6
135	7.88	7,921.0	2,449.1	2,450	4,736	3.6	0.9	116.69	65.4	26.0
139	8.02	8,349.8	1,919.0	1,950	26,632	2.9	0.8	125.44	68.6	25.9
142	7.87	8,013.1	1,867.8	1,880	11,464	2.8	1.3	131.25	67.0	26.3
145	7.89	8,152.8	1,599.0	1,743	9,748	2.6	1.1	135.45	67.3	25.3
149	8.17	8,285.4	1,414.9	1,638	-	2.4	-	139.79	66.5	26.7
157	8.13	7,963.0	1,455.4	1,838	12,052	2.7	0.5	143.08	66.6	24.5
164	8.16	7,958.5	1,325.8	1,560	10,808	2.3	0.5	144.62	62.0	25.3
171	8.10	8,475.1	1,264.8	1,605	8,040	2.4	0.5	145.95	59.2	22.8
178	8.05	8,063.6	1,206.5	1,525	6,880	2.3	0.6	146.37	44.5	21.2
192	8.19	8,193.1	1,174.5	1,792	5,715	2.7	0.4	146.44	36.2	19.8
209	8.14	8,680.4	1,171.1	1,564	6,597	2.3	0.5	146.44	39.3	19.0
210	8.12	9,457.1	2,258.1	1,895	31,610	2.8	0.5	146.51	38.8	18.9

Table A.11 Performance of fixed film reactor of two phase treating food waste (15%TS)

Day	OLR (g COD/l d)	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	TCOD (mg/l)	COD removal (%)	UA (mg/l)	Gas volume (ml)	CH_4 (%)	CO_2 (%)
61	1.0	6.43	10,051.6	33,145.3	37,506	55,391	-	205.2	-	-	-
	EFF	8.10	2,938.5	478.8	0	-	-	0.8	1,960	56.9	23.9
62	1.6	6.45	7,760.7	24,881.5	44,568	46,228	-	167.7	-	-	-
	EFF	8.17	3,277.5	592.2	159	-	99.7	0.7	5,250	68.2	20.8
63	2.1	6.52	9,124.2	28,750.7	42,528	-	-	143.0	-	-	-
	EFF	8.03	3,584.8	1,171.2	848	-	98.4	0.9	6,090	69.8	20.8
64	1.9	6.53	8,661.7	26,865.5	36,972	43,477	-	82.8	-	-	-
	EFF	7.87	4,070.2	993.6	451	3,434	99.0	1.5	5,810	70.4	19.4
65	3.2	6.55	8,215.0	25,365.3	34,512	42,322	-	73.2	-	-	-
	EFF	7.85	4,300.1	644.0	607	1,570	98.6	1.4	9,450	71.4	18.3
66	2.6	6.70	7,897.9	22,587.3	32,034	38,682	-	32.9	-	-	-
	EFF	7.93	4,868.2	1,060.7	864	1,715	97.8	1.1	7,140	70.5	19.5
67	2.4	6.76	7,581.7	20,822.7	28,476	35,700	-	24.9	-	-	-
	EFF	8.03	5,177.2	896.8	899	1,808	97.5	0.9	6,510	71.4	18.5
68	2.7	6.89	7,247.0	18,603.1	24,900	30,744	-	16.3	-	-	-
	EFF	7.96	5,563.3	1,728.0	1,705	2,603	94.5	1.3	6,160	71.7	20.0
69	3.1	6.89	7,131.2	14,687.6	21,126	30,457	-	16.2	-	-	-
	EFF	8.01	5,756.4	2,321.0	2,742	3,671	91.0	1.2	5,320	69.2	19.4
70	3.0	7.16	6,899.5	14,895.7	20,094	31,948	-	10.8	-	-	-
	EFF	7.99	5,859.4	2,780.0	2,579	3,723	91.9	1.2	4,690	70.9	19.1
71	3.0	6.95	6,667.8	12,732.0	19,374	22,246	-	14.8	-	-	-
	EFF	7.86	6,686.3	2,545.4	2,261	3,097	89.8	1.5	-	-	-
72	3.0	7.10	6,686.3	13,531.2	17,106	24,395	-	8.3	-	-	-
	EFF	7.98	6,062.8	2,668.5	2,355	3,306	90.3	1.0	4,760	66.7	18.5
72	1.7	7.19	6,577.7	12,775.2	15,228	23,359	-	6.0	-	-	-
	EFF	8.03	6,091.1	2,344.6	2,263	3,137	90.3	0.9	3,710	66.8	17.6
73	1.5	7.12	6,384.6	11,676.8	11,570	16,841	-	6.4	-	-	-
	EFF	7.92	6,279.0	1,964.5	2,029	2,784	88.0	1.0	-	-	-
74	2.1	7.21	6,412.9	10,745.2	12,726	18,333	-	4.8	-	-	-
	EFF	7.95	6,231.0	1,998.7	2,068	2,996	88.7	1.0	3,570	71.2	17.9
	1.0	7.25	6,334.0	8,817.0	14,868	17,227	-	5.4	-	-	-
	EFF	8.13	6,277.2	1,823.6	1,726	2,570	90.0	0.6	2,450	66.2	16.3

Table A.12 Individual VFAs of control reactor (FC)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	567.9	604.1	663.8	110.2	663.9
2	220.5	737.2	1,231.9	214.7	1,148.8
7	1,452.2	1,175.0	1,780.7	858.2	1,233.2
11	1,400.7	1,242.6	1,927.8	850.4	1,301.8
14	1,464.2	1,213.7	1,887.0	813.5	1,278.0
17	2,025.4	1,584.6	2,599.9	878.8	1,623.9
25	2,054.0	1,562.5	2,595.7	843.3	1,608.6

Table A.13 Individual VFAs of dilution reactor (F1)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	578.7	588.8	679.8	158.1	721.4
2	378.0	467.6	501.0	209.2	505.8
4	1,029.9	904.0	1,108.1	279.0	1,086.5
7	1,643.8	657.7	1,141.3	252.8	1,297.7
13	1,928.1	823.8	1,041.3	295.1	1,334.6
14	2,021.7	1,378.7	2,071.7	301.9	1,788.2
15	639.7	648.0	716.0	141.7	764.4
18	437.9	353.1	523.7	101.4	504.9
21	428.0	405.9	621.9	139.9	635.5
22	589.6	603.0	631.2	160.8	662.5
23	568.8	602.2	619.9	168.2	668.0
24	521.1	583.2	568.6	180.8	643.4
26	433.7	501.1	477.3	105.6	553.2
28	489.6	561.8	521.0	159.7	610.1
30	549.1	571.2	620.9	119.7	644.7
32	639.7	664.2	716.9	128.4	732.2
33	787.0	756.8	892.6	102.9	855.0
34	756.3	734.5	835.8	114.3	864.3
35	741.2	626.6	804.2	154.0	844.2
37	688.0	531.3	781.0	153.4	744.8
39	551.9	535.5	679.5	155.2	730.6
46	600.3	523.7	803.0	142.6	770.5
51	938.4	691.9	1,044.7	229.9	744.3
67	727.9	657.4	1,029.2	169.9	938.9

Table A.14 Individual VFAs of neutral pH reactor (F2)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	1,084.0	1,376.9	1,150.3	209.5	1,188.9
2	657.5	895.3	656.0	296.3	328.8
3	608.3	869.5	618.8	363.8	340.6
4	564.5	799.8	575.3	324.3	295.6
5	587.1	844.5	603.4	380.3	329.9
7	539.5	709.5	591.6	330.9	291.6
14	578.7	692.5	652.5	335.8	239.9
17	571.1	706.3	671.2	339.7	249.2
24	750.3	930.3	865.1	443.3	215.9
28	667.7	824.9	784.4	384.2	243.8
34	780.8	942.5	908.6	443.7	270.3
39	589.4	476.8	700.0	112.1	280.7
44	507.5	479.1	710.2	112.1	295.7
51	465.7	441.8	631.8	107.3	241.8
67	497.6	459.3	640.4	97.9	251.1

Table A.15 Individual VFAs of neutral pH along with dilution reactor (F3)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	724.1	989.7	768.4	201.5	930.4
2	959.7	1,280.0	985.0	199.9	1,159.8
3	774.3	1,020.9	771.1	161.9	807.9
4	759.5	1,054.5	799.6	181.4	1,056.4
6	738.7	282.6	339.8	150.8	339.9
7	706.7	884.5	853.5	173.0	341.8
9	746.5	239.9	304.3	188.9	337.3
13	788.5	472.9	426.9	197.6	512.3
14	739.6	902.9	899.9	177.8	516.2
15	748.9	841.0	806.5	91.3	505.0
22	266.7	242.3	335.1	85.2	419.4
23	697.6	782.0	715.8	80.3	611.1
24	641.5	751.3	659.5	79.1	573.0
26	249.6	235.2	293.9	76.4	312.9
28	667.1	763.0	686.1	78.3	385.5
30	297.5	249.1	342.4	54.9	354.4
32	320.1	244.1	403.2	81.0	343.0
33	621.3	752.1	701.3	73.8	263.3
34	674.8	801.8	772.8	86.1	338.8
35	247.5	217.5	297.4	74.5	312.3
37	222.1	187.6	252.8	70.1	278.8
39	214.3	172.7	244.5	77.6	275.5
46	220.2	165.4	235.8	64.9	281.7
51	193.3	156.1	243.0	53.3	267.3
67	180.6	132.6	238.8	57.6	257.2

Table A.16 iVFA of stepwise pH reactor (F4) of food waste digestion

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
0	1,593.8	321.3	138.2	58.2	176.7
1	1,747.3	237.4	108.2	67.8	106.5
3	2,772.1	240.8	143.1	58.8	107.2
5	1,105.0	752.9	5,070.9	53.1	105.2
7	2,600.2	7,650.0	9,221.9	31.6	150.3
10	1,278.2	1,223.8	1,628.0	43.6	163.9
11	2,369.2	2,713.0	3,447.2	38.3	213.1
13	3,084.0	3,049.9	3,833.6	45.5	252.2
15	2,941.7	2,844.6	3,522.9	38.7	255.4
17	1,157.9	618.1	1,057.5	51.1	254.3
19	1,410.5	740.4	1,357.5	55.2	315.9
21	1,772.5	991.4	1,856.9	64.4	385.2
25	1,668.3	887.0	1,636.2	71.9	373.9
27	2,036.7	1,070.1	1,934.1	84.5	415.4
29	1,165.2	638.1	1,024.3	58.9	261.6
31	1,794.5	961.2	1,592.1	98.6	372.5
33	2,236.4	1,240.9	2,069.2	110.0	457.0
35	1,394.5	788.7	1,248.7	82.9	322.5
37	1,414.0	797.9	1,277.4	92.5	316.0
39	1,719.1	1,012.1	1,613.2	119.7	372.2
41	1,201.1	724.1	1,076.8	93.2	274.6
44	1,193.7	738.4	1,083.9	96.9	288.6
46	947.2	658.8	924.3	94.3	250.9
54	1,864.7	1,249.9	2,022.5	194.8	451.3
61	2,357.5	1,382.1	2,179.8	212.1	520.9
70	1,754.5	996.5	1,581.6	201.5	407.2
76	1,339.1	776.9	1,108.7	177.8	315.0
84	732.6	437.7	509.6	112.6	189.5
90	635.8	383.9	418.3	105.0	170.5
96	739.9	453.2	517.8	115.7	192.8
100	832.6	507.5	579.8	140.7	219.1
103	933.8	574.8	657.7	160.2	229.3
108	405.9	235.0	214.6	53.0	123.0
111	520.8	315.8	313.9	79.1	152.6
117	431.0	255.1	243.2	61.6	136.4
119	449.2	265.6	261.7	69.4	141.8
122	412.5	248.1	221.1	61.3	136.3
127	445.8	266.9	254.2	69.1	144.0
131	471.5	281.6	274.2	71.0	152.9
135	420.1	253.5	224.7	63.1	139.6
139	461.9	274.6	268.1	73.9	148.9
142	424.2	256.8	238.6	67.7	143.7
145	432.7	262.2	236.6	69.1	144.2
149	468.1	286.9	268.0	78.5	153.4
153	415.8	257.5	224.5	68.7	142.3
157	413.2	255.2	220.6	68.6	143.0
164	380.9	237.4	196.6	63.1	136.9
171	397.1	253.3	209.2	70.6	140.3
178	395.8	252.0	210.9	69.5	143.1
185	421.0	262.8	222.9	78.6	148.0
192	426.1	272.7	231.6	83.3	151.6
200	421.3	270.3	226.1	83.6	150.2
207	440.7	284.1	239.4	91.1	156.9
209	427.9	274.2	229.6	90.7	153.4
210	400.6	257.1	208.4	79.1	146.8

Table A.17 iVFA of acid digester (F5) of two phase food waste digestion

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
0	3,461.3	1,796.2	1,436.2	88.0	109.5
1	1,493.4	269.9	153.5	74.6	-
3	1,976.9	279.0	110.9	98.7	-
5	2,424.7	428.6	151.4	83.6	-
7	1,488.6	1,433.9	4,672.7	52.2	113.3
10	1,664.2	1,925.9	2,481.9	-	188.2
11	2,334.1	2,606.5	4,149.7	29.2	267.2
13	2,928.5	3,112.9	5,408.1	39.6	386.8
15	2,772.7	2,294.0	4,190.6	93.4	515.3
17	3,061.8	1,696.3	3,400.4	76.8	581.2
19	2,805.5	1,316.5	2,886.8	89.7	641.6
21	3,446.8	1,686.2	3,782.8	85.9	755.6
25	2,497.4	1,248.2	2,508.7	107.5	552.6
27	3,543.0	1,826.6	3,684.7	133.1	766.8
29	2,535.5	1,389.8	2,544.0	111.1	512.6
31	2,878.3	1,475.7	2,657.7	134.5	546.4
33	3,567.9	1,890.0	3,504.7	175.0	695.2
35	2,846.5	1,524.2	2,691.7	154.1	558.1
36	2,448.7	1,349.4	2,398.0	150.7	507.0
37	2,490.1	1,315.0	2,428.9	125.0	516.2
38	3,322.0	1,757.2	3,302.4	177.3	661.7
39	2,497.4	1,389.8	2,486.4	158.7	547.3
41	2,191.9	1,214.9	2,162.8	141.7	488.6
42	2,045.5	1,201.3	2,060.1	164.5	463.0
44	2,970.9	1,721.5	3,056.0	211.4	635.4
46	1,874.7	1,058.7	1,834.8	138.5	433.1
49	1,481.8	1,019.5	1,726.5	144.6	409.4
51	1,387.2	945.6	1,595.3	144.1	377.1
54	1,762.7	1,164.8	2,026.5	163.1	464.7
61	3,196.9	1,780.7	2,888.4	279.6	665.3
62	3,941.6	2,212.9	3,735.2	336.8	823.0
63	2,831.0	1,613.1	2,702.7	284.0	607.3
64	1,597.9	896.8	1,427.5	170.9	359.1
65	1,453.6	830.4	1,329.8	159.2	345.0
66	944.1	542.7	782.0	98.0	235.7
67	824.8	481.8	658.3	87.9	210.0
68	733.0	430.9	559.8	76.2	189.6
69	726.2	429.7	559.8	76.5	191.5
70	883.4	518.5	708.6	99.3	223.2
71	759.8	459.2	578.4	91.5	188.4
72	618.8	365.4	417.8	68.3	161.0
72	550.2	329.6	360.8	61.8	148.9
73	506.7	301.0	317.1	56.5	141.7
74	473.3	283.4	288.1	51.6	137.9
74	569.3	343.1	370.9	64.8	151.0
75	439.0	258.4	253.0	47.2	130.4

Table A.17 iVFA of acid digester (F5) of two phase food waste digestion (Cont')

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
76	489.4	287.9	296.1	56.8	138.4
77	431.0	257.0	248.3	49.6	130.6
78	431.3	253.7	245.2	49.6	129.9
80	401.1	236.2	219.7	46.2	125.7
82	395.6	229.1	210.0	45.0	123.1
84	381.5	223.6	202.6	44.1	123.0
87	588.3	347.2	366.8	91.4	157.8
90	407.2	237.2	223.0	52.7	126.7
93	684.4	400.2	429.9	104.8	169.5
96	428.7	253.2	234.2	55.2	131.0
100	599.3	358.8	365.2	97.4	163.7
103	629.6	379.3	379.1	90.0	164.6
108	427.2	254.2	237.4	55.6	134.9
111	452.0	266.4	258.4	62.7	138.4
117	410.4	243.4	223.6	57.0	132.5
119	508.6	297.5	305.7	76.3	152.6
122	433.3	257.5	244.4	63.2	139.2
127	484.3	282.8	294.2	76.1	154.8
131	486.3	306.0	292.5	79.5	152.6
135	414.5	247.7	226.1	60.7	138.2
139	490.7	282.8	280.5	75.3	153.8
142	556.2	322.0	339.0	89.9	171.5
145	511.0	303.1	293.9	83.3	159.3
157	373.9	231.9	196.3	58.2	133.5
164	400.7	244.8	209.1	64.8	139.3
171	397.4	243.0	205.4	65.0	139.7
178	395.3	243.7	205.1	66.6	140.7
192	374.0	234.9	193.2	66.2	139.3
209	373.6	237.9	191.0	68.5	140.1
210	353.1	221.7	175.3	59.6	133.7

Table A.18 iVFA of fixed reactor (FF) of two phase market waste digestion

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
61	605.6	372.6	419.4	60.0	156.2
62	556.3	347.1	379.7	54.3	151.5
63	614.3	372.5	410.2	63.1	159.9
64	589.7	351.8	390.1	58.8	153.7
65	645.6	388.6	447.0	69.6	164.9
66	603.2	361.3	398.9	62.3	155.8
67	581.4	347.9	379.2	58.6	156.0
68	567.7	338.8	374.1	56.0	151.6
69	712.3	426.3	509.8	72.8	175.4
70	683.8	412.6	494.1	72.2	173.4
71	697.8	413.4	479.6	77.0	173.0
72	643.7	385.0	437.6	73.7	163.7
72	565.6	341.0	365.2	63.9	149.5
73	549.7	326.7	344.7	61.1	146.5
74	513.6	304.7	315.3	57.6	141.0
74	515.2	309.9	322.6	55.7	141.0
75	458.1	271.8	270.5	51.0	133.2

APPENDIXB

EXPERIMENTAL DATA OF ANAEROBIC MARKET WASTE DIGESTION

Table B.1 Anaerobic digestion of market waste at pH 5

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
5	5.30	835.4	4,381.4	5,500.0	1,429.0	0.0	63.2
9	4.94	948.1	5,645.5	7,500.0	2,365.6	0.0	68.5
12	5.03	1,354.9	7,620.3	10,009.0	2,441.3	8.9	37.5
16	4.88	958.2	7,638.7	10,080.0	3,310.8	5.3	31.3
21	4.87	1,143.2	7,012.4	10,582.7	1,764.6	5.0	28.8
24	5.08	1,741.6	8,874.8	11,285.7	2,232.1	2.0	20.9
40	5.04	1,497.1	8,901.8	12,623.0	2,787.1	4.4	18.6
45	5.11	1,583.6	7,735.6	13,930.0	2,545.4	4.3	18.3
55	4.94	1,107.7	7,307.4	14,270.0	2,972.7	2.4	14.8

Table B.2 Anaerobic digestion of market waste at pH 6

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
5	5.40	2,471.4	9,288.6	9,500.0	2,152.2	0.9	84.2
9	5.84	3,347.2	13,847.6	16,021.0	701.6	11.1	83.0
12	5.64	3,616.8	14,877.8	18,000.0	1,184.1	10.4	71.7
16	5.43	2,777.7	13,958.1	20,500.0	1,472.7	10.7	60.9
21	5.43	3,015.7	13,939.7	19,653.5	1,294.7	7.1	42.2
24	5.54	3,930.4	13,986.3	20,409.5	1,145.0	6.7	41.9
40	5.63	3,301.2	14,073.3	16,890.0	1,452.2	3.8	25.6
45	6.05	3,597.4	13,838.5	18,170.0	357.8	4.0	26.1
55	6.11	3,184.7	13,183.9	17,530.0	421.0	9.2	29.5

Remark : Incomplete pH adjustment for pH 6 during day 0-24

Table B.3 Anaerobic digestion of market waste at pH 7

Day	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
5	5.54	2,541.0	10,427.8	13,000.0	1,051.2	0.7	93.4
9	6.38	6,462.2	15,685.0	16,035.0	201.4	3.7	89.6
12	6.39	5,121.0	19,906.2	20,000.0	195.3	7.0	54.6
16	6.45	4,676.0	17,221.9	21,000.0	131.4	6.0	45.3
21	6.58	5,164.2	16,636.8	21,165.4	93.7	5.3	34.5
24	6.69	6,825.2	18,659.9	26,456.7	133.6	4.0	28.9
40	7.19	5,297.3	17,464.5	26,234.0	35.2	2.2	17.2
45	6.76	5,063.7	15,110.1	26,352.0	71.9	3.0	14.6
55	7.18	5,499.0	13,150.0	25,200.0	25.8	33.7	14.7

Remark : Incomplete pH adjustment for pH 7 during day 0-24

Table B.4 iVFA of market waste at different pH

pH	Day	Concentration (mg/l)				
		AA	PA	BA	iBA	VA
5	5	1,156.7	1,078.3	1,125.5	937.3	1,532.0
	9	1,586.4	1,357.6	1,678.1	210.4	719.1
	12	2,165.7	1,260.6	2,222.8	235.0	633.4
	16	2,337.4	1,481.8	2,213.1	241.6	955.4
	21	1,192.4	763.8	1,316.4	169.6	354.4
	24	1,731.3	1,181.9	1,337.4	544.9	1,627.4
	40	2,539.5	1,277.5	2,711.4	245.2	787.4
	45	2,598.3	1,179.7	2,789.9	202.0	908.8
	55	2,245.6	1,208.3	2,591.6	272.6	687.8
6	5	2,333.9	1,928.4	1,963.7	1,530.2	2,770.9
	9	2,394.9	1,876.4	2,371.5	564.8	990.4
	12	2,917.4	1,961.8	3,059.3	415.8	836.2
	16	2,363.6	1,654.2	2,189.0	331.1	1,094.0
	21	2,135.4	1,290.5	2,486.0	166.6	625.0
	24	2,080.5	1,347.4	1,566.7	538.7	1,814.3
	40	3,684.6	1,979.6	3,901.9	395.7	1,137.5
	45	1,983.2	1,109.9	2,596.9	189.8	701.8
	55	2,859.0	1,619.1	3,146.9	373.6	844.2
7	5	1,620.0	1,289.2	1,317.0	829.9	1,648.0
	9	2,192.9	1,729.2	2,179.8	633.2	919.8
	12	2,360.3	1,578.9	2,565.8	396.2	708.6
	16	1,597.0	1,380.1	1,672.7	432.1	750.2
	21	1,766.9	1,044.0	2,099.5	156.9	551.0
	24	2,989.1	1,846.5	2,180.4	734.8	2,613.4
	40	2,817.6	1,491.5	3,011.3	293.7	899.0
	45	2,085.8	1,062.8	2,434.9	232.2	688.0
	55	1,965.7	1,120.4	2,212.5	220.1	566.3

Remark : Incomplete pH adjustment for pH 6 and 7 during day 0-24

Table B.5 Performance of control reactor (MC)

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	4.97	1,133.1	10,709.2	25,684	-	-	-
1	4.62	954.7	10,862.2	23,032	5,306.1	0	82.9
3	4.11	385.7	12,811.6	22,312	9,776.1	0	70.7
5	4.09	190.3	13,822.4	25,308	-	0	86.3
7	4.05	83.1	13,592.8	25,816	9,662.6	0	85.6
9	4.11	210.3	13,661.3	23,408	-	0	82.0
11	4.32	863.3	17,737.6	25,564	11,967.8	0	85.4
13	5.02	2,127.1	19,951.4	27,588	-	0.5	72.6
16	5.23	2,718.1	17,246.2	32,444	-	0.7	54.2
17	5.14	2,492.6	15,467.9	30,075	3,748.0	0.6	54.4
19	5.06	2,790.7	15,440.4	26,160	-	0.6	40.9
21	5.02	2,402.6	15,652.6	30,435	-	0.6	31.1
23	4.95	2,758.0	15,317.0	30,940	5,171.5	0.8	34.5
25	4.98	2,831.4	15,496.5	31,330	-	1.0	39.1
27	4.96	2,357.1	15,012.2	29,545	4,934.4	1.9	33.0
29	4.95	2,736.9	14,615.6	-	-	2.6	35.2
31	4.99	2,913.4	17,127.9	27,822	-	4.1	30.5
33	4.94	2,587.7	17,374.1	29,575	6,871.8	4.6	26.0
39	4.85	2,981.1	18,352.2	31,455	8,345.6	7.4	24.5
47	5.18	3,384.5	18,668.8	31,304	5,426.5	13.1	28.3
55	5.09	3,246.1	21,819.9	28,100	6,341.7	14.5	28.0
63	4.99	3,001.4	22,123.2	28,292	7,156.9	14.7	27.4
73	4.94	3,019.0	23,466.5	30,580	7,731.1	8.1	19.8
79	4.91	2,471.0	22,484.9	32,468	-	7.6	18.1
87	4.94	3,305.7	25,991.8	33,596	7,679.1	7.6	14.7
96	4.97	2,396.5	28,620.7	35,016	6,919.7	8.3	11.9
103	5.20	2,261.1	23,975.4	30,535	4,955.0	10.1	12.4
115	4.99	2,608.1	25,893.3	33,780	-	9.3	10.3
119	4.72	2,981.8	28,061.9	35,160	-	7.6	8.9

TableB.6 Performance of dilution reactor (M1)

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	4.74	402.0	9,366.3	18,592	1,241.7	-	-
1	4.59	678.3	11,528.5	24,984	1,542.3	0.3	82.1
3	4.40	651.1	13,879.5	23,448	2,131.7	0.2	61.7
5	4.49	1,268.4	18,564.9	26,752	2,152.9	0.2	79.7
7	4.60	1,458.5	17,916.4	28,808	3,419.4	0.2	89.0
9	4.86	1,563.1	18,159.2	24,112	2,154.7	0.0	62.9
11	4.89	2,050.3	18,000.1	26,216	3,763.1	0.0	65.3
13	5.66	3,323.2	16,313.5	28,732	-	0.0	84.5
16	5.38	3,303.1	19,580.6	29,644	1,813.3	0.9	81.3
17	5.24	3,181.9	17,706.3	29,180	-	1.8	63.2
19	5.12	2,788.1	19,506.9	25,800	3,723.7	5.1	52.8
21	5.25	3,094.0	17,826.9	27,715	-	11.3	48.0
23	5.00	3,105.5	19,505.6	28,110	5,350.5	16.2	48.9
24	5.11	3,192.6	24,339.5	29,845	-	-	-
25	4.98	3,470.2	19,349.4	25,165	528.5	18.0	50.2
26	5.10	3,126.3	18,768.3	25,963	-	-	-
27	4.95	2,640.0	19,444.8	26,628	868.5	19.7	47.7
29	4.96	3,080.6	22,225.1	27,912	-	20.8	45.5
31	5.04	2,563.1	22,700.3	26,404	1,456.5	21.0	42.9
33	4.94	2,600.2	19,921.7	27,140	-	23.8	39.8
35	4.99	3,162.9	16,659.0	27,770	1,869.4	21.5	35.4
36	5.02	2,891.1	16,059.9	27,853	2,701.2	-	-
37	4.95	3,721.5	17,393.9	27,700	3,503.5	17.6	30.3
39	4.94	2,928.3	16,791.9	26,530	-	16.2	30.2
41	4.91	2,704.2	19,444.2	27,485	4,377.7	13.7	28.9
43	4.95	2,664.1	19,245.8	28,022	-	13.6	29.2
45	4.92	2,903.8	18,095.2	26,704	2,804.9	13.5	29.2
47	5.19	3,555.8	18,715.9	28,236	-	15.0	31.1
49	5.16	2,563.5	16,983.7	26,292	3,226.0	15.8	32.1
50	4.97	3,356.4	16,710.4	27,616	1,543.6	-	-
51	5.10	3,309.4	17,736.5	27,936	343.4	15.6	28.3
53	5.05	2,920.5	17,565.8	28,624	-	17.6	30.5
55	5.06	3,007.2	19,373.2	23,235	-	18.5	31.2
57	5.04	3,069.7	20,180.4	21,220	426.6	16.2	29.5
59	5.03	2,557.2	21,757.3	22,760	-	15.9	28.5
61	5.09	2,950.5	20,356.8	25,540	358.1	15.4	28.3
63	5.02	2,815.3	19,477.4	26,220	-	16.1	30.2
68	5.20	2,478.9	14,986.6	22,260	-	17.2	32.7
70	4.96	2,665.4	17,967.8	22,128	435.6	16.4	31.7
71	4.94	2,748.8	18,498.0	23,364	425.3	-	-
73	5.06	1,880.1	20,665.1	23,340	406.9	17.3	32.8
75	4.62	2,491.4	20,374.5	24,180	-	-	-
77	4.95	2,483.5	22,002.6	24,204	447.0	-	-
78	4.74	1,831.4	20,081.9	24,588	-	-	-
79	4.96	2,749.5	24,609.4	25,408	535.6	20.7	34.9
81	4.64	2,860.8	21,483.4	23,100	-	21.3	34.4

Table B.6 Performance of dilution reactor (M1) (Cont')

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
82	4.70	1,813.0	20,120.3	23,408	-	-	-
83	4.93	2,351.6	17,733.2	23,305	500.4	21.4	32.5
84	4.96	2,436.7	17,595.0	24,141	637.6	-	-
85	4.95	2,031.2	18,025.6	24,700	-	-	-
87	4.87	2,002.8	17,772.9	22,960	615.3	24.2	33.3
89	4.98	1,560.1	16,741.8	24,608	-	24.8	32.7
91	4.91	2,121.0	19,134.2	24,008	551.7	25.6	32.9
93	4.91	2,524.1	19,491.6	23,016	-	-	-
94	4.87	2,204.9	19,894.7	23,344	442.9	-	-
96	4.87	2,204.8	18,241.1	23,744	-	23.1	27.8
97	4.39	2,421.0	21,188.7	22,204	1,062.6	-	-
98	4.81	2,206.3	18,024.3	23,648	-	-	-
101	4.53	2,223.3	17,722.2	22,432	-	26.8	28.5
103	4.92	2,098.3	24,387.7	27,280	456.3	-	-
104	4.92	2,098.9	25,024.5	27,705	-	-	-
106	4.85	2,431.4	25,642.0	26,320	472.7	-	-
108	4.84	2,425.4	22,068.4	22,116	-	28.3	27.3
109	4.82	2,453.0	21,613.7	22,164	474.7	-	-
115	5.01	2,149.7	20,516.4	24,296	-	-	-
119	4.80	2,424.2	21,337.3	21,654	-	31.8	27.8

Table B.7 Performance of neutral pH reactor (M2)

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	5.06	1,118.0	11,394.0	24,732	-	-	-
1	4.79	1,218.5	11,457.1	24,584	1,154.3	0.2	82.7
3	4.30	651.1	11,983.0	23,948	2,081.4	0.2	75.1
5	4.27	583.5	15,591.2	26,940	-	0.2	72.2
7	5.16	2,599.5	16,906.6	27,180	1,243.5	0.0	94.4
9	5.49	3,098.4	15,826.3	27,596	1,119.0	0.0	88.4
11	6.41	5,050.8	18,006.8	31,556	88.6	0.0	91.2
13	6.51	7,369.6	20,819.0	34,924	68.5	0.0	93.5
16	6.32	12,645.5	29,647.9	36,400	98.5	2.4	94.1
17	7.03	13,963.6	29,217.4	38,090	22.5	5.3	94.3
19	6.98	16,549.4	29,102.8	36,685	16.6	9.0	90.8
21	6.72	17,741.9	29,089.4	37,515	-	8.1	80.7
23	6.80	20,429.9	28,331.0	40,045	24.2	8.2	82.9
25	7.17	23,222.5	29,855.8	39,350	-	6.2	76.3
27	6.69	24,029.2	30,764.0	38,610	-	5.8	84.3
29	6.61	25,688.6	32,151.0	40,465	37.0	6.7	75.9
31	6.52	30,901.1	36,193.9	38,407	-	6.6	73.9
33	7.09	32,652.4	38,727.8	38,950	-	5.9	69.5
35	6.48	34,417.1	40,105.4	41,610	64.9	4.5	60.1
37	6.57	34,337.2	39,531.6	41,382	-	4.9	57.3
39	6.92	36,590.8	40,652.3	42,702	-	5.7	54.9
41	6.83	33,962.5	38,951.4	40,180	27.0	4.6	53.7
43	7.06	41,479.4	41,129.5	43,290	-	4.6	47.5
45	6.53	42,823.4	41,125.5	43,668	-	4.6	37.0
47	7.31	39,071.3	41,635.7	44,064	13.7	4.2	38.1
49	6.66	38,972.3	42,122.2	44,868	-	4.8	44.7
51	7.23	37,503.1	41,533.8	43,668	9.1	4.6	38.4
53	7.30	37,883.7	40,154.8	45,255	-	5.8	47.9
55	7.24	38,475.5	35,842.1	39,522	-	4.7	35.3
57	7.22	40,174.0	34,973.5	38,994	10.4	6.3	48.5
59	7.47	38,824.4	35,201.2	41,160	-	5.9	44.2
61	7.17	36,156.5	33,866.2	44,236	-	6.0	44.2
63	7.21	37,331.0	37,504.1	46,160	10.1	6.9	45.0
68	7.16	37,893.8	38,710.5	46,400	11.8	7.2	43.9
73	6.65	35,725.0	33,192.2	46,614	37.0	8.5	48.9
77	7.03	36,988.9	42,669.7	46,712	16.5	-	-
79	7.02	35,869.7	39,390.6	46,392	15.7	8.0	40.8
85	6.73	35,057.5	38,822.9	42,774	-	9.1	40.0
91	6.70	35,266.2	41,029.4	43,062	33.9	8.0	37.6
97	6.61	40,920.0	38,353.8	42,331	41.7	6.5	29.3
103	6.55	34,623.8	40,415.4	40,644	49.6	6.9	30.1
115	6.72	35,635.8	41,639.3	42,732	-	7.2	30.4
119	6.55	35,477.9	41,674.7	42,024	-	7.3	28.3

Table B.8 Performance of neutral pH along with dilution reactor (M3)

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
0	4.68	703.5	8,159.4	30,408	4,020.7	-	-
1	4.48	590.4	11,525.1	29,032	7,346.1	0.5	80.9
3	4.29	849.6	12,866.9	28,428	-	0.3	77.6
5	4.69	1,293.8	17,471.3	26,804	9,425.8	0.2	89.5
7	4.89	3,375.4	16,538.7	28,460	6,989.1	0.3	93.0
9	5.50	3,265.4	16,702.4	27,552	2,828.7	1.3	98.4
11	6.51	5,475.8	17,515.5	32,312	143.6	2.3	86.7
13	6.43	9,183.9	20,098.8	32,720	148.5	6.9	82.3
16	6.34	12,283.1	28,043.2	36,836	158.4	14.0	76.9
17	7.04	13,798.2	26,405.1	36,695	28.7	15.2	84.3
19	6.81	15,401.4	26,821.5	36,420	39.0	15.3	79.8
21	6.74	17,138.6	27,685.2	37,395	44.3	13.3	73.8
23	6.78	19,137.7	27,966.7	38,700	31.0	14.7	76.9
25	6.64	22,570.1	28,206.0	38,160	49.2	14.0	81.0
27	6.65	24,802.4	32,539.1	37,540	-	10.6	75.7
29	6.63	27,649.0	35,369.1	40,600	56.9	10.3	71.1
31	6.49	31,601.7	34,827.7	38,341	-	9.3	69.6
33	7.10	32,739.9	38,503.3	39,125	-	8.5	67.6
35	6.45	35,263.4	40,136.3	40,232	82.7	7.0	60.3
37	6.62	35,100.2	37,348.8	41,190	-	7.4	59.9
39	6.51	36,142.3	35,558.3	40,950	-	7.5	54.4
41	6.48	37,683.4	42,240.1	43,875	71.1	7.4	54.8
43	7.02	36,466.2	44,304.0	44,700	-	6.8	47.6
45	6.60	39,930.4	41,892.9	42,620	-	6.9	46.6
47	6.79	39,735.3	43,155.1	45,672	41.7	7.6	47.4
49	7.20	42,602.6	42,909.4	44,774	-	7.9	45.6
51	6.64	39,482.2	33,582.4	41,920	-	6.9	39.2
53	7.28	35,833.5	32,455.3	41,495	8.6	5.5	31.0
54	6.56	35,573.1	27,953.7	33,828	45.1	-	-
55	6.84	37,379.9	31,037.3	40,890	12.1	5.7	36.5
57	7.23	40,064.3	33,594.7	38,532	-	5.8	40.7
59	7.32	38,947.3	34,004.7	40,692	-	5.7	41.2
61	6.73	36,725.0	36,848.1	40,134	35.2	5.4	40.0
63	7.23	34,369.3	32,930.1	40,884	12.0	5.5	39.5
68	6.74	36,085.8	34,031.1	39,210	34.2	5.5	39.3
70	6.72	37,920.6	28,822.3	38,706	33.6	4.4	32.3
71	6.80	36,750.2	32,733.5	40,914	30.0	-	-
73	7.19	37,300.3	37,790.5	40,680	13.4	4.5	37.8
75	7.16	35,749.2	32,491.8	39,066	-	-	-
77	7.00	35,469.1	35,761.5	39,240	21.1	-	-
78	6.95	36,586.6	39,413.7	41,523	-	-	-
79	6.66	37,824.7	38,137.2	40,774	34.3	2.4	28.2
81	6.88	40,249.7	32,906.0	40,952	-	2.3	33.7
82	6.97	37,427.6	34,167.5	41,950	-	-	-
83	6.97	36,760.8	34,557.8	38,326	18.3	2.3	31.3
84	6.64	37,621.3	34,266.8	35,629	39.4	-	-

Table B.8 Performance of neutral pH along with dilution reactor (M3) (Cont')

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	UA (mg/l)	CH_4 (%)	CO_2 (%)
85	6.61	35,024.9	32,340.1	37,060	-	-	-
87	6.93	35,756.3	32,656.5	36,040	19.3	3.4	37.2
89	6.97	36,240.5	34,568.4	40,530	-	3.3	34.9
91	7.18	37,441.2	35,382.2	36,280	11.5	3.4	35.8
93	6.68	39,144.7	35,961.8	36,600	41.1	-	-
94	6.59	36,826.8	37,271.0	38,555	-	3.4	35.2
96	7.08	37,328.7	35,049.5	38,030	16.1	-	-
103	6.54	40,677.9	33,152.1	36,625	53.7	3.7	34.3
104	7.06	38,783.3	34,070.1	35,155	-	3.7	30.8
119	6.61	41,710.5	32,350.7	37,338	-	3.7	26.6

Table B.9 Performance of one phase system of market waste (M4)

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	TCOD (mg/l)	UA (mg/l)	Cum. gas vol. (l)	CH_4 (%)	CO_2 (%)
1	4.58	1,001.3	7,690.6	23,702	23,930	4,323.0	0.28	4.6	51.7
2	4.49	920.8	8,464.0	20,300	-	-	0.63	-	-
3	5.60	2,837.3	10,137.4	19,329	-	1,151.4	1.12	3.9	41.5
4	7.18	4,507.5	11,079.1	21,393	-	-	1.12	-	-
5	6.96	4,494.3	13,412.9	26,420	-	57.2	1.12	3.8	47.3
6	5.88	4,547.2	14,654.1	25,552	-	-	1.12	-	-
7	5.68	4,646.6	15,077.6	25,404	-	905.8	1.12	6.9	58.2
8	5.50	4,750.6	17,206.4	27,064	-	-	1.12	-	-
10	5.53	3,882.8	16,671.9	27,080	-	1,017.0	1.12	10.7	59.7
11	5.41	4,838.8	17,546.1	25,752	-	1,718.1	1.12	10.3	55.2
12	5.77	5,601.9	16,566.3	29,728	-	-	1.26	-	-
13	5.79	5,359.9	19,246.8	29,300	-	833.5	1.26	8.9	58.0
14	5.83	5,643.3	19,989.4	29,832	-	-	1.26	-	-
15	5.91	5,736.3	17,449.6	29,524	-	1,082.9	1.26	9.1	60.4
16	6.01	6,120.5	20,648.8	32,508	-	-	1.26	-	-
17	5.98	6,002.0	19,355.8	31,090	-	422.4	1.26	10.6	57.3
19	6.02	5,850.8	17,669.2	28,965	-	577.6	1.26	12.1	54.9
21	6.03	5,941.4	19,863.3	27,175	-	932.7	1.26	14.1	57.9
24	6.20	6,279.9	19,949.3	28,190	-	-	1.26	17.4	60.4
25	6.45	6,624.8	20,553.8	28,336	-	80.5	1.26	18.7	60.5
27	6.36	6,770.6	21,571.4	30,292	-	163.9	1.26	22.5	57.4
29	6.37	6,842.3	22,430.5	29,540	-	128.2	1.26	24.8	55.7
31	7.25	6,922.3	21,659.0	30,764	-	9.5	1.26	27.3	52.7
33	7.46	7,190.7	21,271.4	29,156	-	9.7	1.26	38.6	48.2
35	7.41	7,265.8	22,211.8	27,216	-	6.3	1.33	47.4	40.2
37	7.32	7,310.5	17,519.5	27,600	-	6.2	1.68	54.0	32.4
39	8.03	7,490.6	20,356.4	26,064	-	1.9	1.68	56.6	29.3
41	7.84	7,505.1	19,132.6	26,724	-	2.0	1.68	54.9	27.3
44	7.68	7,502.9	19,579.2	30,648	-	2.9	1.75	55.0	29.8
46	7.53	6,847.2	18,258.5	27,028	-	3.9	1.82	56.3	28.9
54	7.82	6,787.2	19,895.2	25,092	-	2.7	2.10	58.9	30.9
61	7.74	7,027.1	20,168.9	23,116	-	4.9	2.17	59.9	28.3
70	7.21	4,057.3	19,882.3	24,380	-	9.8	2.80	60.6	28.1
76	7.60	7,488.3	19,099.8	22,692	38,700	2.1	5.25	62.2	19.9
84	7.77	7,569.0	14,926.2	16,836	47,052	1.2	12.32	71.3	18.9
90	7.71	8,007.6	11,039.5	12,832	56,058	1.3	16.24	70.5	18.7
96	7.99	8,257.4	10,394.8	11,148	31,674	0.7	18.97	69.9	21.7
103	7.91	8,469.9	6,631.2	8,080	47,490	0.9	22.05	69.7	19.8
111	8.13	8,323.4	3,330.5	6,580	32,100	0.5	23.24	59.6	18.7
117	8.08	7,957.5	1,997.6	3,224	12,384	0.6	23.24	51.2	17.4
122	8.00	7,472.7	1,099.3	2,375	7,910	0.8	23.24	52.3	19.9
127	8.16	7,612.6	1,308.9	2,159	5,180	0.6	23.24	46.5	19.3
131	8.09	7,648.7	1,392.9	2,047	3,785	0.6	23.38	44.7	19.2
157	8.25	7,358.2	1,242.1	1,854	7,826	0.4	23.45	32.0	15.8
209	8.10	7,570.1	1,072.4	1,412	2,661	0.5	23.45	26.4	17.3

Table B.10 Performance of acid digester of two phase system of market waste (M5)

Day	pH	Alkalinity ($mgCaCO_3/l$)	TVA (mgHAc/l)	SCOD (mg/l)	TCOD (mg/l)	UA (mg/l)	Cum. gas vol. (l)	CH_4 (%)	CO_2 (%)
1	4.64	1,055.9	7,626.6	22,974	26,160	3,125.8	0.21	4.6	57.5
2	4.54	984.0	8,261.5	20,076	-	-	1.61	4.6	
3	5.49	2,220.1	8,985.1	19,989	-	1,381.9	9.66	3.8	41.3
4	6.30	4,145.5	9,779.0	24,792	-	-	12.39	3.8	
5	6.09	4,081.5	12,081.8	24,890	-	563.0	12.67	3.8	40.4
6	6.37	4,373.7	14,795.5	25,044	-	-	12.67	-	-
7	5.74	4,452.5	15,451.2	25,872	-	971.8	12.81	8.1	37.5
8	5.62	4,469.6	16,190.3	27,228	-	-	12.81	-	-
10	5.56	3,683.4	16,335.7	27,516	-	707.5	12.88	15.5	59.9
11	5.47	4,538.8	16,173.2	25,956	-	1,621.0	12.88	16.2	58.3
12	5.56	4,455.7	17,311.0	26,440	33,180	1,374.6	12.88	-	-
13	5.67	4,161.7	15,101.4	25,896	-	1,043.2	13.02	15.1	53.3
14	5.68	4,232.5	14,428.4	24,960	31,323	1,158.6	13.02	-	-
15	5.75	4,086.3	14,673.2	23,236	24,430	1,235.4	13.23	13.8	53.4
16	5.90	3,681.0	11,943.9	20,972	35,175	362.6	13.30	13.8	-
17	6.12	3,606.3	9,764.9	19,672	25,240	281.3	13.30	13.4	51.0
19	6.06	2,467.5	11,408.1	16,720	16,345	120.7	13.30	15.3	47.8
20	6.83	3,008.8	9,463.5	14,760	20,028	34.5	13.30	21.1	-
21	7.90	2,685.2	7,557.4	12,365	14,015	3.1	13.79	21.1	53.7
22	6.90	2,640.8	6,962.6	10,405	-	9.9	14.14	22.5	-
23	7.03	2,680.3	7,019.7	10,800	12,040	-	14.49	22.5	46.4
24	7.58	2,724.6	4,349.7	7,096	9,596	2.3	14.70	29.2	45.6
25	7.85	2,384.4	3,878.3	5,840	-	1.3	14.77	33.0	44.9
27	8.01	2,822.5	4,159.5	5,456	-	1.1	15.12	38.4	36.1
29	7.80	2,946.0	4,250.8	4,729	-	1.9	16.03	48.1	33.9
31	7.93	2,791.1	3,593.2	4,050	-	0.9	16.94	53.7	30.5
33	7.97	2,762.0	2,818.7	3,027	-	1.0	18.20	60.5	27.9
35	7.79	2,729.7	1,691.4	1,885	-	1.7	19.32	63.5	24.8
37	8.03	2,819.8	1,183.1	1,531	-	1.0	20.09	61.1	23.0
39	7.40	2,772.5	1,049.7	1,221	-	4.3	20.44	63.6	23.7
41	7.90	2,927.9	1,094.3	1,232	-	1.5	20.44	57.1	21.1
44	8.04	2,943.4	1,079.7	1,158	-	0.9	20.44	63.0	23.3
46	8.04	2,793.1	954.0	1,023	-	0.9	20.44	57.7	21.6
54	7.81	2,789.7	828.9	908	-	1.6	20.44	59.0	22.5
61	7.82	3,001.3	762.9	843	-	1.7	20.44	53.3	21.0
70	8.01	4,507.8	702.9	787	-	1.1	20.44	57.8	23.2
76	7.93	3,051.2	627.2	716	8,796	0.7	20.44	56.3	22.9
84	7.86	3,093.7	538.5	656	2,914	0.8	20.44	58.2	24.4
90	7.90	2,787.6	348.3	620	1,451	0.7	20.44	57.3	24.4
96	7.89	2,833.0	738.9	1,074	2,554	1.0	20.44	57.6	24.1
103	7.97	2,860.2	523.0	720	3,629	0.7	20.44	39.2	22.3
117	7.65	2,911.7	150.5	626	1,477	1.5	20.44	42.4	21.9
127	7.98	3,017.6	486.2	594	1,095	0.8	20.44	21.8	18.6
131	7.73	2,969.5	149.2	556	1,040	1.3	20.44	12.9	15.9
209	8.04	2,935.4	146.2	628	1,285	0.4	20.44	4.8	8.9

Table B.11 Performance of fixed film reactor of two phase system treating market waste

Day	OLR (g COD/l d)	pH	Alkalinity (mg $CaCO_3$/l)	TVA (mg HAc/l)	SCOD (mg/l)	TCOD (mg/l)	COD removal (%)	UA (mg/l)	Gas vol. (ml)	CH_4 (%)	CO_2 (%)
12	1.18	5.56	4,455.7	17,311.0	26,440	33,180	-	1,374.6	350	-	-
	EFF	7.80	1,872.3	480.4	315	-	99.1	1.6	1,400	61.4	26.7
14	1.26	5.65	4,360.8	12,240.8	21,840	24,268	-	1,158.6	70	-	-
	EFF	7.82	3,944.5	4,189.9	3,477	-	85.7	1.6	7,700	63.1	24.4
15	1.75	5.75	4,086.3	14,673.2	23,236	24,430	-	1,235.4	-	-	-
	EFF	7.65	2,563.2	593.8	1,385	-	94.3	142.0	7,140	-	-
16	3.80	5.90	3,681.0	11,943.9	20,972	35,176	-	362.6	-	-	-
	EFF	8.03	2,679.0	615.3	857	-	97.6	1.0	4,760	69.2	20.4
19	1.04	6.06	2467.5	11,408.1	16,720	16,345	-	0.5	-	60.4	15.8
	EFF	7.82	1,588.3	128.2	220	-	98.7	1.2	910	-	-
20	2.17	6.83	3,008.8	9,463.5	14,670	20,028	-	-	-	-	-
	EFF	7.71	2,660.6	541.7	1,420	-	92.9	1.8	5,110	74.3	22.3
21	1.31	7.9	2,685.2	7,557.4	12,365	14,015	-	-	-	-	-
	EFF	8.00	2303.1	505.5	536	-	96.2	0.9	3,640	-	-
	EFF	7.92	2,690.1	192.3	226	-	98.4	1.0	0	-	-
23	1.52	7.03	2,680.3	7,019.7	10,080	12,040	-	-	-	-	-
	EFF	7.97	2,529.1	695.6	655	-	94.6	0.9	3,850	66.7	18.9
24	0.99	7.58	2,724.6	4,349.7	7,096	9,596	-	-	-	-	-
	EFF	8.17	2,570.5	577.8	590	-	93.9	0.5	2,450	66.8	18.6

Table B.12 Individual VFAs of control reactor (MC)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	1,866.4	1,722.5	2,225.7	946.9	1,084.9
3	2,610.9	2,445.9	3,250.8	630.8	1,116.1
7	2,500.7	2,428.4	3,357.5	529.6	1,009.7
11	3,512.5	3,399.2	4,512.7	636.1	1,512.1
17	2,509.7	2,449.4	3,359.4	488.1	1,172.8
23	2,598.3	2,618.2	3,553.3	510.4	1,201.7
27	2,625.5	2,390.0	3,451.8	481.6	1,181.1
33	3,622.1	3,276.3	4,655.3	649.1	1,573.8
39	3,827.6	3,661.6	5,011.8	669.2	1,724.4
47	3,959.9	3,790.9	5,172.2	736.0	1,782.4
55	3,881.7	3,843.6	5,241.6	866.8	1,820.7
63	3,948.9	3,746.8	5,151.9	707.0	1,767.7
73	4,291.9	3,519.3	5,408.4	632.8	1,729.5
87	4,321.9	3,526.3	5,147.0	643.1	1,770.3
96	4,118.4	3,350.1	5,184.1	80.1	1,686.1
103	4,176.1	3,405.8	5,222.3	90.8	1,699.9

Table B.13 Individual VFAs of dilution reactor (M1)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
0	367.1	473.0	441.7	536.3	465.7
1	416.3	534.1	557.3	456.8	495.5
3	497.2	703.8	747.5	276.0	728.2
5	594.6	725.2	858.2	178.9	820.6
7	1,152.1	1,143.9	1,514.4	421.5	1,289.2
9	916.3	1,058.9	1,171.4	227.9	1,187.5
11	1,525.1	1,772.4	2,356.2	561.6	2,039.5
16	1,678.4	1,780.2	2,436.9	586.4	2,019.6
19	2,310.2	2,376.0	3,188.0	769.2	2,639.9
23	2,760.9	2,873.4	3,946.0	840.7	3,169.8
25	232.7	355.8	312.1	79.4	321.1
27	380.3	539.4	529.3	126.6	478.3
31	824.4	939.3	1,048.2	214.1	887.5
35	992.5	1,090.0	1,290.6	240.5	1,069.9
36	1,536.9	1,604.9	1,990.8	324.3	1,604.7
37	1,774.1	1,868.3	2,337.7	439.2	1,896.8
41	1,796.6	2,076.9	3,344.0	451.8	2,167.4
45	1,302.4	1,415.1	1,833.8	287.3	1,562.4
49	2,309.8	2,237.4	2,962.7	423.5	2,494.5
50	797.1	893.9	1,026.0	180.7	863.2
51	154.8	323.8	206.0	73.3	242.1
57	186.9	383.3	235.1	85.7	245.2
61	159.4	336.9	221.1	69.0	240.4
70	157.4	344.3	216.6	80.6	239.6
71	151.6	321.3	206.2	73.4	235.6
73	188.1	352.7	243.7	73.9	259.4
77	151.8	340.1	229.4	85.7	243.7
79	220.1	388.6	285.7	93.6	292.3
83	189.5	355.4	251.9	92.9	258.7
84	263.3	473.4	345.8	120.2	320.1
87	227.1	396.2	296.6	105.8	284.5
91	219.1	369.4	259.7	100.1	288.0
94	90.3	305.4	220.8	85.1	235.7
97	251.7	435.4	327.1	129.5	316.9
103	164.9	339.7	218.0	76.4	233.9
106	140.1	316.0	200.1	96.3	227.4
109	114.7	308.1	199.0	95.8	231.0

Table B.14 Individual VFAs of neutral pH reactor (M2)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	383.6	460.0	491.1	442.0	466.7
3	414.3	671.6	664.6	298.5	667.3
7	771.1	939.0	1,101.7	204.2	989.0
9	1,364.2	1,579.7	1,720.4	263.4	1,507.6
11	472.7	831.9	1,081.8	225.5	942.0
13	483.9	829.3	1,073.9	124.1	934.5
16	673.0	883.6	768.0	215.4	707.4
17	809.4	868.9	964.1	196.9	887.0
19	513.0	612.5	594.9	158.2	565.5
23	507.0	571.8	594.5	148.9	543.0
29	466.3	543.0	661.4	141.7	534.4
35	656.9	729.3	829.7	185.2	674.5
41	616.9	652.0	760.0	162.4	639.5
47	976.8	1,065.9	1,159.4	242.8	860.5
51	447.7	609.3	639.8	168.0	499.3
57	562.0	677.0	688.6	162.6	550.8
63	524.6	645.6	680.5	152.6	505.3
68	538.4	675.9	710.5	189.4	514.2
73	522.4	655.3	707.7	164.3	511.4
77	580.0	694.6	724.5	184.3	532.9
79	526.7	638.1	682.5	176.3	507.9
91	527.7	684.4	715.6	184.5	517.4
97	499.8	649.8	724.5	206.6	551.9
103	551.3	655.7	757.6	216.5	563.5

Table B.15 Individual VFAs of neutral pH along with dilution reactor (M3)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
0	1,137.2	1,229.1	1,705.2	972.7	1,939.9
1	2,734.3	2,494.8	3,077.4	438.4	2,038.2
5	4,260.3	4,082.1	4,183.7	721.9	3,326.9
7	3,446.8	3,394.8	3,994.7	814.0	3,730.0
9	3,640.0	3,605.0	4,832.5	616.2	3,928.4
11	1,471.4	1,651.1	1,918.5	316.4	1,939.8
13	1,310.8	1,372.0	1,790.4	261.1	1,564.6
16	1,130.5	1,460.6	1,360.1	319.9	1,190.3
17	1,205.9	1,134.2	1,252.9	226.8	1,060.2
19	855.8	1,044.5	1,044.6	188.7	763.9
21	741.1	929.4	1,055.0	185.0	858.9
23	633.2	735.2	736.0	143.3	651.6
25	796.0	776.5	898.4	158.1	731.1
29	858.2	906.6	1,053.4	205.7	762.9
35	825.1	882.3	1,008.0	204.5	744.2
41	782.4	791.7	931.9	182.2	685.3
47	978.3	898.2	1,078.0	187.0	872.6
53	530.5	606.2	706.1	144.0	538.2
54	561.6	619.7	710.2	138.1	529.1
57	701.7	817.8	855.7	188.2	587.7
61	608.5	756.5	807.0	183.6	570.9
63	657.9	831.6	846.3	184.3	615.6
68	619.5	744.4	812.3	168.6	568.4
70	586.8	680.8	742.8	164.6	558.9
71	607.9	729.3	806.7	182.1	599.2
73	647.1	810.1	849.7	199.4	676.5
77	680.3	855.8	865.0	216.9	634.7
79	510.4	622.0	635.4	180.3	483.4
83	552.3	674.1	708.3	185.2	510.3
84	554.8	692.5	727.3	190.7	505.5
87	522.0	638.1	668.9	191.7	517.8
91	550.7	666.2	717.0	186.9	555.5
93	609.0	751.6	853.5	222.9	610.8
96	588.3	701.6	830.8	223.7	632.4
103	581.1	665.8	804.6	252.8	599.4

Table B.16 iVFA of anaerobic one phase market waste digestion (M4)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	4,226.1	813.2	1,521.1	101.3	348.2
3	3,424.6	1,630.5	2,847.9	49.9	390.6
5	2,318.9	1,446.9	3,437.4	121.5	807.9
7	2,252.1	1,328.8	3,169.6	117.4	749.5
10	1,975.7	1,400.4	2,486.9	69.4	405.4
11	2,683.0	1,848.3	3,328.6	94.7	592.1
13	2,929.2	1,796.0	3,305.1	125.6	649.2
15	4,735.9	3,041.1	5,878.4	133.2	910.0
17	2,392.4	1,263.1	2,485.5	79.3	488.7
19	3,570.4	1,722.4	3,728.6	143.3	855.2
21	5,955.2	2,821.8	6,076.0	250.4	1,444.0
25	1,336.9	699.9	1,224.9	60.8	303.0
27	2,166.0	1,128.0	2,126.9	91.3	510.3
29	1,740.6	950.6	1,668.1	87.2	365.3
31	995.3	541.1	823.8	54.4	238.8
33	1,575.3	884.6	1,456.1	86.5	360.0
35	921.9	526.1	781.9	56.0	230.1
37	759.7	432.0	598.9	56.3	194.7
39	1,142.8	649.3	1,004.4	72.0	261.0
41	801.4	470.1	644.4	59.3	201.7
44	805.5	474.0	639.4	63.5	195.7
46	758.4	458.7	594.2	74.6	189.8
54	900.2	609.8	895.3	93.2	243.5
61	1,451.6	903.2	1,337.1	141.1	327.8
70	920.4	520.9	735.0	106.0	210.2
76	490.8	292.0	308.0	57.7	142.5
84	442.2	264.1	254.0	55.5	131.2
90	412.8	245.2	228.7	55.4	126.7
96	437.1	255.3	242.0	57.5	131.2
103	454.9	272.8	257.1	67.2	139.6
111	400.7	233.3	210.9	51.5	130.5
117	458.2	277.8	262.1	66.8	144.1
122	482.7	276.9	269.8	73.2	149.4
127	478.6	286.1	292.1	75.7	156.1
131	464.4	277.7	271.3	24.4	150.6
157	402.4	244.2	210.6	63.6	137.3
209	346.3	217.4	170.0	58.1	132.4
210	334.8	206.8	158.4	52.1	127.9

Table B.17 iVFA of acid digester of two phase market waste digestion (M5)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
1	4,531.1	440.8	275.0	90.6	104.0
3	3,808.6	929.2	3,232.9	73.0	118.3
5	2,777.6	1,528.9	5,786.3	141.9	976.4
7	2,406.9	1,291.6	4,546.3	141.6	814.3
10	1,615.2	912.0	1,779.8	48.0	348.3
11	3,043.9	1,687.9	3,582.2	101.5	642.2
12	3,080.6	1,660.5	3,613.3	112.0	669.8
13	2,966.9	1,535.4	3,391.2	104.3	641.0
14	3,531.0	1,682.8	3,758.5	116.4	729.7
15	4,256.8	2,046.5	4,706.3	153.0	910.6
16	1,751.3	898.8	1,752.0	70.2	383.9
17	2,176.5	1,088.8	2,249.2	74.0	478.5
19	874.9	437.9	729.4	33.5	215.6
20	1,324.2	658.6	1,301.6	48.9	339.4
21	1,370.8	678.3	1,357.2	52.7	349.2
22	483.1	265.1	326.5	25.7	142.9
24	507.5	290.8	378.8	27.5	147.9
25	550.4	318.8	429.1	27.8	156.6
27	638.8	360.1	517.6	29.9	172.2
29	703.8	375.6	537.2	40.1	191.3
31	481.7	275.1	311.7	29.8	138.0
33	533.3	312.5	368.9	32.9	150.0
35	629.7	358.5	427.3	40.1	158.9
37	613.4	359.8	434.1	44.0	159.1
39	629.7	385.2	478.1	45.7	168.0
41	736.1	416.2	535.7	53.7	175.7
44	602.7	361.5	414.9	48.4	156.9
46	560.0	361.2	409.8	51.8	157.2
54	568.4	365.0	421.6	57.1	163.7
61	645.0	395.2	446.7	70.0	168.6
70	640.7	379.3	448.8	66.5	161.1
76	366.7	215.8	192.4	37.0	120.9
84	380.6	219.1	194.5	42.3	121.3
90	354.7	204.1	173.6	39.5	118.4
96	458.7	258.7	255.9	60.5	136.5
103	378.6	218.3	192.7	48.0	123.1
117	415.3	240.8	223.5	55.9	134.6
127	485.0	271.6	274.9	69.9	151.2
131	416.2	236.9	217.8	55.3	136.3
209	291.1	172.0	121.0	34.5	115.4
210	285.1	168.5	117.3	32.0	113.6

Table B.18 iVFA of fixed film reactor of two phase market waste digestion (FF)

Day	Individual VFA (mg/l)				
	AA	PA	BA	iBA	VA
13	586.6	303.5	467.3	28.3	168.8
14	617.2	323.9	520.7	28.0	180.0
15	615.1	320.8	525.2	33.0	180.1
16	740.3	375.6	586.6	30.9	176.5
17	612.7	333.3	499.7	29.5	170.9
19	433.1	233.7	276.7	25.8	138.2
20	472.6	251.5	321.1	24.2	142.8
21	552.1	301.4	408.2	25.7	155.5
22	545.5	290.2	350.5	30.9	144.4
23	492.5	284.1	341.4	27.6	140.1
24	482.3	281.4	333.4	27.9	140.6