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ภาคผนวก

ข้อมูลของการทดลอง

ตารางที่ 1 ข้อมูลการทดลองที่ 1 ของชุดที่ 1

	FEED CHARACTERISTICS							EFFLUENT CHARACTERISTIC						GAS PRODUCTION				
	F.R.	COD_T	O.L	SS	pH	Alk	VFA	COD_T	pH	SS	Alk	VFA	COD reduct	Biogas	CH_4	exp CH_4	theo CH_4	
day	l/d	mg/l	kg COD/m³.d	mg/l		mg/l as $CaCO_3$	mg/l as HAc	mg/l		mg/l	mg/l as $CaCO_3$	mg/l as HAc	%	l/d	%	l/d	l/d	
1	89	817	0.686	30	6.6			75	7.0				90.8	22.7		20.43	27.2	
2		975	8.8.0		9.3			33	7.2	10			96.6	25.2		22.68	29.4	
3		864	0.725	340	9.4			20	7.35	10			97.7	18.9		17.01	26.4	
4		624	0.52	140	9.3			28	7.35	10			95.5	13.7		12.33	18.6	
5		512	0.430	120	9.2	450	137	40	7.5	5	636	216	92.2	9.7		8.73	14.7	
6		1056	0.887	230	8.3	450	39	68	7.45	10	583	78	98.8	14.5		13.05	30.9	
7		1216	1.021	100	8.3	450	98	80	7.2	15	556	59	93.4	15.5		13.95	35.5	
8		648	0.544	85	9.55	450	59	28	7.4	10	662	62	95.7	16.6		14.94	19.4	
9		960	0.806	115	9.4	477	118	20	7.3	15	662	147	97.9	11.2		10.08	29.4	
10		1456	1.222	250	9.0	556	147	76	7.2	20	623	98	94.8	23.1	90.0	20.79	43.1	
11		1200	1.017	180	8.4	490	196	44	7.2	20	623	88	96.3	17.3		15.57	36.1	
12		880	0.739	205	9.5	530	137	44	7.4	20	662	98	95.0	11.7		10.53	26.1	
13		988	0.746	145	9.4	503	78	64	7.0	5	384	20	92.8	0			25.7	
14		544	0.457	90	8.6	411	99	64	7.05	35	424	20	88.2	0.42		0.378	16.0	
15		856	0.719	75	10.2	530	137	84	7.3	5	720	20	90.2	0			14.1	
16		1168	0.951	130	9.35	397	86	94	6.9		623	19	91.9	0			32.7	
17		943	0.782	295	9.1	503	176	36	6.9	10	569	10	96.2	0			28.3	
18		632	0.531	95	9.3	543	19	52	7.5	20	543	19	91.8	0			18.1	
19		1256	1.055	195	9.3	596	137	92	6.85	25	662	39	92.7	52.5		50.85	36.4	
20		1016	0.853	285	9.1	517	98	72	6.85	30	609	39	92.9	29.6		26.64	29.5	
21		880	0.739	190	10.4	874	98	432	8.6	55	821	98	50.9	7.8		7.02	14.0	

ตารางที่ 2 ข้อมูลการทดลองชุดที่ 1

	FEED CHARACTERISTICS							EFFLUENT CHARACTERISTICS						GAS PRODUCTION				
	F.R	COD_T	O.L.	SS	pH	Alk	VFA	COD_T	pH	SS	Alk	VFA	COD reduction	Biogas	CH_4	exp CH_4	theo CH_4	
	l/d												%	l/l	%	l/d	l/d	
1	106	644		46	9.4			100	7.6	68	662		84.5	2.1	89.8	1.89	20.2	
2		1336		55	10.3	543		104	7.5	50	689	180	92.2	6.0		5.39	458	
3		1352		90	7.0	689		114	7.5	40	742	19.6	91.6	6.2	92	5.70	46.1	
4		1144		31	9.2	609	294	88	7.3	54	722	167	92.3	11.0	92	10.12	39.3	
5		1560		70	9.35	609	104	96	7.7	40	583	167	93.8	23	92.4	21.25	54.5	
6		984		19	9.4	583	377	184	7.05	50	477	177	81.3	12	91.0	10.92	29.8	
7		1144		35	9.4	636	471	160	7.3	80	715	309	86.0	14.2	91.0	12.92	36.6	
8		824		30	10.1	662	412	48	7.3	10	662	463	94.2	10.1	91.0	9.19	28.9	
9		1408		23	9.35	662	589	44	7.2	11	689	157	96.9	33.7	91.2	30.73	80.7	
10		1664		26	10.2	795	368	80	7.35		795	294	95.2	43.6	91.0	39.68	58.9	
11		1208		50	9.1	530	157	124	7.2	40	477	88	89.7	22	90.6	19.93	40.3	
12		1832		82	8.8	530	421	108	7.2	11	583	118	94.1	32	90.2	28.86	64.1	
13		952		13	9.6	609	383	112	7.4	8	715	309	88.2	20	90.1	18.02	31.3	
14		952		65	9.8	556	339	124	7.5	10	636	147	86.9	23.1		20.81	30.8	
15		872		28	9.6	662	783	124	7.1	10	662	265	85.8	4	90.0	3.6	27.8	
16		744		70	9.35	636	427	132	7.3	75	689	167	82.3	5.1		4.59	22.8	
17		1296		380	9.6	662	377	124	7.7	20	742	294	90.4	12.6	89.0	11.21	43.6	
18		480		40	9.3	689	397	128	8.0	90	689	294	68.0	3.2		2.85	10.1	
19		1112		500	9.7	689	471	108	7.8	10	742	358	90.3	5	90.0	4.5	27.4	
20		800		130	10.0	583	441	96	7.6	30	742	358	88.0	3		2.7	26.2	
21		904		400	9.1	583	508	88	7.4	10	715	411	90.3	10	92.4	9.24	30.4	
22		808		90	9.2	636	647	84	7.4	10	662	332	89.6	3		2.77	26.9	
23		480		40	10.0	689	441	108	8.05	10	715	782	77.5	2.4	86.8	2.08	13.9	
24		1248		170	9.8	715	573	96	7.2	130	662	447	92.3	45.4	90.0	40.86	42.9	
25		1696		1380	9.4	689	588	136	7.5	40	768	406	91.9	31.4	90.6	28.45	58.0	
26		1360		280	9.8	715	559	108	7.2	10	848	412	92.1	56.8	88.5	50.27	46.6	
27		1320		130	8.9	715	750	91	7.4	80	742	470	93.1	12.4	88.5	10.97	45.7	
28		1186		420	9.6	848	853	84	7.65	50	636	376	92.9	13.7		12.12	41.0	
29		1392		290	7.8	821	720	88	7.6	90	901	426	93.7	9.7	92.0	8.92	46.2	

ตารางที่ 3 ข้อมูลการทดลองชุดที่ 1 (ต่อ)

	FEED CHARACTERISTICS							AFTER ACID					EFFLUENT CHARACTERISTICS						GAS PRODUCTION			
	F.L	COD_T	O.L.	SS	pH	Alk	VFA	COD_f	pH	SS	Alk	VFA	COD_T	pH	SS	Alk	VFA	COD reduct	BIOGH	CH_4	exp CH_4	theo CH_4
	l/d	mg/l	kg COD m³·d	mg/l		mg/l as $CaCO_3$	mg/l as HAc	mg/l		mg/l	mg/l as $CaCO_3$	mg/l as HAc	mg/l		mg/l	mg/l as $CaCO_3$	mg/l as HAc	%	l/d	%	l/d	l/d
30	106	960	0.96	300	9.4	662	617						116	7.3		715	292	87.9	25.9	93	24.09	31.4
31		608	0.608		8.9	662	.670						88	7.4	20	689	338	85.5	8.8	54.6	8.32	19.3
32		821	0.821	170	9.7	662	494						80	7.5	170	636	413	90.3	8.1	95	7.69	27.6
33		1060	1.060	200	9.8	715	605						91	7.2	40	662	362	91.4	44.9	92	41.31	36.1
34		1472	1.472	130	9.3	583	437						181	7.3	150	689	90	87.7	54.9	88.8	48.75	48.0
35		1102	1.102	550	9.6	503	153						90	7.35	80	503	112	91.8	44.9	88	39.51	39.7
36		770	0.770	240	10.3	556	72						52	7.3	60	636	72	93.2	28.6	92.5	26.46	26.7
37		557	0.557	200	7.7	530	297						79	7.45	30	609	61	85.8	20.9	89	18.60	17.8
38		1134	1.134	410	10.1	609	126						67	7.4	40	689	90	94.1	26.5	90.8	24.06	39.7
39		847	0.847	230	9.86	583	153						112	7.4	30	715	72	86.8	20.1	92	18.49	27.3
40		954	0.954	480	11.12	689	72						84	7.4	60	662	72	91.2	20.9	90.6	18.94	32.4
41		1094	1.094	190	9.35	583	540		7.1		768	513	109	7.2	30	689	278	90.0	38.5	90.4	34.80	36.6
42		989	0.989	130	9.4						715	540	45	7.1	50	689		95.4	35.0	92.7	32.45	35.1
43		1116	1.116	130	7.2	689	581						83	7.3	50	742	378	92.6	38.95	91.7	35.72	38.4
44		535	0.535	130	9.6	662	675	606	7.7		742	612	58	7.8	340	715	378	83.6	24.0		22.01	16.6
45		932	0.932	490	9.35	662	540	484	7.6		768	648	87	7.8	190	636	180	90.7	3.5	91.2	3.19	31.4
46		548	0.548	520	9.4	552	419	1365	7.1	1220	742	810	87	7.3	10	768	473	84.1	1.7		1.55	17.2
47		976	0.976	160	8.0	742	675	944	7.1	130	795	608	87	7.2	10	636	405	91.1	4.7	92.0	4.32	33.1
48		1071	1.071	260	9.4	715	608	809	7.65	2120	848	752	103	7.3	10	715	297	90.4	4.6		4.23	36.0
49		1405	1.405	270	9.9	768	594	913	7.3	2320	874	702	99	7.2	40	795	378	93.0	5.6	91.8	5.14	48.6
50		698	0.698	260	9.2	609	500	383	7.6			351	84	7.0	160	715	108	88.0	6.8		6.24	22.8
51		874	0.874	200	6.8	318	144	398	7.2	2070	450	324	92	7.05	180	503	104	89.5	3.2	91.2	2.92	29.1
52		751	0.751	580	9.5	503	405	276	8.1	1220	636	419	115	7.2	40	397	107	84.7	2.8		2.55	23.7
53		782	0.782	460	10.1	742	473	319	8.0	1080	662	583	156	8.15	5	662	324	80.1	31	91.0	2.82	23.3
54		1056	1.056	230	9.6	662	559	699	7.6	2710	742	540	133	7.3	5	689	324	87.4	5.2		4.73	34.3
55		1330	1.330	250	9.6	662	554	637	7.8	2100	795	513	142	7.3	10	795	180	89.3	6.0	90.8	5.45	44.2
56		899	0.899	240	9.15	477	284	592	7.5	1370	636	351	127	7.2	10	609	139	85.9	4.2		3.81	28.7
57		921	0.921	140	9.6	662	405	479	8.6	2910	689	437	112	7.5	5	530	142	87.8	5.0	92.0	4.6	30.1
58		824	0.824	60	9.8	636	467	562	7.85	1600	689	505	90	7.55	5	662	162	89.1	3.8		3.5	27.3

ตารางที่ 4 ข้อมูลการทดลองชุดที่ 1 (ต่อ)

	FEED CHARACTERISTICS							AFTER ACID					EFFLUENT CHARACTERISTICS						GAS PRODUCTION			
	F.L	COD_T	O.L.	SS	pH	Alk	VFA	COD_f	pH	SS	Alk	VFA	COD_T	pH	SS	Alk	VFA	COD reduction	Biogas	CH_4	exp CH_4	theo CH_4
	ล./ว	mg/ล	Kg COD/ลบ.ม.-วัน	mg/ล		mg/ล as $CaCO_3$	mg/ล as HAc	mg/ล		mg/ล	mg/ล as $CaCO_3$	mg/ล as HAc	mg/ล		mg/ล	mg/ล as $CaCO_3$	mg/ล as HAc	%	ล./ล	%	ล./ล	ล./ล
59	106	1348	1.348	270	9.45	662	602	644	7.5	1710	874	626	75	7.2	15	742	419	94.4	5.1	91.6	4.64	47.4
60		644	0.644	50	9.8	742	486	643	8.7	2190	742	600	86	7.5	10	821	400	86.6	3.2		2.91	20.8
61		543	0.543	240	9.2	503	454	421	7.65	1810	609	494	71	7.8	10	662	372	86.9	3.0	89.2	2.68	17.6
62		1107	1.107	190	8.9	556	513	764	7.7	2260	795	567	96	7.15	5	715	397	91.3	8.4		7.49	37.6
63		807	0.807	190	9.3	583	446	300	7.7	1100	662	396	104	7.35	10	503	171	87.1	7.6	96.0	6.84	26.2
64		1107	1.107	240	9.15	662	405	557	7.4	2080	821	454	118	7.3	30	715	446	89.3	8.2		7.38	36.8
65		836	0.836	220	9.6	609	429	571	7.25	1840	768	491	96	7.3	5	635	282	88.5	4.6	91.0	4.19	27.5
66		493	0.493	60	9.7	609	432	650	8.05	1910	715	513	168	7.3	10	662	311	65.9	1.0	89.0	0.89	12.1
67		1150	1.150	240	10.2	689	427	690	8.9	2120	715	540	193	7.4	5	662	297	83.2	3.2		2.85	35.6
68	212	1586	3.172	410	9.7	609	405	967	7.4	330	715	513	91	7.05	5	636	284	94.3	12.4	90.2	11.18	111.2
69		701	1.402	20	9.85	662	459	323	7.9	320	718	413	71	7.4	5	715	139	89.9	6.8		6.13	46.9
70		992	1.984	260	9.7	662	449	402	8.6	340	742	437	102	7.7	10	662	338	89.7	9.6	90.0	8.64	66.2
71		1157	2.314	140	9.65	636	505	473	7.6	560	848	424	164	7.65	20	742	319	85.8	8.4	89.4	7.51	73.9
72		1099	2.199	240	10.25	795	481	682	9.05	1890	874	497	111	8.6	10	795	180	89.9	12.6	90.0	11.34	73.5
73		1456	2.912	250	9.3	609	497	690	7.7	960	768	540	126	7.65	20	795	319	91.3	24.8	91.2	22.62	95.9
74		1157	2.314	200	12.5	3576	662	1126					690					40.4	2.2		2.01	34.8
75		1099	2.198		9.3			473					164					85.1	13.4	90.2	12.09	69.6
76		818	1.636	40	9.5	400	429	1037	7.5	1030	660	541	522	7.3	20	660	555	36.0	0			21.9
77		610	1.22	146	7.8	420	300	560	7.7	1120	660	551	380	7.6	20	660	480	37.7	0			17.1
78		860	1.72		10	580	388	765	7.25	1720	660	756	380	7.45	10	660	540	55.8	0			35.7
79		1246	2.492	200	9.3	580	576	1087	6.8	1230	660	810	507	7.45	20	680	585	59.3	0			55.0
80	318	881	2.658	50	9.8	660	315	864	7.0	6070	640	660	480	7.4	60	620	528	45.8	0			45.3
81		849	2.547	110	11.0	960	495	1247	7.5	3370	760	816	487	7.6	100	720	642	42.6	0			40.4
82		1525	4.195	320	7.9	540	561	1324	7.15	1320	700	900	701	7.0	90	700	735	55.2	0			96.4
83		1900	5.7	1000	8.1	500	405	1488	6.7	2500	580	660	566	6.7	180	540	540	70.2	0			148.9
84		1060	3.78	570	9.1	480	474	1409	7.8	3990	620	435	452	7.0	20	580	300	63.8	0			89.7
85		1103	3.309	750	8.8	500	150	755	7.6	1910	600	300	406	7.1	50	600	282	63.2	0			77.8

ตารางที่ 5 ข้อมูลการทดลองชุดที่ 2

	FEED CHARACTERISTICS							AFTER ACID					EFFLUENT CHARACTERISTICS						GAS PRODUCTION			
	F.R.	COD_T	O.L.	SS	pH	Alk	VFA	COD_f	pH	SS	Alk	VFA	COD_T	pH	SS	Alk	VFA	COD reduction	BIOGAS	CH_4	exp CH_4	theo CH_4
day	ℓ/d	mg/ℓ	kgCOD/m^3.d	mg/ℓ		mg/ℓ as $CaCO_3$	mg/ℓ as HAc	mg/ℓ		mg/ℓ	mg/ℓ as $CaCO_3$	mg/ℓ as HAc	mg/ℓ		mg/ℓ	mg/ℓ as $CaCO_3$	mg/ℓ as HAc	%	ℓ/d	%	ℓ/d	ℓ/d
1	53	1311	0.656	130	9.6	490	160	826	6.9	1620	600	465	102	7.7	80	960	56	92.2	0.1	84	0.084	22.5
2		403	0.202	80	10.4	660	80	805	8.1	940	700	375	72	7.7	5	840	100	82.1	0.1		0.084	6.5
3		683	0.342	70	9.8	580	110	628	7.6	1500	620	354	61	7.5	65	720	90	91.1	0.2	87	0.174	11.6
4		717	0.359	170	9.6	580	140	594	7.5	570	660	510	61	7.5	10	700	90	91.5	0.1		0.087	12.1
5		922	0.461	200	9.9	590	84	567	7.5	710	660	411	34	7.4	25	640	48	96.3	0.3	89.2	0.258	165
6		874	0.437	170	9.5	620	279	655	7.2	1400	680	486	24	7.8	5	700	70	97.3	0		-	15.8
7		1222	0.611	230	7.8	580	444	694	7.2	1480	720	480	24	7.75	20	680	90	98.04	0.6	90	0.54	22.3
8		608	0.304	150	9.25	600	330	584	7.6	470	680	360	39	7.7	15	740	56	93.6	0.1		0.09	10.6
9		519	0.259	30	9.5	480	100	488	7.5	1670	560	345	54	7.7	40	520	90	89.6	0.2	90.1	0.18	8.7
10		915	0.458	400	8.65	440	84	457	7.1	1120	540	300	66	7.8	50	640	64	928	1.2	90.4	1.08	15.8
11		729	0.365	470	8.15	480	360	388	7.9	830	560	282	54	7.3	5	560	84	92.6	0.3	90.8	0.27	12.6
12		1310	0.655	60	9.6	500	114	791	7.4	1260	620	375	66	7.8	90	540	40	94.9	0.2		0.182	23.1
13	106	1326	1.326	390	7.6	540	315	780	7.6	940	660	495	66	7.5	5	640	70	95.02	0.4	90.2	0.361	46.4
14		1158	1.158	130	9.6	560	140	687	7.65	860	620	345	73	7.6	5	680	54	93.7	0.2	90.2	0.18	40.4
15		988	0.988	60	9.4	580	150	541	7.7	470	720	370	31	7.4	35	640	40	96.9	0.2		0.18	22.2
16		1089	1.089	280	9.5	580	150	624	7.85	1050	700	375	49	7.4	5	720	94	95.5	0.3	90.1	0.27	38.7
17		677	0.677	120	9.85	580	120	479	7.95	770	640	285	23	7.8	5	640	80	96.6	0.2		0.18	24.3
18		548	0.548	70	9.9	540	120	477	7.5	1540	680	270	46	7.7	5	620	52	91.6	0.1		0.09	18.6
19		1129	1.129	100	9.9	580	120	649	8.1	2710	620	321	49	7.5	10	600	30	95.7	1.4	92	1.288	40.2
20		921	0.921	320	9.95	600	90	596	7.4	1210	700	306	49	7.7	5	620	30	94.7	0		-	32.4
21	160	928	1.485	250	9.6	580	128	515	7.35	1890	700	291	34	7.4	15	580	40	96.3	0.2	90.0	0.18	50.2
22		1000	1.600	290	9.4	460	100	432	7.6	1250	580	114	42	7.7	5	580	34	95.8	0.3	91.2	0.274	53.8
23		886	1.418	120	9.95	620	90	727	7.7	2980	720	342	42	7.4	150	640	48	95.3	0.2	91.5	0.183	47.4
24		538	0.861	250	9.4	440	56	519	7.0	1160	560	154	82	7.4	5	460	46	84.8	0.2		0.183	25.6
25		882	1.411	170	9.7	540	124	511	7.65	530	620	130	111	7.3	85	560	46	87.4	0.2	90.1	0.18	43.3
26		1696	2.714	270	9.65	520	102	1319	5.8	1500	520	750	211	6.8	50	620	100	87.6	0.1		0.09	83.4
27		926	1.482	390	9.3	480	108	544	7.05	710	480	324	148	6.95	5	580	100	84.0	0.2	89.2	0.178	43.7
28		816	1.306	190	9.95	600	108	472	7.4	970	740	288	80	7.2	40	660	48	90.2	0.3	90.0	0.27	41.3
29		840	1.344	240	9.1	540	152	682	7.95	1560	640	318	86	7.4	5	680	42	89.9	0.2		0.18	42.3

ตารางที่ 6 ข้อมูลการทดลองชุดที่ 2 (ต่อ)

	FEED CHARACTERISTICS							AFTER ACID					EFFLUENT CHARACTERISTICS						GAS PRODUCTION			
	F.R.	COD_T	O.L.	SS	pH	ALK	VFA	COD_f	pH	SS	ALK	VFA	COD_T	pH	SS	ALK	VFA	COD reduced	BIOGAS	CH_4	exp CH_4	theo CH_4
day	l/d	mg/l	kg COD/m3.d	mg/l		mg/l as $CaCO_3$	mg/l as HAc	mg/l		mg/l	mg/l as $CaCO_3$	mg/l as HAc	mg/l		mg/l	mg/l as $CaCO_3$	mg/l as HAc	%	l/d	%	l/d	l/d
30		1294	2.070	750	6.95	380	170	523	7.35	890	620	286	86	7.3	5	600	48	93.4	0.1	90	0.09	67.8
31	318	1020	3.060	70	9.7	600	.136	548	7.4	370	680	300	50	7.3	20	640	34	96.1	0.3	90.1	0.27	103.3
32		1205	3.615	730	7.7	500	285	587	7.3	700	660	339	73	7.05	80	640	46	93.9	0.4	89.6	0.358	126.4
33		1313	3.939	190	7.3	560	342	541	7.6	1380	640	288	73	7.2	20	680	38	94.4	0.5	91.4	0.457	139.4
34		1691	5.073	510	6.75	460	390	787	7.45	720	720	393	120	7.1	15	740	60	92.9	0.5	91.2	0.456	175.4
35		896	2.670	100	9.75	520	84	672	7.95	1650	660	180	70	7.65	85	660	48	92.2	0.3	91.0	0.273	92.2
36		890	2.670	140	9.75	500	110	806	7.6	2970	620	339	84	7.4	70	660	46	90.6	0			89.9
37		1065	3.195	110	8.6	460	116	551	7.2	1780	520	282	53	7.05	10	560	38	95.0	1.2	90.4	1.085	112.9
38		1593	4.779	590	9.7	560	152	928	7.1	1120	680	531	64	7.0	120	680	46	95.9	0.8	90.2	0.722	170.7
39	636	1140	6.54	360	9.3	600	336	702	7.95	1020	700	633	60	7.5	15	720	45	94.7	0.6	92.1	2.395	248.0
40		702	4.212	180	9.2	620	170	506	8.2	690	660	170	53	7.5	25	620	54	92.5	0.4	92.1	0.368	144.0
41		566	3.396	230	8.15	500	148	445	7.7	580	580	142	102	7.35	150	520	44	81.9	0.3	91.0	0.273	106.5
42		621	3.726	270	9.45	440	86	358	7.4	1930	780	84	62	7.35	20	520	46	90.0	0.1		0.091	128.3
43		952	5.736	360	10.1	620	94	599	7.8	1390	700	342	88	7.55	760	620	58	90.8	0.2	90.4	0.181	199.3

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