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**APPENDIX**

Table A.1 Loading, BOD, COD and MLSS

Flow (l/day)	Detention		BOD(mg/l)		COD(mg/l)		% Removal		MLSS(mg/l)			
	Time (day)	F/M	Fc/M	Inf.	Eff.	Inf.	Eff.	BOD	COD	Ini.	Fin.	Ave.
Group I ; F/M = 0.2, SVI = 41												
10	1.26	0.202	0.32	533	10	855	27	98.1	96.8	2200	2404	2302
10	1.26	0.197	0.32	524	12	840	26.3	97.7	96.8	2200	2443	2324
10	1.26	0.208	0.32	560	7	853	13	98.7	98.4	2200	2480	2340
10	1.26	0.204	0.32	547	9	850	19	98.7	98.9	2200	2489	2344.5
Group II ; F/M = 0.4 ; SVI = 70												
10	1.26	0.383	0.59	980	18	1522	141.3	98.2	90.7	2200	2260	2230
10	1.26	0.404	-	1020	28	-	-	97.2	-	2200	2225	2212.5
10	1.26	0.387	0.625	1045	23	1687	104	97.8	93.8	2200	2510	2355
10	1.26	0.378	0.64	1020	50	1737	223	95.1	87.2	2200	2222	2211
10	1.26	0.379	0.63	1037	19	1719	164	98.2	90.4	2200	2572	2386

Inf. = Influent, Eff. = Effluent, Ini. = Initial  
 Fin. = Final, Ave. = Average

Table A.1 (Continued)

Flow (l/day)	Deten- tion Time (day)	F/M	F <sub>c</sub> /M	BOD(mg/l)		COD(mg/l)		% Removal		MLSS(mg/l)		
				Inf.	Eff.	Inf.	Eff.	BOD	COD	Ini.	Fin.	Ave.
Group III; F/M = 0.6 ; SVI = 60												
10	1.26	0.57	1.26	1575	32.6	3472	182	97.9	94.7	2200	2596	2398
10	1.26	0.57	1.09	1550	22	1934	128	98.6	95.6	2200	2510	2355
10	1.26	0.55	1.06	1620	21	3114	103	98.7	96.7	2200	2911	2555.5
10	1.26	0.57	1.10	1580	17	3045	107.3	98.9	96.4	2200	2620	2410
10	1.26	0.57	1.10	1572	12	3052	98	99.2	96.8	2200	2632	2416
Group IV; F/M = 0.8 ; SVI = 147												
10	1.26	0.73	0.93	2750	120	3477.6	105.8	95.6	96.9	3110	3452	3281
10	1.26	0.73	1.07	2742	92.5	4025.6	207	96.6	94.8	3110	3490	3300
10	1.26	0.74	1.28	2769	45	4838.4	139.8	98.3	97.1	3110	3482	3296
10	1.26	0.73	1.34	2768	60	5064	121	97.8	97.6	3110	3510	3310

Inf. = influent, Eff. = Effluent, Ini. = Initial  
 Fin. = Final, Ave. = Average

Table A.1 (Continued)

Flow (l/day)	Deten- tion Time (day)	F/M	Fc/M	BOD(mg/l)		COD(mg/l)		% Removal		MLSS(mg/l)		
				Inf.	Eff.	Inf.	Eff.	BOD	COD	Ini.	Fin.	Ave.
Group V, F/M = 1.2 : SVI = 114												
10	1.26	1.15	2.1	4841	183	8810	280	96.2	96.8	3330	4040	3685
10	1.26	1.14	2.02	4893	259	8714	216	94.7	97.5	3330	4215	3772.5
10	1.26	1.12	2.1	4814	143	9046	234	97.0	97.4	3330	4200	3765
10	1.26	1.10	2.05	4796	151	8921	195	96.9	97.8	3330	4294	3812

Inf. = Influent, Eff. = Effluent, Ini. = Initial  
 Fin. = Final, Ave. = Average

Table A-2 Maximum rate of substrate utilization per unit weight of microorganisms (k) and Malf velocity coefficient (Ks)

So	Se	So-Se	Xa	$\frac{So - Se}{Xat}$
524	12	512	2101.5	0.193
1045	23	1022	2124.5	0.381
1620	21	1599	2310	0.549
2769	45	2724	2967	0.728
4814	143	4671	3390	1.094

Remark

So = Influent BOD; mg/l

Se = Effluent BOD; mg/l

So-Se = BOD removed, mg/l

Xa = microorganism per unit volume, mg/l

$\frac{So-Se}{Xat}$  = Rate of waste utilization per unit mass of microorganism; Day<sup>-1</sup>

$$= \frac{dF/dt}{X}$$

t = 1.25 day



Table A.3 Growth Yield Coefficient (Y)

Group	BOD Removal Xi	MLSS Yi	Xi <sup>2</sup>	XiYi
I	512	248	262,144	126,976
	553	260	305,809	143,780
II	962	60	925,444	57,720
	1,022	310	1,044,484	316,820
III	1,608	420	2,585,664	675,360
	1,560	432	2,433,600	673,920
IV	2,724	1,282	7,420,176	3,492,168
	2,760	1,310	7,617,600	3,615,600
V	4,658	1,840	21,696,964	8,570,720
	4,645	2,094	21,576,025	9,726,630
$\Sigma$	21,004	8,256	65,867,910	27,399,694

$$\begin{aligned}
 Y &= \frac{n \Sigma XiYi - (\Sigma Xi)(\Sigma Yi)}{n \Sigma Xi^2 - (\Sigma Xi)^2} \\
 &= \frac{10(27,399,694) - (21,004)(8,256)}{10(65,867,910) - (21,004)^2} \\
 &= 0.415
 \end{aligned}$$



Table A.4 Microorganism decay coefficient,  $\text{day}^{-1}$  (b)

Time (day)	MLSS		
$X_i$	$Y_i$	$X_i^2$	$X_i Y_i$
0	3,500	0	0
1	3,322	1	3,322
2	3,196	4	6,392
3	3,108	9	9,324
4	2,925	6	11,700
5	2,841	25	14,205
$\Sigma$ 15	18,892	55	44,943

$$\text{average MLSS} = \frac{18,892}{6} = 3148.7$$

$$\begin{aligned} \bar{p} &= \frac{n \Sigma X_i Y_i - (\Sigma X_i)(\Sigma Y_i)}{n \Sigma X_i Y_i - (\Sigma X_i)^2} \\ &= \frac{6(44,943) - (15)(18,892)}{6(55) - (15)^2} \\ &= -130.69 \\ b &= \frac{-130.69}{3148.7} \\ &= 0.0415 \end{aligned}$$

Table A.5 Solids retention time and Food : microorganism

So	Se	So-Se	X	U	SRT	F/M
mg/l	mg/l	mg/l	mg/l	day <sup>-1</sup>	day	
533	10	523	2404	0.1717	33.61	0.202
524	12	512	2448	0.1651	37.01	0.197
560	7	553	2480	0.1760	31.70	0.208
547	9	538	2489	0.1706	34.13	0.204
980	18	962	2260	0.3360	10.21	0.383
1020	28	992	2222	0.3524	9.55	0.404
1045	23	1022	2510	0.3214	10.88	0.387
1020	50	970	2222	0.3445	9.86	0.378
1037	19	1018	2572	0.3124	11.35	0.379
1575	32.6	1542.4	2596	0.4689	6.53	0.57
1550	22	1528	2510	0.4805	6.33	0.57
1620	21	1599	2911	0.4335	7.23	0.55
1580	17	1563	2620	0.4708	6.50	0.57
1572	12	1560	2632	0.4678	6.55	0.57
2750	120	2360	3452	0.5396	5.48	0.73
2742	92.5	2239.5	3490	0.5268	5.65	0.73
2769	45	2724	3482	0.5494	5.36	0.74
2768	60	2708	3510	0.6089	4.73	0.73
4841	183	4658	4040	0.9100	2.97	1.15
4893	259	4634	4215	0.8677	3.14	1.14
4814	143	4671	4200	0.8778	3.10	1.12
4796	151	4645	4294	0.8538	3.20	1.10

Table A.6 Suspended Solids and Total Solids

Group	Suspended Solids (mg/l)			Total Solids (mg/l)	
	Inf.	Eff.	% Removed	Inf.	Eff.
I	153	27	82.3	-	-
	127	22	82.7	680	217
	218	34	89.9	524	126
	142	21	85.2	573	124
II	532	54	89.8	1053	2213
	1054	201	80.9	1625	1939
	696	63	90.9	-	-
	782	107	86.3	1460	866
	721	64	91.1	-	-
III	596	52	91.3	1370	1076
	558	20	96.4	1576	810
	744	38	94.9	1683	966
	748	39	96.1	-	-
	721	36	95.0	1710	952
IV	1242	12	99.0	2554	704
	1224	58	95.2	2620	716
	2522	56	97.8	3160	402
	-	-	-	-	-
V	1841	103	97.0	3832	1209
	1742	108	93.8	3910	1850
	1820	139	95.9	3856	1943
	-	-	-	-	-

Table A.7 Nitrogen and phosphate

Group	Organic N <sub>2</sub> (mg/l)		Ammonia N <sub>2</sub> (mg/l)		PO <sub>4</sub> (mg/l)	
	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.
I	-	-	-	-	-	-
	192	521	112.4	0.1	1.14	8.5
	230	43	248	7.5	0.96	7.3
	210	86.2	136.1	9.3	1.08	6.7
II	338	17.28	267.8	8.5	3.68	14.9
	580.7	117.8	-	120.5	2.7	16.0
	420.3	110	224	16.8	-	-
	381.4	101.6	21.3	372.7	3.6	20.9
	-	-	-	-	-	-
III	312	71.4	259.9	129.8	3.6	14.3
	375.4	54.0	368.4	127.8	3.81	11.0
	370.0	76.8	355.4	156.0	4.0	13.9
	-	-	-	-	-	-
	403.1	58.2	324.2	97.5	4.2	12.6
IV	333.7	21.35	305.5	21.4	7.6	17.1
	335.8	30.05	292.5	21.5	7.0	15.0
	355.4	73.41	424.8	17.0	7.2	12.2
	-	-	-	-	-	-
V	672.1	40.3	436	90.4	13.4	18.6
	583.4	65.6	478.5	74.8	15.8	21.3
	629.6	43.1	392	13.9	12.9	19.1
	-	-	-	-	-	-

Table A.8 Temperature, pH and dissolved oxygen

Group	Temperature °C	pH			DO (mg/l)
		Inf.	Aer. Tank	Eff.	Aer. Tank
I	24	6.7	6.6	6.65	5.5
	26	6.6	6.37	6.44	6.4
	28	6.26	6.05	5.65	5.9
	28	6.5	6.35	5.65	5.9
II	26	6.55	6.03	5.85	3.5
	26	6.55	6.65	6.3	3.3
	26	6.57	7.0	7.0	2.0
	26	6.4	7.1	7.0	3.7
	26	6.5	6.9	6.8	4.0
III	28	6.25	6.65	6.8	3.0
	26	6.35	6.0	6.15	3.2
	25	6.30	5.6	5.85	3.6
	28	6.30	5.5	5.6	3.3
	26	6.30	5.6	5.65	3.6
IV	27.5	6.2	6.25	6.6	2.2
	28	6.17	6.6	6.7	2.0
	28.5	6.4	7.05	6.8	2.2
	28.5	6.4	6.8	6.8	2.1
V	28	6.35	7.4	7.2	1.2
	29	6.4	7.3	7.3	0.6
	28.5	6.4	7.5	7.4	0.9
	28	6.4	7.4	7.4	1.1

## VITA

The author, Mr. Boonlert Padungsupalai, recieved a bachelor degree in sanitary engineering from Chulalongkorn University in 1974. Presently, he is working with the Ministry of Public Health.

