

APPENDIXES

Appendix Table A1 Properties of Kaolin clay 200 mesh : Sample No. 47-016

SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	MgO (%)	CaO (%)	Na ₂ O (%)	K ₂ O (%)	TiO ₂ (%)	P ₂ O ₅ (%)	MnO (%)	Cl ₂ O ₃ (%)	V ₂ O ₅ (%)	LOI (%)	SUM (%)
68.7	20.3	0.88	0.21	0.11	2.06	3.02	0.03	0.02	0.08	<0.01	<0.01	4.41	99.8

Note : Whole Rock Analysis (WRA) by XRE, Exploration package

Source : Siam FineClay Co.,Ltd. (2005)

Appendix Table B1 Properties of Polypropylene

Typical	Data	Unit	Value	Test Method
Properties	MFI 2016 kg/230 °C	g/10 min	2.1	ASTM D 1238
	Tensile strength at yield	N/mm ²	23	ASTM D 638
	Charpy notched impact strength at 20 °C	mJ/mm ²	20	DIN 53453
	Shear modulus	N/mm ²	465	DIN 53457
	Ball indentation hardness	N/mm ²	55	DIN 53456
	Heat distortion temperature at 0.45 N/mm ²	°C	92	ASTM D 648
Application	For Injection molding with UV Stabilizer for Outdoor Application			
	Very high impact resistance for furniture, autopart, electrical, appliance, toy, container, and agriculture product.			
	Temperature 190 ~ 280 °C			
Processing				

Source : Thai Petrochemical Industry Public Co. Ltd. (2005)

Appendix Table C1 Properties of Polyaluminiumchloride (PAC) 30%

Appearance	Unit	Yellowish power
Aluminium oxide (Al_2O_3)	wt%	30% min
Basicity	wt%	65% min
pH Value (1% solution w/v)		3.5 ~ 5.0
Water insoluble matter	wt%	< 1.0 %
Iron (Fe)	wt%	< 1.0 %
Sulphate (SO_4)	wt%	< 0.1 %
Ammoniacal nitrogen (N)	wt%	0.03 max
Manganese (Mn)	mg/kg	45 max
Lead (Pb)	mg/kg	15 max
Cadmium (Cd)	mg/kg	3.0 max
Chromium (Cr)	mg/kg	15 max
Arsenic (As)	mg/kg	3.0 max
Mercury (Hg)	mg/kg	0.3 max

Source : LIANG CHEMI INTERNATIONAL CO., LTD. (2005)

APPENDIX D
EXPERIMENTAL DATA

Appendix Table D1 Experimental data of run no.1

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	83	6.97	30	60.0	-	-	0.10	0.05	0.10	0.10	-	-
30	5	7.16	31	60.0	-	-	0.40	0.50	0.20	0.20	-	94.0
60	9	7.02	31	60.0	-	-	0.30	0.40	0.20	0.30	-	89.2
90	15	7.33	31.5	60.1	-	-	0.30	0.50	0.40	0.20	-	81.9
120	18	7.45	31.8	60.1	-	-	0.20	0.50	0.50	0.20	-	78.3
150	15	7.31	31.8	60.1	-	-	0.40	0.50	0.50	0.30	-	81.9
180	12	7.29	32	60.1	-	-	0.40	0.50	0.50	0.30	-	85.5
240	10	7.25	32	60.1	-	-	0.50	0.60	0.60	0.40	-	88.0
300	10	7.26	32	60.1	-	-	0.50	0.60	0.60	0.40	-	88.0
360	10	7.21	32	60.1	-	-	0.50	0.60	0.60	0.40	-	88.0

Time (min)	Porosity of media (f)			$10^{-6} \cdot \nu$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.8039	100.7	215.8	18.9	9.2	13.0	13.0	-	13.5
30	0.340	-	-	0.7870	100.7	215.8	38.2	29.3	18.5	18.5	-	26.1
60	0.340	-	-	0.7870	100.7	215.8	33.0	26.2	18.5	22.7	-	25.1
90	0.341	-	-	0.7789	100.7	215.8	33.2	29.4	26.3	18.6	-	26.9
120	0.341	-	-	0.7740	100.7	215.8	27.2	29.5	29.5	18.7	-	26.2
150	0.341	-	-	0.7740	100.7	215.8	38.4	29.5	29.5	22.8	-	30.1
180	0.341	-	-	0.7708	100.7	215.8	38.5	29.6	29.6	22.9	-	30.1
240	0.341	-	-	0.7708	100.7	215.8	43.1	32.4	32.4	26.4	-	33.6
300	0.341	-	-	0.7708	100.7	215.8	43.1	32.4	32.4	26.4	-	33.6
360	0.341	-	-	0.7708	100.7	215.8	43.1	32.4	32.4	26.4	-	33.6

Conditions: Hydraulic rate = $2.5 \text{ m}^3/\text{m}^2 \cdot \text{h}$, Dose of PACl = 10 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D2 Experimental data of run no.2

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	85	7.26	30.5	60.0	-	-	0.20	0.10	0.20	0.10	0.10	-
30	12	7.16	31.5	60.0	-	-	0.20	0.10	0.20	0.10	0.20	86.7
60	4	7.14	32.0	60.0	-	-	0.10	0.20	0.20	0.20	0.10	95.2
90	4	7.13	32.0	60.0	-	-	0.20	0.20	0.20	0.10	0.20	95.2
120	3	7.09	32.0	60.0	-	-	0.20	0.20	0.20	0.20	0.10	95.2
150	3	7.15	32.0	60.0	-	-	0.20	0.30	0.20	0.20	0.10	96.4
180	2	7.11	32.0	60.0	-	-	0.30	0.30	0.30	0.10	0.10	96.4
240	3	7.07	32.5	60.0	-	-	0.30	0.40	0.30	0.10	0.10	96.4
300	4	7.08	32.5	60.1	-	-	0.30	0.40	0.30	0.10	0.10	96.4
360	4	7.16	32.5	60.1	-	-	0.30	0.40	0.30	0.10	0.10	96.4

Time (min)	Porosity of media (f)			$10^{-6} \cdot \nu$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7955	100.7	215.8	26.8	13.0	18.4	13.0	13.0	16.9
30	0.340	-	-	0.7789	100.7	215.8	27.1	13.2	18.6	13.2	18.6	18.1
60	0.340	-	-	0.7708	100.7	215.8	19.3	18.7	18.7	18.7	13.2	17.7
90	0.340	-	-	0.7708	100.7	215.8	27.3	18.7	18.7	13.2	18.7	19.3
120	0.340	-	-	0.7708	100.7	215.8	27.3	18.7	18.7	18.7	13.2	19.3
150	0.340	-	-	0.7708	100.7	215.8	27.3	22.9	18.7	18.7	13.2	20.2
180	0.340	-	-	0.7708	100.7	215.8	33.4	22.9	22.9	13.2	13.2	21.1
240	0.340	-	-	0.7630	100.7	215.8	33.6	26.6	23.0	13.3	13.3	22.0
300	0.341	-	-	0.7630	100.7	215.8	33.5	26.6	23.0	13.3	13.3	21.9
360	0.341	-	-	0.7630	100.7	215.8	33.5	26.6	23.0	13.3	13.3	21.9

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 5 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D3 Experimental data of run no.3

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	83	6.98	31	60.00	-	-	0.10	0.10	0.20	0.10	0.00	-
30	11	7.06	31.2	60.00	-	-	0.10	0.20	0.20	0.10	0.00	86.7
60	4	6.96	31.5	60.05	-	-	0.20	0.20	0.20	0.10	0.00	95.2
90	4	7.11	31.5	60.05	-	-	0.20	0.20	0.20	0.15	0.00	95.2
120	4	7.09	31.8	60.05	-	-	0.20	0.20	0.20	0.20	0.00	95.2
150	3	7.16	31.8	60.05	-	-	0.20	0.20	0.20	0.20	0.00	96.4
180	3	7.18	32	60.05	-	-	0.20	0.20	0.20	0.20	0.00	96.4
240	3	7.25	32	60.10	-	-	0.35	0.25	0.25	0.10	0.05	96.4
300	3	7.26	32.5	60.10	-	-	0.35	0.25	0.25	0.10	0.05	96.4
360	3	7.22	32.5	60.10	-	-	0.35	0.25	0.25	0.10	0.05	96.4
420	3	7.18	32.5	60.10	-	-	0.35	0.25	0.25	0.10	0.05	96.4
480	3	7.23	32.5	60.10	-	-	0.35	0.25	0.25	0.10	0.05	96.4

Time (min)	Porosity of media (f)			$10^{-6} \mu$ (m ² /s)	θ_1 (s)	$\theta_{2.5}$ (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7870	100.7	215.8	19.1	13.1	18.5	13.1	0.0	15.9
30	0.340	-	-	0.7838	100.7	215.8	19.1	18.6	18.6	13.1	0.0	17.3
60	0.340	-	-	0.7789	100.7	215.8	27.1	18.6	18.6	13.2	0.0	19.4
90	0.340	-	-	0.7789	100.7	215.8	27.1	18.6	18.6	16.1	0.0	20.1
120	0.340	-	-	0.7740	100.7	215.8	27.2	18.7	18.7	18.7	0.0	20.8
150	0.340	-	-	0.7740	100.7	215.8	27.2	18.7	18.7	18.7	0.0	20.8
180	0.340	-	-	0.7708	100.7	215.8	27.3	18.7	18.7	18.7	0.0	20.8
240	0.341	-	-	0.7708	100.7	215.8	36.0	20.9	20.9	13.2	9.3	20.1
300	0.341	-	-	0.7630	100.7	215.8	36.2	21.0	21.0	13.3	9.4	20.2
360	0.341	-	-	0.7630	100.7	215.8	36.2	21.0	21.0	13.3	9.4	20.2
420	0.341	-	-	0.7630	100.7	215.8	36.2	21.0	21.0	13.3	9.4	20.2
480	0.341	-	-	0.7630	100.7	215.8	36.2	21.0	21.0	13.3	9.4	20.2

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D4 Experimental data of run no.4

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	81	7.43	29.5	60.0	-	-	0.20	0.40	0.50	0.40	0.30	-
30	6	7.23	29.5	60.0	-	-	0.40	0.50	0.50	0.50	0.25	92.6
60	11	7.25	30.0	60.0	-	-	0.40	0.70	0.80	0.60	0.25	86.4
90	22	7.26	31.0	60.2	-	-	0.60	1.00	0.80	0.60	0.45	72.8
120	24	7.22	31.0	60.2	-	-	0.60	1.30	1.00	0.70	0.50	70.4
150	29	7.19	31.0	60.2	-	-	1.00	1.20	1.10	1.10	0.40	64.2
180	30	7.24	31.0	60.2	-	-	0.80	1.50	1.20	1.10	0.40	63.0
240	30	7.23	31.5	60.2	-	-	0.80	1.70	1.50	1.20	0.40	63.0
300	31	7.27	32.0	60.2	-	-	1.00	2.00	1.70	1.10	0.50	61.7
360	29	7.22	32.0	60.2	-	-	0.70	2.20	2.00	1.10	0.50	64.2

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.8127	50.4	108.0	37.5	36.3	40.5	36.3	31.4	36.4
30	0.340	-	-	0.8127	50.4	108.0	53.1	40.5	40.5	40.5	28.7	40.7
60	0.340	-	-	0.8039	50.4	108.0	53.4	48.2	51.6	44.6	28.8	45.3
90	0.341	-	-	0.7870	50.4	108.0	65.9	58.2	52.0	45.0	39.0	52.0
120	0.341	-	-	0.7870	50.4	108.0	65.9	66.3	58.2	48.7	41.1	56.0
150	0.341	-	-	0.7870	50.4	108.0	85.1	63.7	61.0	61.0	36.8	61.5
180	0.341	-	-	0.7870	50.4	108.0	76.1	71.2	63.7	61.0	36.8	61.8
240	0.341	-	-	0.7789	50.4	108.0	76.5	76.2	71.6	64.0	37.0	65.1
300	0.341	-	-	0.7708	50.4	108.0	83.9	83.1	76.6	61.6	41.6	69.4
360	0.341	-	-	0.7708	50.4	108.0	70.2	87.2	83.1	61.6	41.6	68.7

Conditions: Hydraulic rate = 5 m³/m²-h, Dose of PACl = 40 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D5 Experimental data of run no.5

Time (min)	Tb (NTU)	pH	Temp ($^{\circ}\text{C}$)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	84	7.06	31.5	60.0	-	-	0.20	0.20	0.20	0.20	0.15	-
30	4	6.92	32.0	60.0	-	-	0.10	0.30	0.20	0.40	0.20	95.2
60	4	6.94	32.0	60.1	-	-	0.10	0.30	0.40	0.30	0.20	95.2
90	5	6.97	31.5	60.1	-	-	0.20	0.50	0.40	0.30	0.20	94.0
120	8	7.01	31.5	60.1	-	-	0.40	0.50	0.50	0.30	0.30	90.5
150	11	7.04	31.5	60.1	-	-	0.30	0.80	0.50	0.50	0.20	86.9
180	10	7.03	31.9	60.1	-	-	0.40	0.80	0.60	0.50	0.20	88.1
240	21	6.98	32.0	60.1	-	-	0.40	1.00	0.60	0.70	0.30	75.0
300	22	7.04	32.0	60.1	-	-	0.50	1.50	0.90	0.90	0.20	73.8
360	21	7.03	32.0	60.1	-	-	0.70	1.40	1.00	0.90	0.30	75.0

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m^2/s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s^{-1})	G_2 (s^{-1})	G_3 (s^{-1})	G_4 (s^{-1})	G_5 (s^{-1})	G_{AVE} (s^{-1})
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7789	50.4	108.0	38.3	26.2	26.2	26.2	22.7	27.9
30	0.340	-	-	0.7708	50.4	108.0	27.2	32.2	26.3	37.2	26.3	29.9
60	0.341	-	-	0.7708	50.4	108.0	27.2	32.2	37.2	32.2	26.3	31.0
90	0.341	-	-	0.7789	50.4	108.0	38.3	41.4	37.0	32.0	26.2	35.0
120	0.341	-	-	0.7789	50.4	108.0	54.2	41.4	41.4	32.0	32.0	40.2
150	0.341	-	-	0.7789	50.4	108.0	46.9	52.3	41.4	41.4	26.2	41.6
180	0.341	-	-	0.7724	50.4	108.0	54.4	52.5	45.5	41.5	26.3	44.1
240	0.341	-	-	0.7708	50.4	108.0	54.4	58.8	45.6	49.2	32.2	48.0
300	0.341	-	-	0.7708	50.4	108.0	60.9	72.0	55.8	55.8	26.3	54.2
360	0.341	-	-	0.7708	50.4	108.0	71.7	69.6	58.8	55.8	32.2	57.6

Conditions: Hydraulic rate = $5 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 10 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D6 Experimental data of run no.6

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	81	7.05	32.0	60.0	-	-	0.10	0.10	0.30	0.20	0.20	-
30	4	7.09	32.0	60.0	-	-	0.10	0.40	0.20	0.20	0.20	95.1
60	2	7.11	32.8	60.0	-	-	0.20	0.40	0.20	0.30	0.20	97.5
90	4	7.16	32.5	60.0	-	-	0.30	0.60	0.30	0.30	0.10	95.1
120	4	7.14	33.0	60.0	-	-	0.40	0.50	0.30	0.40	0.10	95.1
150	4	7.17	33.2	60.0	-	-	0.40	0.70	0.70	0.00	0.10	95.1
180	5	7.14	33.0	60.0	-	-	0.60	0.60	0.70	0.20	0.30	93.8
240	15	7.15	33.5	60.1	-	-	0.50	1.00	0.70	0.50	0.20	81.5
300	15	7.11	33.5	60.1	-	-	0.60	1.20	0.80	0.50	0.50	81.5
360	16	7.13	33.5	60.1	-	-	0.80	1.30	1.00	0.80	0.30	80.2

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7708	50.4	108.0	27.2	18.6	32.2	26.3	26.3	26.1
30	0.340	-	-	0.7708	50.4	108.0	27.2	37.2	26.3	26.3	26.3	28.7
60	0.340	-	-	0.7582	50.4	108.0	38.9	37.5	26.5	32.5	26.5	32.4
90	0.340	-	-	0.7630	50.4	108.0	47.4	45.8	32.4	32.4	18.7	35.4
120	0.340	-	-	0.7551	50.4	108.0	55.1	42.1	32.6	37.6	18.8	37.2
150	0.340	-	-	0.7520	50.4	108.0	55.2	49.9	49.9	0.0	18.8	34.7
180	0.340	-	-	0.7551	50.4	108.0	67.4	46.1	49.8	26.6	32.6	44.5
240	0.341	-	-	0.7475	50.4	108.0	61.8	59.7	50.0	42.2	26.7	48.1
300	0.341	-	-	0.7475	50.4	108.0	67.7	65.4	53.4	42.2	42.2	54.2
360	0.341	-	-	0.7475	50.4	108.0	78.2	68.1	59.7	53.4	32.7	58.4

Conditions: Hydraulic rate = 5 m³/m²-h, Dose of PACl = 5 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D7 Experimental data of run no.7

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	82	7.23	30.5	60.0	-	-	0.20	0.10	0.10	0.30	0.20	-
30	5	7.39	30.5	60.0	-	-	0.20	0.20	0.30	0.20	0.20	93.9
60	5	7.41	32.8	60.0	-	-	0.20	0.40	0.40	0.30	0.10	93.9
90	5	7.36	32.8	60.0	-	-	0.30	0.30	0.50	0.20	0.10	93.9
120	5	7.32	32.8	60.0	-	-	0.30	0.40	0.40	0.20	0.20	93.9
150	14	7.35	32.5	60.1	-	-	0.30	0.50	0.30	0.30	0.30	82.9
180	6	7.38	32.0	60.1	-	-	0.40	0.50	0.50	0.40	0.20	92.7
240	5	7.39	33.0	60.1	-	-	0.30	0.70	0.30	0.60	0.20	93.9
300	8	7.42	33.1	60.1	-	-	0.50	0.70	0.60	0.30	0.30	90.2
360	8	7.45	33.1	60.1	-	-	0.50	0.75	0.75	0.40	0.30	90.2
420	8	7.38	33.1	60.1			0.60	0.90	0.70	0.60	0.10	90.2
480	8	7.33	33.5	60.1			0.50	1.10	0.70	0.55	0.25	90.2
540	8	7.31	33.0	60.1			0.60	1.00	0.80	0.50	0.20	90.2

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7955	50.4	108.0	37.9	18.3	18.3	31.7	25.9	26.4
30	0.340	-	-	0.7955	50.4	108.0	37.9	25.9	31.7	25.9	25.9	29.5
60	0.340	-	-	0.7582	50.4	108.0	38.9	37.5	37.5	32.5	18.8	33.0
90	0.340	-	-	0.7582	50.4	108.0	47.6	32.5	42.0	26.5	18.8	33.5
120	0.340	-	-	0.7582	50.4	108.0	47.6	37.5	37.5	26.5	26.5	35.1
150	0.341	-	-	0.7630	50.4	108.0	47.4	41.8	32.4	32.4	32.4	37.3
180	0.341	-	-	0.7708	50.4	108.0	54.4	41.6	41.6	37.2	26.3	40.2
240	0.341	-	-	0.7551	50.4	108.0	47.6	49.7	32.5	46.0	26.6	40.5
300	0.341	-	-	0.7536	50.4	108.0	61.6	49.8	46.1	32.6	32.6	44.5
360	0.341	-	-	0.7536	50.4	108.0	61.6	51.5	51.5	37.6	32.6	47.0
420	0.341	-	-	0.7536	50.4	108.0	67.4	56.4	49.8	46.07	18.8	47.7
480	0.341	-	-	0.7475	50.4	108.0	61.8	62.6	50	44.29	29.9	49.7
540	0.341	-	-	0.7551	50.4	108.0	67.4	59.4	53.1	42.02	26.6	49.7

Conditions: Hydraulic rate = 5 m³/m²-h, Dose of PACl = 2.5 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D8 Experimental data of run no.8

Time	Tb	pH	Temp	Bed Expansion			Δh_1	Δh_2	Δh_3	Δh_4	Δh_5	% Tb
(min)	(NTU)		($^{\circ}\text{C}$)	(cm)			(m)	(m)	(m)	(m)	(m)	removal
				1	2	3						
0	81	7.38	30.0	60.0	-	-	0.10	0.30	0.20	0.30	0.10	-
60	11	7.32	31.5	60.0	-	-	0.10	0.30	0.30	0.30	0.20	86.1
120	9	7.29	32.0	60.0	-	-	0.10	0.40	0.30	0.30	0.10	88.6
180	9	7.26	32.0	60.0	-	-	0.10	0.50	0.40	0.30	0.20	88.6
240	10	7.24	32.0	60.0	-	-	0.20	0.50	0.40	0.40	0.10	87.3
300	10	7.21	31.5	60.0	-	-	0.20	0.50	0.50	0.40	0.10	87.3
360	11	7.25	31.5	60.0	-	-	0.20	0.60	0.50	0.50	0.30	86.1
420	10	7.27	31.0	60.0	-	-	0.30	0.40	0.40	0.50	0.20	88.0
480	12	7.33	31.2	60.0	-	-	0.20	0.50	0.40	0.70	0.20	85.5
540	10	7.31	31.5	60.0	-	-	0.20	0.60	0.50	0.60	0.20	88.0
600	11	7.35	32.0	60.1	-	-	0.20	0.70	0.40	0.80	0.20	86.7
660	15	7.29	32.0	60.1	-	-	0.30	0.80	0.50	0.80	0.20	81.9
720	17	7.22	32.0	60.1	-	-	0.30	0.90	0.60	0.80	0.30	79.5
780	16	7.24	32.8	60.1	-	-	0.30	1.00	0.80	0.80	0.30	80.7
840	14	7.25	31.0	60.1	-	-	0.40	0.90	0.60	0.60	0.30	83.1
900	15	7.27	31.2	60.1	-	-	0.40	0.90	0.60	0.80	0.30	81.9
960	16	7.22	31.5	60.1	-	-	0.40	1.00	0.70	0.80	0.40	80.7
1020	19	7.21	32.0	60.1	-	-	0.60	1.10	0.70	0.70	0.30	77.1
1080	37	7.19	32.0	60.2	-	-	0.60	1.10	1.00	0.80	0.20	55.4
1140	15	7.26	32.0	60.2	-	-	0.60	1.30	0.90	0.80	0.30	81.9
1200	18	7.22	32.2	60.2	-	-	0.60	1.40	0.90	0.90	0.30	78.3
1260	14	7.29	32.5	60.2	-	-	0.60	1.40	1.10	0.90	0.10	83.1
1320	17	7.33	32.5	60.2	-	-	0.70	1.50	1.20	0.90	0.20	79.5
1380	13	7.30	32.0	60.2	-	-	0.80	1.60	1.10	1.10	0.30	84.3
1440	17	7.28	31.5	60.2	-	-	0.90	1.70	1.20	0.90	0.50	79.5

Appendix Table D8 Experimental data of run no.8 (Cont'd)

Time	Porosity of media (f)			$10^{-6} \cdot \gamma$	θ_1	θ_{2-5}	G_1	G_2	G_3	G_4	G_5	G_{AVE}
(min)	Top	Medium	Bottom	(m^2/s)	(s)	(s)	$\begin{smallmatrix} -1 \\ (s) \end{smallmatrix}$	$\begin{smallmatrix} -1 \\ (s) \end{smallmatrix}$	$\begin{smallmatrix} -1 \\ (s) \end{smallmatrix}$	$\begin{smallmatrix} -1 \\ (s) \end{smallmatrix}$	$\begin{smallmatrix} -1 \\ (s) \end{smallmatrix}$	$\begin{smallmatrix} -1 \\ (s) \end{smallmatrix}$
	layer	layer	layer									
0	0.340	-	-	0.8039	50.4	108.0	26.7	31.6	25.8	31.6	18.2	26.8
60	0.340	-	-	0.7789	50.4	108.0	27.1	32.1	32.1	32.1	26.2	29.9
120	0.340	-	-	0.7708	50.4	108.0	27.2	37.2	32.2	32.2	18.6	29.5
180	0.340	-	-	0.7708	50.4	108.0	27.2	41.6	37.2	32.2	26.3	32.9
240	0.340	-	-	0.7708	50.4	108.0	38.5	41.6	37.2	37.2	18.6	34.6
300	0.340	-	-	0.7789	50.4	108.0	38.3	41.4	41.4	37.0	18.5	35.3
360	0.340	-	-	0.7789	50.4	108.0	38.3	45.4	41.4	41.4	32.1	39.7
420	0.340	-	-	0.7870	50.4	108.0	46.7	36.8	36.8	41.2	26.1	37.5
480	0.340	-	-	0.7838	50.4	108.0	38.2	41.3	36.9	48.8	26.1	38.3
540	0.340	-	-	0.7789	50.4	108.0	38.3	45.4	41.4	45.4	26.2	39.3
600	0.341	-	-	0.7708	50.4	108.0	38.5	49.2	37.2	52.6	26.3	40.8
660	0.341	-	-	0.7708	50.4	108.0	47.2	52.6	41.6	52.6	26.3	44.0
720	0.341	-	-	0.7708	50.4	108.0	47.2	55.8	45.6	52.6	32.2	46.7
780	0.341	-	-	0.7582	50.4	108.0	47.5	59.3	53.0	53.0	32.5	49.1
840	0.341	-	-	0.7870	50.4	108.0	53.9	55.2	45.1	45.1	31.9	46.2
900	0.341	-	-	0.7838	50.4	108.0	54.0	55.3	45.2	52.2	31.9	47.7
960	0.341	-	-	0.7789	50.4	108.0	54.2	58.5	48.9	52.3	37.0	50.2
1020	0.341	-	-	0.7708	50.4	108.0	66.7	61.7	49.2	49.2	32.2	51.8
1080	0.341	-	-	0.7708	50.4	108.0	66.6	61.6	58.8	52.6	26.3	53.2
1140	0.341	-	-	0.7708	50.4	108.0	66.6	67.0	55.7	52.6	32.2	54.8
1200	0.341	-	-	0.7692	50.4	108.0	66.7	69.6	55.8	55.8	32.2	56.0
1260	0.341	-	-	0.7630	50.4	108.0	67.0	69.9	61.9	56.0	18.7	54.7
1320	0.341	-	-	0.7630	50.4	108.0	72.3	72.3	64.7	56.0	26.4	58.4
1380	0.341	-	-	0.7708	50.4	108.0	76.9	74.3	61.6	61.6	32.2	61.3
1440	0.341	-	-	0.7789	50.4	108.0	81.2	76.2	64.0	55.5	41.3	63.6

Conditions: Hydraulic rate = $5 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 1.25 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D9 Experimental data of run no.9

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	83	6.97	30.0	60.0	-	-	0.20	0.50	0.40	0.40	0.30	-
30	19	7.41	31.0	60.0	-	-	0.40	0.70	0.60	1.60	0.80	77.1
60	26	7.43	31.2	60.0	-	-	0.50	1.40	1.20	0.80	1.30	68.7
90	32	7.38	31.2	60.0	-	-	0.70	1.70	0.90	1.80	0.60	61.4
120	35	7.36	31.2	60.0	-	-	0.50	2.00	1.40	0.60	0.90	57.8
150	37	7.38	31.5	60.0	-	-	0.50	1.90	1.40	0.90	0.70	55.4
180	34	7.35	31.5	60.2	-	-	0.50	2.00	1.40	0.90	0.70	59.0
240	41	7.28	31.5	60.2	-	-	0.50	2.40	1.20	0.50	0.70	50.6
300	54	7.27	31.5	60.4	-	-	0.20	2.10	0.30	0.70	0.80	34.9
360	56	7.31	32.0	60.5	-	-	0.50	2.10	0.50	0.60	0.70	32.5

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.8039	25.2	53.9	53.4	57.7	51.6	51.6	44.7	51.8
30	0.340	-	-	0.7870	25.2	53.9	76.4	69.0	63.9	104.3	73.8	77.5
60	0.340	-	-	0.7838	25.2	53.9	85.5	97.8	90.5	73.9	94.2	88.4
90	0.340	-	-	0.7838	25.2	53.9	101.2	107.8	78.4	110.9	64.0	92.5
120	0.340	-	-	0.7838	25.2	53.9	85.5	116.9	97.8	64.0	78.4	88.5
150	0.340	-	-	0.7789	25.2	53.9	85.8	114.3	98.1	78.6	69.4	89.2
180	0.341	-	-	0.7789	25.2	53.9	85.7	117.0	97.9	78.5	69.2	89.7
240	0.341	-	-	0.7789	25.2	53.9	85.7	128.2	90.7	58.5	69.2	86.5
300	0.342	-	-	0.7789	25.2	53.9	54.1	119.7	45.3	69.1	73.9	72.4
360	0.343	-	-	0.7708	25.2	53.9	85.9	120.3	58.7	64.3	69.4	79.7

Conditions: Hydraulic rate = $10 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 40 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D10 Experimental data of run no.10

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm.)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	79	7.45	33.0	60.0	-	-	0.30	0.30	0.40	0.60	0.30	-
30	12	7.32	32.8	60.0	-	-	0.20	0.60	0.50	0.40	0.50	84.8
60	16	7.36	32.8	60.0	-	-	0.30	0.80	0.40	0.50	0.50	79.7
90	16	7.37	33.0	60.0	-	-	0.30	1.20	0.70	0.50	0.40	79.7
120	16	7.34	32.8	60.1	-	-	0.40	1.30	0.60	0.40	0.60	79.7
150	19	7.28	32.8	60.1	-	-	0.40	1.70	0.70	0.60	0.60	75.9
180	23	7.25	32.5	60.1	-	-	0.60	2.10	0.60	0.80	0.60	70.9
240	29	7.27	32.5	60.1	-	-	0.70	2.00	0.90	0.80	0.70	63.3
300	28	7.32	32.8	60.2	-	-	0.60	1.90	1.00	0.80	0.90	64.6
360	29	7.34	32.6	60.2	-	-	0.50	1.70	1.00	1.00	1.00	63.3

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 -1 (s)	G_2 -1 (s)	G_3 -1 (s)	G_4 -1 (s)	G_5 -1 (s)	G_{AVE} -1 (s)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7551	25.2	53.9	67.5	46.1	53.3	65.2	46.1	55.6
30	0.340	-	-	0.7582	25.2	53.9	55.0	65.1	59.4	53.1	59.4	58.4
60	0.340	-	-	0.7582	25.2	53.9	67.4	75.2	53.1	59.4	59.4	62.9
90	0.340	-	-	0.7551	25.2	53.9	67.5	92.2	70.4	59.5	53.3	68.6
120	0.341	-	-	0.7582	25.2	53.9	77.7	95.7	65.0	53.1	65.0	71.3
150	0.341	-	-	0.7582	25.2	53.9	77.7	109.5	70.2	65.0	65.0	77.5
180	0.341	-	-	0.7630	25.2	53.9	94.9	121.3	64.8	74.9	64.8	84.1
240	0.341	-	-	0.7630	25.2	53.9	102.5	118.4	79.4	74.9	70.0	89.0
300	0.341	-	-	0.7582	25.2	53.9	95.1	115.6	83.9	75.0	79.6	89.8
360	0.341	-	-	0.7614	25.2	53.9	86.6	109.1	83.7	83.7	83.7	89.4

Conditions: Hydraulic rate = $10 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 10 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D11 Experimental data of run no.11

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm.)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	82	6.92	31.0	60.0	-	-	0.10	0.60	0.40	0.40	0.20	-
30	7	6.98	32.0	60.0	-	-	0.30	0.60	0.50	0.50	0.20	91.5
60	9	7.04	32.0	60.0	-	-	0.40	0.90	0.70	0.50	0.30	89.0
90	15	7.03	32.1	60.0	-	-	0.50	1.20	0.80	0.50	0.30	81.7
120	18	7.05	32.5	60.0	-	-	0.50	1.30	0.80	0.50	0.20	78.0
150	22	7.08	32.5	60.0	-	-	0.60	1.40	0.90	0.60	0.50	73.2
180	25	7.11	32.5	60.0	-	-	0.80	1.50	0.90	0.70	0.70	69.5
240	28	7.14	32.8	60.2	-	-	0.70	1.80	0.90	0.50	0.60	65.9
300	29	7.17	32.8	60.2	-	-	0.60	1.80	0.90	0.60	0.70	64.6
360	28	7.15	32.8	60.2	-	-	0.40	1.80	0.90	0.60	1.20	65.9

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7870	25.2	53.9	38.2	63.9	52.2	52.2	36.9	48.7
30	0.340	-	-	0.7708	25.2	53.9	66.8	64.6	58.9	58.9	37.3	57.3
60	0.340	-	-	0.7708	25.2	53.9	77.2	79.1	69.7	58.9	45.6	66.1
90	0.340	-	-	0.7692	25.2	53.9	86.3	91.4	74.6	59.0	45.7	71.4
120	0.340	-	-	0.7630	25.2	53.9	86.7	95.5	74.9	59.2	37.5	70.8
150	0.340	-	-	0.7630	25.2	53.9	95.0	99.1	79.5	64.9	59.2	79.5
180	0.340	-	-	0.7630	25.2	53.9	109.7	102.6	79.5	70.1	70.1	86.4
240	0.341	-	-	0.7582	25.2	53.9	102.7	112.5	79.6	59.3	65.0	83.8
300	0.341	-	-	0.7582	25.2	53.9	95.1	112.5	79.6	65.0	70.2	84.5
360	0.341	-	-	0.7582	25.2	53.9	77.7	112.5	79.6	65.0	91.9	85.3

Conditions: Hydraulic rate = m³/m²-h, Dose of PACl = 5 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D12 Experimental data of run no.12

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	79	7.31	31.0	60.0	-	-	0.20	0.70	0.60	0.70	0.20	-
30	17	7.18	32.0	60.0	-	-	0.40	0.80	0.70	0.80	0.30	78.5
60	11	7.24	32.0	60.0	-	-	0.50	0.70	0.70	0.70	0.40	86.1
90	11	7.29	32.2	60.0	-	-	0.40	0.70	0.80	0.80	0.40	86.1
120	13	7.25	32.5	60.0	-	-	0.30	0.90	0.80	0.80	0.30	83.5
150	13	7.23	33.0	60.0	-	-	0.50	0.90	0.90	0.80	0.40	83.5
180	13	7.17	32.8	60.0	-	-	0.40	1.10	1.10	0.80	0.40	83.5
240	17	7.22	33.0	60.0	-	-	0.60	1.60	1.20	1.10	0.40	78.5
300	21	7.26	32.8	60.2	-	-	0.60	1.40	1.20	1.20	0.50	73.4
360	21	7.23	30.0	60.2	-	-	0.50	1.50	1.40	1.10	0.70	73.4
420	22	7.25	31.0	60.6	-	-	0.40	1.30	1.30	1.10	0.80	72.2

Time (min)	Porosity of media (f)			$10^{-6} \cdot \nu$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7870	25.2	53.9	54.0	69.0	63.9	69.0	36.9	58.6
30	0.340	-	-	0.7708	25.2	53.9	77.2	74.5	69.7	74.5	45.6	68.3
60	0.340	-	-	0.7708	25.2	53.9	86.3	69.7	69.7	69.7	52.7	69.6
90	0.340	-	-	0.7692	25.2	53.9	77.2	69.8	74.6	74.6	52.8	69.8
120	0.340	-	-	0.7630	25.2	53.9	67.2	79.5	74.9	74.9	45.9	68.5
150	0.340	-	-	0.7551	25.2	53.9	87.2	79.9	79.9	75.3	53.3	75.1
180	0.340	-	-	0.7582	25.2	53.9	77.8	88.1	88.1	75.2	53.1	76.5
240	0.340	-	-	0.7551	25.2	53.9	95.5	106.5	92.2	88.3	53.3	87.2
300	0.341	-	-	0.7582	25.2	53.9	95.1	99.3	91.9	91.9	59.3	87.5
360	0.341	-	-	0.8039	25.2	53.9	84.3	99.8	96.4	85.4	68.2	86.8
420	0.343	-	-	0.7870	25.2	53.9	76.0	93.6	93.6	86.1	73.4	84.5

Conditions: Hydraulic rate = 10 m³/m²-h, Dose of PACl = 2.5 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D13 Experimental data of run no.13

Time (min)	Tb (NTU)	pH	Temp (°C)	Bed Expansion			Δh_1	Δh_2	Δh_3	Δh_4	Δh_5	% Tb removal
				(cm)			(m)	(m)	(m)	(m)	(m)	
				1	2	3						
0	82	7.32	31.0	60.0	-	-	0.10	0.60	0.60	0.50	0.40	-
30	28	7.10	31.2	60.0	-	-	0.30	0.50	0.50	0.70	1.20	65.9
60	22	7.16	31.0	60.0	-	-	0.30	0.40	0.70	0.40	0.30	73.2
90	21	7.14	31.0	60.0	-	-	0.30	0.70	0.60	0.40	0.20	74.4
120	29	7.12	31.2	60.2	-	-	0.40	0.70	0.60	0.70	0.30	64.6
150	26	7.18	31.5	60.2	-	-	0.30	0.70	0.80	0.70	0.30	68.3
180	23	7.23	31.5	60.2	-	-	0.40	0.70	0.70	0.80	0.40	72.0
240	26	7.24	31.5	60.2	-	-	0.40	0.90	0.70	0.80	0.40	68.3
300	25	7.21	31.5	60.2	-	-	0.40	0.90	0.90	0.90	0.40	69.5
360	26	7.24	32.0	60.2	-	-	0.50	0.90	1.00	0.80	0.50	68.3

Time (min)	Porosity of media (f)			$10^{-6} * \nu$	θ_1	θ_{2-5}	G_1	G_2	G_3	G_4	G_5	G_{AVE}
	Top	Medium	Bottom	(m ² /s)	(s)	(s)	⁻¹ (s)	⁻¹ (s)	⁻¹ (s)	⁻¹ (s)	⁻¹ (s)	⁻¹ (s)
	layer	layer	layer									
0	0.340	-	-	0.7870	25.2	53.9	38.2	63.9	63.9	58.3	52.2	55.3
30	0.340	-	-	0.7838	25.2	53.9	66.3	58.4	58.4	69.1	90.5	68.6
60	0.340	-	-	0.7870	25.2	53.9	66.1	52.2	69.0	52.2	45.2	56.9
90	0.340	-	-	0.7870	25.2	53.9	66.1	69.0	63.9	52.2	36.9	57.6
120	0.341	-	-	0.7838	25.2	53.9	76.4	69.0	63.9	69.0	45.2	64.7
150	0.341	-	-	0.7789	25.2	53.9	66.4	69.2	74.0	69.2	45.3	64.8
180	0.341	-	-	0.7789	25.2	53.9	76.6	69.2	69.2	74.0	52.3	68.3
240	0.341	-	-	0.7789	25.2	53.9	76.6	78.5	69.2	74.0	52.3	70.2
300	0.341	-	-	0.7789	25.2	53.9	76.6	78.5	78.5	78.5	52.3	72.9
360	0.341	-	-	0.7708	25.2	53.9	86.1	78.9	83.2	74.4	58.8	76.3

Conditions: Hydraulic rate = 10 m³/m²-h, Dose of PACl = 1.25 mg/L

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D14 Experimental data of run no.14

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	86	6.98	28.5	30	-	-	0.05	0.05	0.10	-	-	-
30	23	7.31	29.2	30	-	-	0.05	0.05	0.05	-	-	73.3
60	14	7.26	29.5	30	-	-	0.05	0.05	0.10	-	-	83.7
90	11	7.24	30.0	30	-	-	0.10	0.10	0.05	-	-	87.2
120	10	7.18	30.5	30	-	-	0.10	0.10	0.05	-	-	88.4
150	9	7.15	30.5	30	-	-	0.10	0.10	0.05	-	-	89.5
180	12	7.17	31.0	30	-	-	0.05	0.05	0.20	-	-	86.0
240	11	7.19	31.0	30	-	-	0.05	0.05	0.20	-	-	87.2
300	10	7.23	31.0	30	-	-	0.05	0.05	0.20	-	-	88.4
360	10	7.26	31.0	30	-	-	0.05	0.05	0.20	-	-	88.4

Time (min)	Porosity of media (f)			$10^{-6} \cdot \nu$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.360	-	-	0.8304	100.7	215.8	12.8	8.7	12.3	-	-	11.3
30	0.360	-	-	0.8179	100.7	215.8	12.9	8.8	8.8	-	-	10.1
60	0.360	-	-	0.8127	100.7	215.8	12.9	8.8	12.5	-	-	11.4
90	0.360	-	-	0.8039	100.7	215.8	18.3	12.5	8.9	-	-	13.2
120	0.360	-	-	0.7955	100.7	215.8	18.4	12.6	8.9	-	-	13.3
150	0.360	-	-	0.7904	100.7	215.8	18.4	12.6	8.9	-	-	13.3
180	0.360	-	-	0.7870	100.7	215.8	13.1	9.0	17.9	-	-	13.3
240	0.360	-	-	0.7870	100.7	215.8	13.1	9.0	17.9	-	-	13.3
300	0.360	-	-	0.7870	100.7	215.8	13.1	9.0	17.9	-	-	13.3
360	0.360	-	-	0.7870	100.7	215.8	13.1	9.0	17.9	-	-	13.3

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 6 mm, Media depth = 30 cm

Appendix Table D15 Experimental data of run no.15

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	85	7.12	29.0	60	-	-	0.10	0.10	0.05	0.05	-	-
30	13	7.01	29.3	60	-	-	0.10	0.05	0.05	0.05	-	84.7
60	10	7.03	29.5	60	-	-	0.10	0.05	0.05	0.05	-	88.2
90	8	6.97	30.0	60	-	-	0.10	0.05	0.10	0.10	-	90.6
120	7	6.99	30.0	60	-	-	0.10	0.05	0.10	0.10	-	91.8
150	8	7.04	30.3	60	-	-	0.10	0.10	0.10	0.10	-	90.6
180	7	7.06	30.3	60	-	-	0.10	0.10	0.10	0.10	-	91.8
240	8	7.03	30.3	60	-	-	0.10	0.10	0.10	0.10	-	90.6
300	7	7.01	30.3	60	-	-	0.10	0.10	0.10	0.10	-	91.8
360	7	7.04	30.3	60	-	-	0.10	0.10	0.10	0.10	-	91.8

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.360	-	-	0.8214	100.7	215.8	18.1	12.4	8.8	8.8	-	12.0
30	0.360	-	-	0.8162	100.7	215.8	18.2	8.8	8.8	8.8	-	11.1
60	0.360	-	-	0.8127	100.7	215.8	18.2	8.8	8.8	8.8	-	11.2
90	0.360	-	-	0.8039	100.7	215.8	18.3	8.9	12.5	12.5	-	13.1
120	0.360	-	-	0.8039	100.7	215.8	18.3	8.9	12.5	12.5	-	13.1
150	0.360	-	-	0.7990	100.7	215.8	18.4	12.6	12.6	12.6	-	14.0
180	0.360	-	-	0.7990	100.7	215.8	18.4	12.6	12.6	12.6	-	14.0
240	0.360	-	-	0.7990	100.7	215.8	18.4	12.6	12.6	12.6	-	14.0
300	0.360	-	-	0.7990	100.7	215.8	18.4	12.6	12.6	12.6	-	14.0
360	0.360	-	-	0.7990	100.7	215.8	18.4	12.6	12.6	12.6	-	14.0

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 6 mm, Media depth = 60 cm

Appendix Table D16 Experimental data of run no.16

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	88	7.45	31.0	30	-	-	0.10	0.10	0.10	0.10	-	-
30	15	7.22	30.5	30	-	-	0.10	0.20	0.10	0.10	-	83.0
60	12	7.24	30.8	30	-	-	0.10	0.20	0.10	0.10	-	86.4
90	8	7.23	31.0	30	-	-	0.10	0.20	0.10	0.10	-	90.9
120	6	7.28	31.0	30	-	-	0.10	0.30	0.10	0.10	-	93.2
150	6	7.26	31.0	30	-	-	0.30	0.20	0.10	0.10	-	93.2
180	6	7.21	31.0	30	-	-	0.40	0.30	0.10	0.10	-	93.2
240	6	7.18	31.0	30	-	-	0.40	0.30	0.10	0.10	-	93.2
300	5	7.16	31.0	30	-	-	0.40	0.30	0.10	0.10	-	94.3
360	5	7.23	31.0	30	-	-	0.40	0.30	0.10	0.10	-	94.3

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 ⁻¹ (s)	G_2 ⁻¹ (s)	G_3 ⁻¹ (s)	G_4 ⁻¹ (s)	G_5 ⁻¹ (s)	G_{AVE} ⁻¹ (s)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.7870	100.7	215.8	19.1	13.0	13.0	13.0	-	14.5
30	0.340	-	-	0.7955	100.7	215.8	19.0	18.3	13.0	13.0	-	15.8
60	0.340	-	-	0.7904	100.7	215.8	19.0	18.4	13.0	13.0	-	15.9
90	0.340	-	-	0.7870	100.7	215.8	19.1	18.4	13.0	13.0	-	15.9
120	0.340	-	-	0.7870	100.7	215.8	19.1	22.6	13.0	13.0	-	16.9
150	0.340	-	-	0.7870	100.7	215.8	33.0	18.4	13.0	13.0	-	19.4
180	0.340	-	-	0.7870	100.7	215.8	38.2	22.6	13.0	13.0	-	21.7
240	0.340	-	-	0.7870	100.7	215.8	38.2	22.6	13.0	13.0	-	21.7
300	0.340	-	-	0.7870	100.7	215.8	38.2	22.6	13.0	13.0	-	21.7
360	0.340	-	-	0.7870	100.7	215.8	38.2	22.6	13.0	13.0	-	21.7

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 30 cm

Appendix Table D17 Experimental data of run no.17

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	81	7.21	29	60	-	-	0.10	0.10	0.20	0.10	0.00	-
30	26	7.02	30.8	60	-	-	0.10	0.20	0.20	0.10	0.00	67.9
60	5	7.05	31	60	-	-	0.10	0.20	0.20	0.10	0.10	93.8
90	5	7.03	31	60	-	-	0.10	0.20	0.20	0.10	0.10	93.8
120	4	7.07	31.2	60	-	-	0.10	0.20	0.20	0.10	0.10	95.1
150	3	7.06	31.2	60	-	-	0.10	0.20	0.20	0.00	0.20	96.3
180	3	7.13	31.8	60	-	-	0.30	0.30	0.20	0.20	0.20	96.3
240	3	7.14	31.8	60	-	-	0.30	0.30	0.20	0.20	0.20	96.3
300	2	7.16	31.8	60	-	-	0.30	0.30	0.20	0.20	0.20	97.5
360	2	7.09	31.8	60	-	-	0.30	0.30	0.20	0.20	0.20	97.5

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	-	-	0.8214	100.7	215.8	18.7	12.8	18.0	12.8	0.0	12.4
30	0.340	-	-	0.7904	100.7	215.8	19.0	18.4	18.4	13.0	0.0	13.8
60	0.340	-	-	0.7870	100.7	215.8	19.1	18.4	18.4	13.0	13.0	16.4
90	0.340	-	-	0.7870	100.7	215.8	19.1	18.4	18.4	13.0	13.0	16.4
120	0.340	-	-	0.7838	100.7	215.8	19.1	18.5	18.5	13.1	13.1	16.4
150	0.340	-	-	0.7838	100.7	215.8	19.1	18.5	18.5	0.0	18.5	14.9
180	0.340	-	-	0.7740	100.7	215.8	33.3	22.8	18.6	18.6	18.6	22.4
240	0.340	-	-	0.7740	100.7	215.8	33.3	22.8	18.6	18.6	18.6	22.4
300	0.340	-	-	0.7740	100.7	215.8	33.3	22.8	18.6	18.6	18.6	22.4
360	0.340	-	-	0.7740	100.7	215.8	33.3	22.8	18.6	18.6	18.6	22.4

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 60 cm

Appendix Table D18 Experimental data of run no.18

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	87	7.03	29.8	30	-	-	0.05	0.05	0.10	-	-	-
30	50	7.34	30.0	30	-	-	0.05	0.05	0.05	-	-	42.5
60	26	7.35	30.3	30	-	-	0.05	0.05	0.05	-	-	73.5
90	26	7.29	30.8	30	-	-	0.05	0.05	0.05	-	-	73.5
120	25	7.31	30.8	30	-	-	0.05	0.05	0.05	-	-	74.5
150	25	7.33	30.8	30	-	-	0.05	0.05	0.10	-	-	74.5
180	21	7.34	31.0	30	-	-	0.05	0.05	0.10	-	-	78.6
240	21	7.28	31.0	30	-	-	0.05	0.05	0.10	-	-	78.6
300	21	7.26	31.0	30	-	-	0.05	0.05	0.10	-	-	78.6
360	21	7.27	31.0	30	-	-	0.05	0.05	0.10	-	-	78.6

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 ⁻¹ (s)	G_2 ⁻¹ (s)	G_3 ⁻¹ (s)	G_4 ⁻¹ (s)	G_5 ⁻¹ (s)	G_{AVE} ⁻¹ (s)
	Top layer	Medium layer	Bottom layer									
0	0.400	-	-	0.8074	100.7	215.8	12.3	8.4	11.9	-	-	10.8
30	0.400	-	-	0.8039	100.7	215.8	12.3	8.4	8.4	-	-	9.7
60	0.400	-	-	0.7950	100.7	215.8	12.4	8.5	8.5	-	-	9.8
90	0.400	-	-	0.7904	100.7	215.8	12.4	8.5	8.5	-	-	9.8
120	0.400	-	-	0.7904	100.7	215.8	12.4	8.5	8.5	-	-	9.8
150	0.400	-	-	0.7904	100.7	215.8	12.4	8.5	12.0	-	-	11.0
180	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	-	-	11.0
240	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	-	-	11.0
300	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	-	-	11.0
360	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	-	-	11.0

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 10 mm, Media depth = 30 cm

Appendix Table D19 Experimental data of run no.19

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	87	7.41	29.5	60	-	-	0.05	0.05	0.10	0.00	0.00	-
30	18	7.26	30.5	60	-	-	0.05	0.05	0.10	0.00	0.00	79.3
60	14	7.29	31	60	-	-	0.05	0.05	0.10	0.00	0.00	83.9
90	13	7.23	31	60	-	-	0.05	0.05	0.10	0.00	0.00	85.1
120	12	7.27	31	60	-	-	0.10	0.10	0.10	0.00	0.00	86.2
150	12	7.24	31.2	60	-	-	0.10	0.10	0.10	0.00	0.00	86.2
180	10	7.25	31.5	60	-	-	0.05	0.05	0.10	0.10	0.10	88.5
240	11	7.28	31.5	60	-	-	0.05	0.05	0.10	0.10	0.10	87.4
300	10	7.21	31.5	60	-	-	0.05	0.05	0.10	0.10	0.10	88.5
360	10	7.25	31.5	60	-	-	0.05	0.05	0.10	0.10	0.10	88.5

Time (min)	Porosity of media (f)			$10^{-6} \cdot \nu$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.400	-	-	0.8127	100.7	215.8	12.2	8.4	11.8	0.0	0.0	6.5
30	0.400	-	-	0.7955	100.7	215.8	12.4	8.5	12.0	0.0	0.0	6.6
60	0.400	-	-	0.7870	100.7	215.8	12.4	8.5	12.0	0.0	0.0	6.6
90	0.400	-	-	0.7870	100.7	215.8	12.4	8.5	12.0	0.0	0.0	6.6
120	0.400	-	-	0.7870	100.7	215.8	17.6	12.0	12.0	0.0	0.0	8.3
150	0.400	-	-	0.7838	100.7	215.8	17.6	12.0	12.0	0.0	0.0	8.3
180	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	12.1	12.1	11.5
240	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	12.1	12.1	11.5
300	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	12.1	12.1	11.5
360	0.400	-	-	0.7789	100.7	215.8	12.5	8.5	12.1	12.1	12.1	11.5

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 10 mm, Media depth = 60 cm

Appendix Table D20 Experimental data of run no.20

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	85	6.95	31.8	15	15	-	0.05	0.00	0.05	-	-	-
30	45	7.16	32.0	15	15	-	0.10	0.05	0.05	-	-	47.1
60	27	7.18	31.8	15	15	-	0.10	0.05	0.05	-	-	70.7
90	14	7.15	31.8	15	15	-	0.10	0.10	0.05	-	-	84.8
120	16	7.19	31.8	15	15	-	0.10	0.10	0.05	-	-	82.6
150	15	7.14	32.0	15	15	-	0.10	0.10	0.05	-	-	83.7
180	13	7.07	32.0	15	15	-	0.10	0.10	0.05	-	-	85.9
240	15	7.06	32.0	15	15	-	0.10	0.10	0.05	-	-	83.7
300	13	7.11	32.0	15	15	-	0.10	0.10	0.05	-	-	85.9
360	14	7.13	32.0	15	15	-	0.10	0.10	0.05	-	-	84.8

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (⁻¹ (s))	G_2 (⁻¹ (s))	G_3 (⁻¹ (s))	G_4 (⁻¹ (s))	G_5 (⁻¹ (s))	G_{AVE} (⁻¹ (s))
	Top layer	Medium layer	Bottom layer									
0	0.360	0.400	-	0.7740	100.7	215.8	13.2	0.0	8.6	-	-	7.3
30	0.360	0.400	-	0.7708	100.7	215.8	18.7	8.8	8.6	-	-	12.0
60	0.360	0.400	-	0.7740	100.7	215.8	18.7	8.8	8.6	-	-	12.0
90	0.360	0.400	-	0.7740	100.7	215.8	18.7	12.4	8.6	-	-	13.2
120	0.360	0.400	-	0.7740	100.7	215.8	18.7	12.4	8.6	-	-	13.2
150	0.360	0.400	-	0.7708	100.7	215.8	18.7	12.5	8.6	-	-	13.3
180	0.360	0.400	-	0.7708	100.7	215.8	18.7	12.5	8.6	-	-	13.3
240	0.360	0.400	-	0.7708	100.7	215.8	18.7	12.5	8.6	-	-	13.3
300	0.360	0.400	-	0.7708	100.7	215.8	18.7	12.5	8.6	-	-	13.3
360	0.360	0.400	-	0.7708	100.7	215.8	18.7	12.5	8.6	-	-	13.3

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 6 mm, Media depth = 15 cm at top layer.

: Media size = 10 mm, Media depth = 15 cm at bottom layer

Appendix Table D21 Experimental data of run no.21

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	87	7.44	28.8	30	30	-	0.05	0.05	0.05	0.05	0.05	-
30	16	7.33	30.0	30	30	-	0.10	0.10	0.05	0.05	0.05	81.6
60	14	7.42	30.8	30	30	-	0.10	0.10	0.05	0.05	0.05	83.9
90	13	7.95	31.3	30	30	-	0.10	0.10	0.10	0.05	0.05	85.1
120	14	7.24	31.3	30	30	-	0.10	0.10	0.10	0.10	0.10	83.9
150	11	7.13	31.7	30	30	-	0.10	0.10	0.10	0.10	0.10	87.4
180	9	7.03	31.7	30	30	-	0.10	0.10	0.10	0.10	0.10	89.7
240	9	7.26	31.7	30	30	-	0.10	0.10	0.10	0.10	0.10	89.7
300	8	7.20	31.7	30	30	-	0.10	0.10	0.10	0.10	0.10	90.8
360	8	7.23	31.7	30	30	-	0.10	0.10	0.10	0.10	0.10	90.8

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.360	0.400	-	0.8250	100.7	215.8	12.8	8.7	8.5	8.3	8.3	9.3
30	0.360	0.400	-	0.8039	100.7	215.8	18.3	12.5	8.6	8.4	8.4	11.3
60	0.360	0.400	-	0.7904	100.7	215.8	18.5	12.6	8.7	8.5	8.5	11.4
90	0.360	0.400	-	0.7821	100.7	215.8	18.6	12.7	12.4	8.5	8.5	12.1
120	0.360	0.400	-	0.7821	100.7	215.8	18.6	12.7	12.4	12.1	12.1	13.6
150	0.360	0.400	-	0.7757	100.7	215.8	18.7	12.8	12.4	12.1	12.1	13.6
180	0.360	0.400	-	0.7757	100.7	215.8	18.7	12.8	12.4	12.1	12.1	13.6
240	0.360	0.400	-	0.7757	100.7	215.8	18.7	12.8	12.4	12.1	12.1	13.6
300	0.360	0.400	-	0.7757	100.7	215.8	18.7	12.8	12.4	12.1	12.1	13.6
360	0.360	0.400	-	0.7757	100.7	215.8	18.7	12.8	12.4	12.1	12.1	13.6

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 6 mm, Media depth = 30 cm at top layer.

: Media size = 10 mm, Media depth = 30 cm at bottom layer

Appendix Table D22 Experimental data of run no.22

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm.)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	84	7.42	30.7	15	15	-	0.10	0.10	0.10	-	-	-
30	17	7.39	30.8	15	15	-	0.10	0.10	0.10	-	-	79.8
60	13	7.43	31.2	15	15	-	0.10	0.10	0.10	-	-	84.5
90	12	7.46	31.8	15	15	-	0.10	0.10	0.10	-	-	85.7
120	13	7.35	31.6	15	15	-	0.10	0.10	0.10	-	-	84.5
150	12	7.31	31.6	15	15	-	0.10	0.10	0.20	-	-	85.7
180	11	7.34	31.2	15	15	-	0.10	0.10	0.20	-	-	86.9
240	9	7.27	31.2	15	15	-	0.10	0.10	0.20	-	-	89.3
300	9	7.80	31.2	15	15	-	0.10	0.10	0.20	-	-	89.3
360	9	7.30	31.2	15	15	-	0.10	0.10	0.20	-	-	89.3

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	0.360	-	0.7920	100.7	215.8	19.0	12.8	12.6	-	-	14.8
30	0.340	0.360	-	0.7900	100.7	215.8	19.0	12.8	12.6	-	-	14.8
60	0.340	0.360	-	0.7838	100.7	215.8	19.1	12.9	12.7	-	-	14.9
90	0.340	0.360	-	0.7740	100.7	215.8	19.2	13.0	12.8	-	-	15.0
120	0.340	0.360	-	0.7773	100.7	215.8	19.1	12.9	12.7	-	-	14.9
150	0.340	0.360	-	0.7773	100.7	215.8	19.2	12.9	18.0	-	-	16.7
180	0.340	0.360	-	0.7838	100.7	215.8	19.1	12.9	17.9	-	-	16.6
240	0.340	0.360	-	0.7838	100.7	215.8	19.1	12.9	17.9	-	-	16.6
300	0.340	0.360	-	0.7838	100.7	215.8	19.1	12.9	17.9	-	-	16.6
360	0.340	0.360	-	0.7838	100.7	215.8	19.1	12.9	17.9	-	-	16.6

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 15 cm at top layer.

: Media size = 6 mm, Media depth = 15 cm at bottom layer

Appendix Table D23 Experimental data of run no.23

Time (min)	Tb (NTU)	pH	Temp ($^{\circ}\text{C}$)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	85	7.28	29.4	30	30	-	0.10	0.10	0.10	0.10	0.10	-
30	14	7.38	30.5	30	30	-	0.10	0.20	0.10	0.10	0.10	84.1
60	8	7.18	30.7	30	30	-	0.10	0.20	0.10	0.10	0.10	90.9
90	6	7.17	30.8	30	30	-	0.10	0.20	0.10	0.10	0.10	93.2
120	7	7.15	31.1	30	30	-	0.10	0.20	0.20	0.20	0.10	92.0
150	5	7.14	31.3	30	30	-	0.10	0.20	0.20	0.20	0.10	94.3
180	6	7.21	31.3	30	30	-	0.10	0.20	0.20	0.20	0.10	93.2
240	5	7.21	31.3	30	30	-	0.10	0.20	0.20	0.20	0.10	94.3
300	6	7.19	31.3	30	30	-	0.10	0.20	0.20	0.20	0.10	93.2
360	5	7.19	31.3	30	30	-	0.10	0.20	0.20	0.20	0.10	94.3

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m^2/s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s^{-1})	G_2 (s^{-1})	G_3 (s^{-1})	G_4 (s^{-1})	G_5 (s^{-1})	G_{AVE} (s^{-1})
	Top layer	Medium layer	Bottom layer									
0	0.340	0.360	-	0.8144	100.7	215.8	18.8	12.8	12.6	12.5	12.5	13.8
30	0.340	0.360	-	0.7955	100.7	215.8	19.0	18.3	12.8	12.6	12.6	15.1
60	0.340	0.360	-	0.7920	100.7	215.8	19.0	18.4	12.8	12.6	12.6	15.1
90	0.340	0.360	-	0.7900	100.7	215.8	19.0	18.4	12.8	12.6	12.6	15.1
120	0.340	0.360	-	0.7854	100.7	215.8	19.1	18.5	18.2	17.9	12.7	17.3
150	0.340	0.360	-	0.7821	100.7	215.8	19.1	18.5	18.2	18.0	12.7	17.3
180	0.340	0.360	-	0.7821	100.7	215.8	19.1	18.5	18.2	18.0	12.7	17.3
240	0.340	0.360	-	0.7821	100.7	215.8	19.1	18.5	18.2	18.0	12.7	17.3
300	0.340	0.360	-	0.7821	100.7	215.8	19.1	18.5	18.2	18.0	12.7	17.3
360	0.340	0.360	-	0.7821	100.7	215.8	19.1	18.5	18.2	18.0	12.7	17.3

Conditions: Hydraulic rate = $2.5 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 30 cm at top layer.

: Media size = 6 mm, Media depth = 30 cm at bottom layer

Appendix Table D24 Experimental data of run no.24

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	85	7.73	27.6	15	15	-	0.05	0.05	0.05	0.05	-	-
30	51	7.35	28.2	15	15	-	0.10	0.20	0.10	0.10	-	40.0
60	13	7.3	28.6	15	15	-	0.10	0.10	0.10	0.10	-	84.7
90	11	7.23	28.7	15	15	-	0.20	0.10	0.10	0.10	-	87.1
120	12	7.13	29.1	15	15	-	0.20	0.10	0.10	0.10	-	85.9
150	11	7.21	29.1	15	15	-	0.20	0.20	0.10	0.10	-	87.1
180	11	7.17	29.5	15	15	-	0.20	0.20	0.10	0.10	-	87.1
240	11	7.39	29.5	15	15	-	0.20	0.20	0.10	0.10	-	87.1
300	11	7.22	29.5	15	15	-	0.20	0.20	0.10	0.10	-	87.1
360	11	7.13	29.5	15	15	-	0.20	0.20	0.10	0.10	-	87.1

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	0.400	-	0.8469	100.7	215.8	13.0	8.5	8.2	8.2	-	9.5
30	0.340	0.400	-	0.8358	100.7	215.8	18.5	17.1	11.7	11.7	-	14.7
60	0.340	0.400	-	0.8286	100.7	215.8	18.6	12.2	11.7	11.7	-	13.5
90	0.340	0.400	-	0.8268	100.7	215.8	26.3	12.2	11.7	11.7	-	15.5
120	0.340	0.400	-	0.8197	100.7	215.8	26.4	12.2	11.8	11.8	-	15.6
150	0.340	0.400	-	0.8197	100.7	215.8	26.4	17.3	11.8	11.8	-	16.8
180	0.340	0.400	-	0.8127	100.7	215.8	26.6	17.4	11.8	11.8	-	16.9
240	0.340	0.400	-	0.8127	100.7	215.8	26.6	17.4	11.8	11.8	-	16.9
300	0.340	0.400	-	0.8127	100.7	215.8	26.6	17.4	11.8	11.8	-	16.9
360	0.340	0.400	-	0.8127	100.7	215.8	26.6	17.4	11.8	11.8	-	16.9

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 15 cm at top layer.

: Media size = 10 mm, Media depth = 15 cm at bottom layer

Appendix Table D25 Experimental data of run no.25

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	82	6.86	28.7	30	30	-	0.10	0.20	0.10	0.10	0.05	-
30	16	7.20	29.7	30	30	-	0.10	0.20	0.10	0.10	0.10	80.5
60	15	7.15	29.8	30	30	-	0.10	0.30	0.10	0.10	0.10	81.7
90	8	7.29	29.9	30	30	-	0.10	0.20	0.10	0.10	0.10	90.2
120	7	7.30	30.0	30	30	-	0.10	0.20	0.10	0.10	0.10	91.5
150	7	7.43	29.9	30	30	-	0.20	0.40	0.10	0.10	0.10	91.5
180	6	7.67	29.9	30	30	-	0.20	0.40	0.10	0.10	0.10	92.7
240	6	7.59	29.9	30	30	-	0.20	0.40	0.10	0.10	0.10	92.7
300	6	7.50	29.9	30	30	-	0.20	0.40	0.10	0.10	0.10	92.7
360	6	7.44	29.9	30	30	-	0.20	0.40	0.10	0.10	0.10	92.7
Time (min)	Porosity of media (f)			$10^{-6} * \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 -1 (S)	G_2 -1 (S)	G_3 -1 (S)	G_4 -1 (S)	G_5 -1 (S)	G_{AVE} -1 (S)
	Top layer	Medium layer	Bottom layer									
0	0.340	0.400	-	0.8268	100.7	215.8	18.6	18.0	12.2	11.7	8.3	13.8
30	0.340	0.400	-	0.8092	100.7	215.8	18.8	18.2	12.3	11.9	11.9	14.6
60	0.340	0.400	-	0.8074	100.7	215.8	18.8	22.3	12.3	11.9	11.9	15.4
90	0.340	0.400	-	0.8057	100.7	215.8	18.9	18.2	12.3	11.9	11.9	14.6
120	0.340	0.400	-	0.8039	100.7	215.8	18.9	18.2	12.4	11.9	11.9	14.7
150	0.340	0.400	-	0.8057	100.7	215.8	26.7	25.8	12.3	11.9	11.9	17.7
180	0.340	0.400	-	0.8057	100.7	215.8	26.7	25.8	12.3	11.9	11.9	17.7
240	0.340	0.400	-	0.8057	100.7	215.8	26.7	25.8	12.3	11.9	11.9	17.7
300	0.340	0.400	-	0.8057	100.7	215.8	26.7	25.8	12.3	11.9	11.9	17.7
360	0.340	0.400	-	0.8057	100.7	215.8	26.7	25.8	12.3	11.9	11.9	17.7

Conditions: Hydraulic rate = $2.5 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 30 cm at top layer.

: Media size = 10 mm, Media depth = 30 cm at bottom layer

Appendix Table D26 Experimental data of run no.26

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	86	7.41	28.7	10	10	10	0.10	0.10	0.10	-	-	-
30	18	7.17	29.4	10	10	10	0.10	0.10	0.10	-	-	79.1
60	17	7.27	29.7	10	10	10	0.10	0.20	0.10	-	-	80.2
90	18	7.31	29.8	10	10	10	0.10	0.20	0.10	-	-	79.1
120	15	7.23	29.9	10	10	10	0.10	0.20	0.10	-	-	82.6
150	13	7.23	29.9	10	10	10	0.10	0.20	0.10	-	-	84.9
180	13	7.23	29.9	10	10	10	0.10	0.20	0.10	-	-	84.9
240	12	7.28	29.9	10	10	10	0.10	0.20	0.10	-	-	86.0
300	11	7.21	29.9	10	10	10	0.10	0.20	0.10	-	-	87.2
360	12	7.20	29.9	10	10	10	0.10	0.20	0.10	-	-	86.0

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	0.360	0.400	0.8268	100.7	215.8	18.6	11.5	11.7	-	-	14.0
30	0.340	0.360	0.400	0.8144	100.7	215.8	18.8	11.6	11.8	-	-	14.1
60	0.340	0.360	0.400	0.8092	100.7	215.8	18.8	16.5	11.9	-	-	15.7
90	0.340	0.360	0.400	0.8074	100.7	215.8	18.8	16.5	11.9	-	-	15.7
120	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	16.5	11.9	-	-	15.8
150	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	16.5	11.9	-	-	15.8
180	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	16.5	11.9	-	-	15.8
240	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	16.5	11.9	-	-	15.8
300	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	16.5	11.9	-	-	15.8
360	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	16.5	11.9	-	-	15.8

Conditions: Hydraulic rate = $2.5 \text{ m}^3/\text{m}^2\text{-h}$, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 10 cm at top layer.

: Media size = 6 mm, Media depth = 10 cm at medium layer.

: Media size = 10 mm, Media depth = 10 cm at bottom layer

Appendix Table D27 Experimental data of run no.27

Time (min)	Tb (NTU)	pH	Temp (⁰ C)	Bed Expansion (cm)			Δh_1 (m)	Δh_2 (m)	Δh_3 (m)	Δh_4 (m)	Δh_5 (m)	% Tb removal
				1	2	3						
0	85	7.33	28.7	20	20	20	0.10	0.10	0.10	0.10	0.10	-
30	11	7.14	29.4	20	20	20	0.10	0.10	0.10	0.10	0.10	87.1
60	10	7.27	29.7	20	20	20	0.20	0.20	0.10	0.10	0.05	88.2
90	9	7.26	29.8	20	20	20	0.20	0.20	0.10	0.10	0.05	89.4
120	10	7.29	29.9	20	20	20	0.20	0.20	0.10	0.10	0.05	88.2
150	8	7.28	29.9	20	20	20	0.25	0.20	0.10	0.10	0.05	90.6
180	7	7.29	29.9	20	20	20	0.25	0.20	0.10	0.10	0.05	91.8
240	8	7.23	29.9	20	20	20	0.25	0.20	0.10	0.10	0.05	90.6
300	8	7.26	29.9	20	20	20	0.25	0.20	0.10	0.10	0.05	90.6
360	8	7.05	29.9	20	20	20	0.25	0.20	0.10	0.10	0.05	90.6

Time (min)	Porosity of media (f)			$10^{-6} \cdot \gamma$ (m ² /s)	θ_1 (s)	θ_{2-5} (s)	G_1 (s ⁻¹)	G_2 (s ⁻¹)	G_3 (s ⁻¹)	G_4 (s ⁻¹)	G_5 (s ⁻¹)	G_{AVE} (s ⁻¹)
	Top layer	Medium layer	Bottom layer									
0	0.340	0.360	0.400	0.8322	100.7	215.8	18.6	12.5	12.3	10.7	11.7	13.2
30	0.340	0.360	0.400	0.8057	100.7	215.8	18.9	12.7	12.5	10.9	11.9	13.4
60	0.340	0.360	0.400	0.7990	100.7	215.8	26.8	18.0	12.6	10.9	8.4	15.3
90	0.340	0.360	0.400	0.7990	100.7	215.8	26.8	18.0	12.6	10.9	8.4	15.3
120	0.340	0.360	0.400	0.7950	100.7	215.8	26.8	18.1	12.6	11.0	8.5	15.4
150	0.340	0.360	0.400	0.7950	100.7	215.8	30.0	18.1	12.6	11.0	8.5	16.0
180	0.340	0.360	0.400	0.7940	100.7	215.8	30.0	18.1	12.6	11.0	8.5	16.0
240	0.340	0.360	0.400	0.7940	100.7	215.8	30.0	18.1	12.6	11.0	8.5	16.0
300	0.340	0.360	0.400	0.7940	100.7	215.8	30.0	18.1	12.6	11.0	8.5	16.0
360	0.340	0.360	0.400	0.7940	100.7	215.8	30.0	18.1	12.6	11.0	8.5	16.0

Conditions: Hydraulic rate = 2.5 m³/m²-h, Dose of PACl = 2.5 mg/L.

: Media size = 3 mm, Media depth = 20 cm at top layer.

: Media size = 6 mm, Media depth = 20 cm at medium layer.

: Media size = 10 mm, Media depth = 20 cm at bottom layer

APPENDIX E
FLOC SIZE DISTRIBUTION

Appendix Table E.1 Floc size distribution of run no. 1

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	47	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53
60min	37	12	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
90min	26	29	13	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
120min	18	23	15	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
150min	12	30	17	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
180min	10	21	24	7	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
240min	12	14	22	11	8	12	6	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	94
300min	14	12	28	11	13	7	8	9	4	3	3	-	-	-	-	-	-	-	-	-	-	-	112
360min	12	17	22	16	12	13	7	5	1	2	2	3	-	-	-	-	-	-	-	-	-	-	112
420min	11	15	21	24	13	9	10	8	6	5	3	4	2	-	-	-	-	-	-	-	-	-	131
480min	16	13	19	26	14	8	9	12	10	5	3	3	4	-	-	-	-	-	-	-	-	-	142

Appendix Table E2 Floc size distribution of run no. 2

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	47	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53
60min	37	12	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
90min	26	29	13	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
120min	18	23	15	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
150min	12	30	17	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
180min	10	21	24	7	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
240min	12	14	22	11	8	12	6	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	94
300min	14	12	28	11	13	7	8	9	4	3	3	-	-	-	-	-	-	-	-	-	-	-	112
360min	12	17	22	16	12	13	7	5	1	2	2	3	-	-	-	-	-	-	-	-	-	-	112
420min	11	15	21	24	13	9	10	8	6	5	3	4	2	-	-	-	-	-	-	-	-	-	131
480min	16	13	19	26	14	8	9	12	10	5	3	3	4	-	-	-	-	-	-	-	-	-	142

Appendix Table E3 Floc size distribution of run no. 3

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	47	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53
60min	37	12	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
90min	26	29	13	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
120min	18	23	15	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
150min	12	30	17	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
180min	10	21	24	7	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
240min	12	14	22	11	8	12	6	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	94
300min	14	12	28	11	13	7	8	9	4	3	3	-	-	-	-	-	-	-	-	-	-	-	112
360min	12	17	22	16	12	13	7	5	1	2	2	3	-	-	-	-	-	-	-	-	-	-	112
420min	11	15	21	24	13	9	10	8	6	5	3	4	2	-	-	-	-	-	-	-	-	-	131
480min	16	13	19	26	14	8	9	12	10	5	3	3	4	-	-	-	-	-	-	-	-	-	142

Appendix Table E.4 Floc size distribution of run no. 4

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
60min	16	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
120min	11	13	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
180min	8	16	12	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
240min	8	12	7	6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39
300min	4	10	15	12	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
360min	8	14	20	14	12	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
420min	5	9	17	10	4	6	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58
480min	12	9	18	13	11	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71
540min	3	7	21	14	10	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
600min	7	6	16	9	2	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
660min	4	13	23	16	10	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70
720min	9	3	15	10	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
780min	8	4	16	9	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43

Appendix Table E4 Floc size distribution of run no. 4 (cont'd)

Time	Floc size (μm)																			Sum			
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064		1120	1176	1232
840min	10	13	19	11	8	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65
900min	12	14	15	9	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
960min	9	8	13	10	4	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
1020min	7	9	18	7	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
1080min	11	12	16	9	2	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58
1140min	8	8	11	9	3	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
1200min	13	14	17	11	7	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
1260min	9	13	15	11	6	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
1320min	6	7	14	8	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
1380min	8	11	16	9	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
1440min	5	7	11	9	5	2	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46

Appendix Table E5 Floc size distribution of run no. 5

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
60min	16	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
90min	15	9	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
120min	15	18	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
150min	16	20	14	8	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66
180min	11	19	22	15	10	9	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	89
240min	12	17	20	19	9	8	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	91
300min	15	14	24	20	14	11	9	8	7	-	-	-	-	-	-	-	-	-	-	-	-	-	122
360min	10	13	14	19	16	11	9	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-	107
420min	13	12	14	16	13	9	5	6	4	2	-	-	-	-	-	-	-	-	-	-	-	-	94
480min	14	15	15	17	11	13	9	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	99
520min	17	14	19	23	18	15	11	4	6	1	-	-	-	-	-	-	-	-	-	-	-	-	128

Appendix Table E.6 Floc size distribution of run no.6

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
60min	12	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
90min	13	8	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
120min	11	14	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
150min	13	16	14	9	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59
180min	10	14	19	15	10	9	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	79
240min	11	15	16	13	9	8	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
300min	11	14	20	18	12	6	5	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	93
360min	10	16	18	12	9	8	4	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	86

Appendix Table E7 Floc size distribution of run no. 7

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
60min	35	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
90min	30	25	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83
120min	30	34	27	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	103
150min	31	36	33	19	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125
180min	23	28	37	30	27	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159
240min	26	31	33	28	31	25	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	179
300min	27	30	32	31	28	13	16	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	189
360min	19	27	30	26	23	16	19	13	11	-	-	-	-	-	-	-	-	-	-	-	-	-	184

Appendix Table E8 Floc size distribution of run no. 8

Time	Floc size (μm)																						Sum
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176	1232	
30min	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
60min	23	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
90min	16	20	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50
120min	14	20	16	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62
150min	18	19	14	13	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
180min	20	22	17	14	13	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	97
240min	14	19	21	18	15	14	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	111
300min	20	12	20	14	18	16	12	9	6	-	-	-	-	-	-	-	-	-	-	-	-	-	127
360min	11	15	26	16	14	13	10	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	115

Appendix Table E9 Floc size distribution of run no. 9

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	13	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
60min	11	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
90min	13	11	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
120min	10	14	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
150min	6	9	7	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
180min	9	12	10	7	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
240min	12	15	11	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45
300min	8	12	9	7	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
360min	4	10	15	12	9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55

Appendix Table E10 Floc size distribution of run no. 10

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	40	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76
60min	38	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	69
90min	33	35	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100
120min	29	37	34	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	131
150min	35	41	37	33	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	175
180min	35	37	32	29	24	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	176
240min	31	34	38	33	30	29	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220
300min	26	29	32	30	27	26	23	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	214
360min	31	33	34	30	26	29	23	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	225
420min	29	33	36	30	27	24	22	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	222

Appendix Table E11 Floc size distribution of run no. 11

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	45	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84
60min	41	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78
90min	37	40	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	111
120min	34	37	34	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	135
150min	38	41	37	33	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	173
180min	35	43	40	35	28	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	203
240min	38	41	45	36	35	33	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	254
300min	33	37	39	35	33	31	27	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	251
360min	31	33	36	30	31	29	25	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	232

Appendix Table E12 Floc size distribution of run no. 12

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	42	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80
60min	39	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
90min	43	39	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	118
120min	36	41	38	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	149
150min	36	40	37	33	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	175
180min	35	44	39	30	29	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	201
240min	38	41	42	36	35	33	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	254
300min	33	37	44	37	34	31	25	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	259
360min	31	33	39	30	27	24	21	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	221

Appendix Table E15 Floc size distribution of run no. 15

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	35	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
60min	28	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
90min	23	16	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
120min	17	20	14	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
150min	14	18	11	6	5	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58
180min	9	13	12	10	4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
240min	6	9	14	13	10	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55
300min	6	12	15	11	10	6	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	66
360min	8	7	14	10	12	6	4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	65

Appendix Table E16 Floc size distribution of run no. 16

Time	Floc size (μm)																						Sum
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176	1232	
30min	31	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
60min	29	33	11	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
90min	21	22	24	12	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	81
120min	13	16	21	14	12	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	81
150min	11	13	14	20	17	14	4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	98
180min	9	12	10	19	16	12	9	6	3	2	3	1	1	-	-	-	-	-	-	-	-	-	103
240min	6	7	8	10	19	13	14	16	8	6	5	2	3	2	-	-	-	-	-	-	-	-	119
300min	7	9	9	14	26	22	17	10	7	4	1	2	1	-	1	1	-	-	-	-	-	-	131
360min	5	7	11	15	24	18	16	17	10	6	-	2	2	-	1	-	-	-	-	-	-	-	134

Appendix Table E17 Floc size distribution of run no. 17

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	31	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
60min	26	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
90min	17	19	10	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
120min	13	17	9	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45
150min	8	10	11	6	5	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44
180min	12	13	19	14	4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66
240min	6	8	14	17	13	1	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	63
300min	10	12	12	15	10	6	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	71
360min	8	7	9	16	12	8	5	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	70

Appendix Table E18 Floc size distribution of run no. 18

Time	Floc size (μm)																			Sum			
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064		1120	1176	1232
30min	36	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48
60min	28	11	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
90min	17	24	14	6	8	5	4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	82
120min	8	10	21	15	9	2	2	1	2	2	1	3	-	-	-	-	-	-	-	-	-	-	76
150min	9	11	14	22	16	5	3	1	4	-	2	-	1	2	-	-	-	-	-	-	-	-	90
180min	11	9	11	23	30	17	13	4	2	3	2	2	1	2	1	3	2	-	-	-	-	-	136
240min	8	12	10	22	41	17	8	4	2	2	2	-	-	-	3	1	3	1	-	-	-	-	137
300min	6	15	13	19	27	36	13	9	7	3	2	-	-	1	2	-	-	-	2	3	-	-	159
360min	6	13	15	18	23	28	13	11	9	5	3	1	2	3	1	1	1	2	1	2	-	-	158

Appendix Table E19 Floc size distribution of run no. 19

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	35	14	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50
60min	28	12	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45
90min	20	19	11	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57
120min	10	22	14	10	9	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70
150min	11	14	16	13	6	5	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	72
180min	11	12	25	23	16	17	13	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	125
240min	10	12	20	28	17	15	8	4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	121
300min	13	15	21	30	27	16	13	9	7	3	2	1	-	-	-	-	-	-	-	-	-	-	157
360min	13	13	15	31	23	14	10	11	9	5	3	1	2	-	-	-	-	-	-	-	-	-	150

Appendix Table E20 Floc size distribution of run no. 20

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	32	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
60min	23	10	6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44
90min	11	13	9	6	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
120min	10	15	20	9	3	3	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	66
150min	7	7	22	13	7	4	3	5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	74
180min	6	12	14	20	12	9	7	2	2	2	-	2	-	-	-	-	-	-	-	-	-	-	88
240min	10	16	19	25	12	3	4	4	1	2	2	2	-	-	-	-	-	-	-	-	-	-	100
300min	11	13	14	26	11	2	5	5	5	4	2	3	1	2	-	-	-	-	-	-	-	-	104
360min	7	14	20	30	11	7	3	2	2	1	1	-	3	3	2	-	-	-	-	-	-	-	106

Appendix Table E21 Floc size distribution of run no. 21

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	30	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
60min	26	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
90min	16	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
120min	14	23	12	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
150min	10	18	13	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
180min	8	16	12	14	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59
240min	13	12	16	10	9	8	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	73
300min	10	14	19	13	7	4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71
360min	11	14	20	14	12	5	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	81

Appendix Table E23 Floc size distribution of run no. 23

Time	Floc size (μm)																						Sum
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176	1232	
30min	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
60min	31	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
90min	27	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38
120min	28	10	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
150min	27	19	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51
180min	25	17	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48
240min	24	17	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
300min	20	26	8	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62
360min	21	23	6	5	3	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63

Appendix Table E24 Floc size distribution of run no. 24

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	31	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
60min	23	28	8	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62
90min	20	26	17	11	9	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90
120min	16	17	27	12	9	4	5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	98
150min	10	18	21	13	14	10	7	5	2	2	1	2	-	-	-	-	-	-	-	-	-	-	105
180min	8	11	15	19	12	15	10	6	7	2	3	2	-	2	1	-	-	-	-	-	-	-	113
240min	10	11	13	22	12	9	11	7	7	4	3	3	3	-	-	2	-	-	-	-	-	-	117
300min	7	9	11	15	19	14	12	8	6	6	4	3	1	2	1	1	1	-	-	-	-	-	120
360min	9	8	12	18	23	14	8	6	7	4	4	2	2	1	2	1	1	-	-	2	1	-	125

Appendix Table E25 Floc size distribution of run no. 25

Time	Floc size (μm)																				Sum		
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120		1176	1232
30min	28	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
60min	23	15	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
90min	20	25	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54
120min	16	24	14	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60
150min	18	21	13	10	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71
180min	10	12	15	10	8	9	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
240min	11	11	17	9	12	9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
300min	15	16	23	13	6	5	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	88
360min	19	15	26	17	5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	89

Appendix Table E26 Floc size distribution of run no. 26

Time	Floc size (μm)																						Sum
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176	1232	
30min	44	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
60min	36	24	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
90min	25	34	10	4	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82
120min	23	27	16	8	8	6	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94
150min	22	32	19	8	9	3	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	99
180min	14	21	37	10	9	5	5	3	5	5	7	-	-	-	-	-	-	-	-	-	-	-	121
240min	9	11	23	43	7	9	6	4	3	5	2	1	2	4	2	-	-	-	-	-	-	-	131
300min	12	15	37	41	9	4	8	4	4	2	-	3	3	1	1	1	-	-	-	-	-	-	145
360min	8	10	25	36	13	9	9	5	7	5	3	2	1	2	5	3	-	-	-	-	-	-	143

Appendix Table E27 Floc size distribution of run no. 27

Time	Floc size (μm)																					Sum	
	56	112	168	224	280	336	392	448	504	560	616	680	728	784	840	896	952	1008	1064	1120	1176		1232
30min	44	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
60min	36	24	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
90min	25	34	10	4	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82
120min	23	27	16	8	8	6	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94
150min	22	32	19	8	9	3	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	99
180min	14	21	37	10	9	5	5	3	5	5	7	-	-	-	-	-	-	-	-	-	-	-	121
240min	9	11	23	43	7	9	6	4	3	5	2	1	2	4	2	-	-	-	-	-	-	-	131
300min	12	15	37	41	9	4	8	4	4	2	-	3	3	1	1	1	-	-	-	-	-	-	145
360min	8	10	25	36	13	9	9	5	7	5	3	2	1	2	5	3	-	-	-	-	-	-	143

APPENDIX F
IMAGE PROCESSING STEPS

```

1  %===== convert flie format =====
2
3  clear, close all;
4  I = imread('new1.jpg');
5  imwrite(I,'new2.tif');
6  map = [cool(255); ];
7  whos
8  image(I);
9  title('Original Color Indexed Image')
10 colormap(map); colorbar
11
12 %===== Gray Scale =====
13
14 I2 = .2990*I(:, :, 1)+.5870*I(:, :, 2)+.1140*I(:, :, 3);
15 min(I2(:));
16 max(I2(:));
17 n = 255;
18 map2 = gray(n);
19 figure,colormap(gray(256));
20 image(I2),title('Processed Gray Scale Indexed Image')
21 colormap(map2), colorbar;
22 figure, imhist(I2);
23 imwrite(I2,'new3.tif');
24
25 %===== Corp =====
26
27 I3 = imcrop(I2,[707 564 708 1690]);
28 figure,imshow(I3)
29 figure,imhist(I3)
30 imwrite(I3,'new4.tif');
31

```

Tissy2.m* x Tissy1.m x Floc Size.m x

script Ln 39 Col 1 OVR

Appendix Figure F1 Image processing steps

```

32 %===== select floc =====
33
34 J = imadjust(I3,[0.1 0.83],[ ]);
35 figure, imshow(J);
36 level = graythresh(J);
37
38 %===== convert to binary =====
39
40 BW = im2bw(J,level);
41 figure,imshow(BW);
42 imwrite(BW,'new4.tif');
43
44 %===== change background =====
45
46 figure,imshow(~BW);
47 imwrite(~BW,'new5.tif');
48
49 %===== count number & area =====
50
51 [labeled,numObjects] = bwlabel(~BW,8);
52 numObjects
53 L = bwlabel(~BW);
54 s = regionprops(L,'all');
55 %s(1)
56 Area = sort([s.Area]);
57
58 %===== Diameter =====
59
60 for i = 1:numObjects
61     pixel(i) = sqrt((4*area)/pi);
62 end

```

Tissy2.m* x Tissy1.m x Floc Size.m x

script Ln 70 Col 1 OVR

Appendix Figure F2 Image processing steps (cont'd)

```

64  %===== conversion pixel to um =====
65
66  for i = 1:numObjects
67      z(i) = pixel(i)*3.55*1.4*10;
68  end
69
70  %===== Data =====
71
72  size = sort(z);
73  pixel
74  size
75  PlotY
76  numObjects
77  max = max(size); max
78  min = min(size); min
79  median = median(size); median
80  mean = mean(size); mean
81
82  %===== Finish =====
83
84
85

```

Appendix Figure F3 Image processing steps (cont'd)