LAMPIRAN

Tabel 1. Hasil Praktikum Filtrasi dengan Lumpur Waduk UNDIP

Variabel	Block	Tekanan (kg/cm2)	Konsentrasi (gr/L)	Cake (gr)	TSS (gr/mL)	SC (%)
1	1 (Tawas)	60,00000	80,0000	1220	6	99,0212
2	1 (Tawas)	60,00000	120,0000	1230	8	98,7076
3	1 (Tawas)	80,00000	80,0000	1510	9	98,8150
4	1 (Tawas)	80,00000	120,0000	1550	11	98,5906
5	1 (Tawas)	70,00000	100,0000	1500	7	99,0710
6	2 (PAC)	55,85786	100,0000	1710	7	99,1846
7	2 (PAC)	84,14214	100,0000	1910	8	99,1658
8	2 (PAC)	70,00000	71,7157	1790	9	98,9994
9	2 (PAC)	70,00000	128,2843	1520	40	94,8718
10	2 (PAC)	70,00000	100,0000	1630	9	98,9018

1. Lampiran Perhitungan

   a. Viskositas $(\mu) = \frac{tx.dx}{d0.t0} \times \mu o$

   Dimana : μ = viskositas

   μo = viskositas air

   dx/do = perbandingan density

   tx/to = perbandingan waktu

Tabel 2. Data Perhitungan Viskositas

Variabel	Densitas sampel (gr/ml)	Densitas air (gr/ml)	Waktu sampel (s)	Waktu air (s)
1.	0,9868	1	0,91	0,8
2.	0,9888	1	0,89	0,8
3.	0,9964	1	0,85	0,8
4.	0,9996	1	0,83	0,8
5.	0,9872	1	0,94	0,8
6.	0,9868	1	0,93	0,8
7.	0,994	1	0,83	0,8
8.	0,9936	1	0,95	0,8
9.	1,0008	1	0,9	0,8
10.	0,9968	1	0,89	0,8

1. $\mu(1) = \frac{0{,}987 \; x \; 0{,}91 \; gr/ml}{1 \; x \; 0{,}8 \; gr/ml} \times 1{,}002 \text{ cp} = 1{,}12 \text{ cp}$

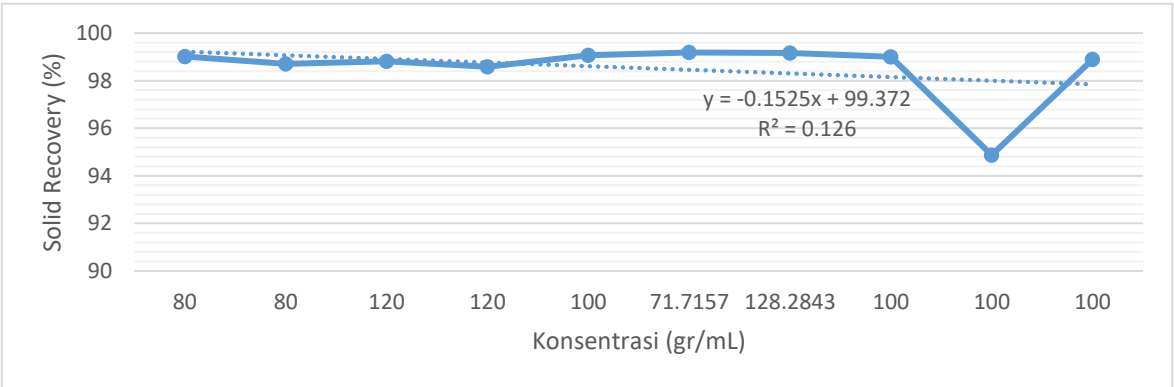
2. $\mu(2) = \frac{0{,}989 \; x \; 0{,}89 \; gr/ml}{1 \; x \; 0{,}8 \; gr/ml} \times 1{,}002 \text{ cp} = 1{,}10 \text{ cp}$

3. $\mu(3) = \frac{0{,}996\ x\ 0{,}85\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,06 cp
4. $\mu(4) = \frac{1{,}000\ x\ 0{,}83\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,04 cp
5. $\mu(5) = \frac{0{,}987\ x\ 0{,}94\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,16 cp
6. $\mu(6) = \frac{0{,}987\ x\ 0{,}93\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,15 cp
7. $\mu(7) = \frac{0{,}994\ x\ 0{,}83\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,03 cp
8. $\mu(8) = \frac{0{,}994\ x\ 0{,}95\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,18 cp
9. $\mu(9) = \frac{1{,}001\ x\ 0{,}9\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,13 cp
10. $\mu(10) = \frac{0{,}997\ x\ 0{,}89\ gr/ml}{1\ x\ 0{,}8\ gr/ml}$ x 1,002 cp = 1,11 cp

b. Solid Recovery (%)

Tabel 3. Data Solid Recovery (%)

Variabel	Cake (gr)	TSS (gr/mL)	Solid Recovery (%)
1	1220	6	99,021
2	1230	8	98,708
3	1510	9	98,815
4	1550	11	98,591
5	1500	7	99,071
6	1710	7	99,185
7	1910	8	99,166
8	1790	9	98,999
9	1520	40	94,872
10	1630	9	98,902



Gambar 1. Grafik Pengaruh Konsentrasi terhadap Solid Recovery

Solid Recovery (%)

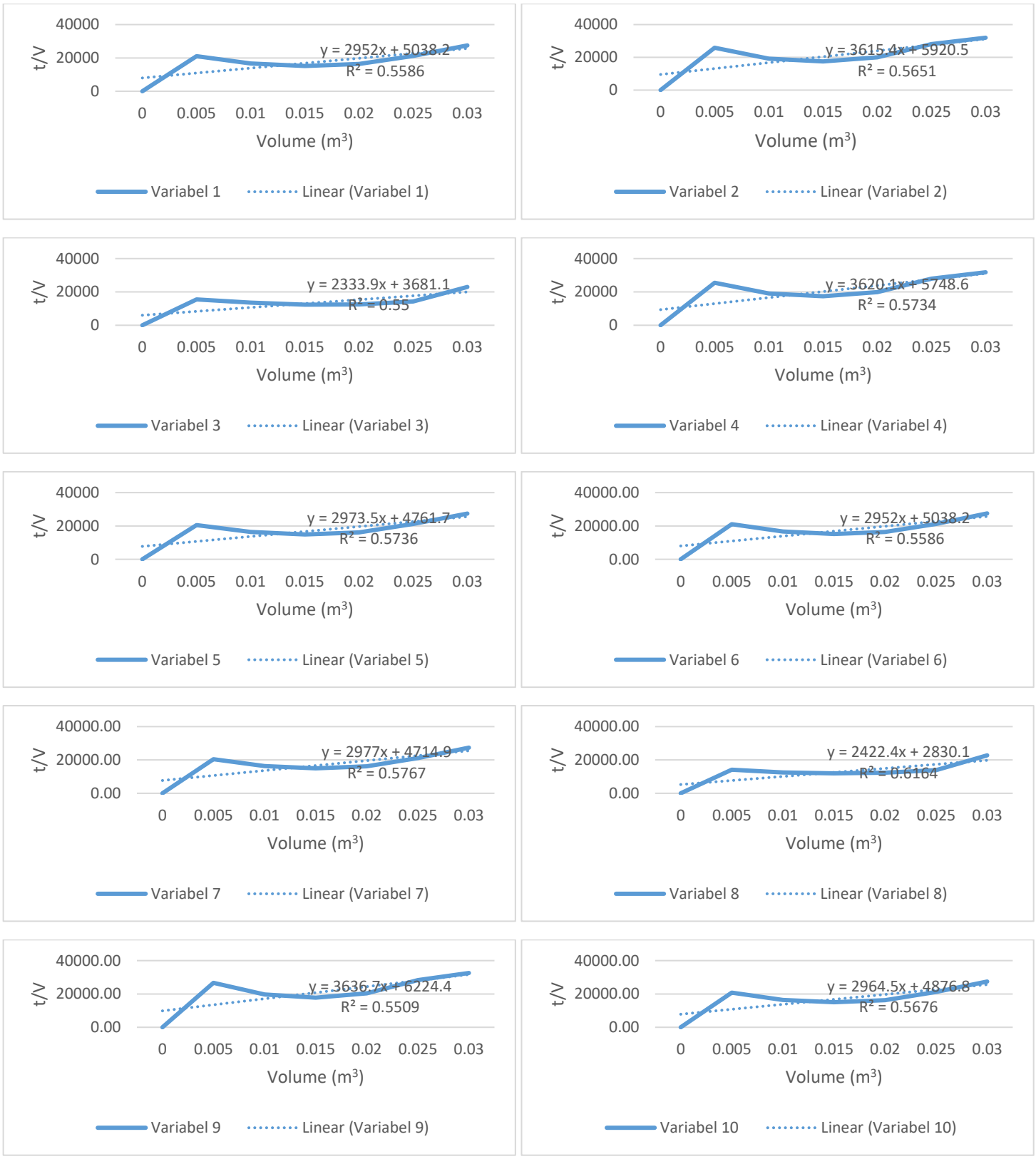
SC(%) = $\frac{Massa\ cake\ (gr) - Massa\ filtrat\ (gr)}{Massa\ total\ (gr)}$ x 100% = 99,021%

1. SC(%) = $\frac{1220-6}{1220+6}$ x 100% = 99,021%
2. SC(%) = $\frac{1230-8}{1230+8}$ x 100% = 98,708%
3. SC(%) = $\frac{1510-9}{1510+9}$ x 100% = 98,815%
4. SC(%) = $\frac{1550-11}{1550+11}$ x 100% = 98,591%
5. SC(%) = $\frac{1500-7}{1500+7}$ x 100% = 99,071%
6. SC(%) = $\frac{1710-7}{1710+7}$ x 100% = 99,185%
7. SC(%) = $\frac{1910-8}{1910+8}$ x 100% = 99,166%
8. SC(%) = $\frac{1790-9}{1790+9}$ x 100% = 98,999%
9. SC(%) = $\frac{1520-40}{1520+40}$ x 100% = 94,872%
10. SC(%) = $\frac{1630-9}{1630+9}$ x 100% = 98,902%

c. Alpha (α)

Tabel 4. Nilai t/v terhadap V

Volume Filtrat	Variabel 1 (80 gr/L)		Variabel 2 (80 gr/L)		Variabel 3 (120 gr/L)		Variabel 4 (120 gr/L)		Variabel 5 (100 gr/L)	
(*V, m3)*	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)
0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,005	80,78	16156,0	129,10	25820,0	77,52	15504,0	127,27	25454,0	102,73	20546,0
0,01	141,19	14119,0	192,15	19215,0	135,25	13525,0	190,10	19010,0	163,54	16354,0
0,015	192,97	12864,7	263,31	17554,0	185,72	12381,3	261,46	17430,7	224,27	14951,3
0,02	252,19	12609,5	401,27	20063,5	250,32	12516,0	398,35	19917,5	323,81	16190,5
0,025	359,19	14367,6	701,14	28045,6	355,20	14208,0	700,19	28007,6	528,32	21132,8
0,03	691,67	23055,7	959,32	31977,3	689,51	22983,7	953,47	31782,3	822,49	27416,3
Volume Filtrat	Variabel 6 (72 gr/L)		Variabel 7 (128 gr/L)		Variabel 8 (100 gr/L)		Variabel 9 (100 gr/L)		Variabel 10 (100 gr/L)	
(*V, m3)*	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)	(*t,secon*)	(*t/V*)
0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
0,005	104,94	20988,0	102,40	20479,0	70,38	14076,0	133,05	26610,0	103,67	20734,0
0,01	166,67	16667,0	162,68	16267,5	125,31	12531,0	197,27	19727,0	164,68	16467,5
0,015	228,14	15209,3	223,59	14906,0	179,92	11994,7	266,43	17762,0	225,87	15057,7
0,02	326,73	16336,5	324,34	16216,7	246,67	12333,5	407,96	20398,0	325,54	16276,7
0,025	530,17	21206,6	527,70	21107,8	348,30	13932,0	708,17	28326,8	528,94	21157,4
0,03	825,50	27516,5	821,49	27383,0	683,13	22771,0	977,23	32574,3	823,50	27449,8



Gambar 2. Grafik hubungan t/V terhadap V

A = 0,2209 m

A^2 = 0,048797 m^2

Massa lumpur = 6,489 kg

ρ = 721 kg/m^3

vol pelarut = 25 L

C = 259,56 kg/m^3

Cs = 186,9 kg solid/m^3

Variabel 1 (Tawas 80 gr/L)

Y = 2.952x +5.038,2

Slope = Kp/2

Kp = slope x 2

Kp = 2.952 x 2

Kp = 5.904 s/m^6

P = 60 kg/cm^2 = 5884000 N/m^2

μ = 1,12 cp = 0,00112 Ndet/m^2

$$\alpha_1 = \frac{Kp\ A^2(-\Delta P)}{\mu Cs}$$

$$= \frac{5.904\ s/m6\ x\ 0{,}048797\ m2\ x\ (5884000\ N/m2)}{0{,}00112 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$$

= 8,1E+09 m/kg

Variabel 2 (Tawas 80 gr/L)

Y = 3615x + 5920,5

Kp = 7230 s/m^6

P = 80 kg/cm^2 = 7845000 N/m^2

μ = 0,0011 Ndet/m^2

$$\alpha_2 = \frac{7230\ s/m6\ x\ 0{,}048797\ m2\ x\ (7845000\ N/m2)}{0{,}0011 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$$

= 1,35E+10 m/kg

Variabel 3 (Tawas 120 gr/L)

Y = 2333,9x + 3681,1

Kp = 4667,8 s/m^6

P = 60 kg/cm^2 = 5884000 N/m^2

μ = 0,00106 Ndet/m^2

$$\alpha_3 = \frac{4667{,}8 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 5884000\ \text{N/m2}}{0{,}00106 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$$

= 6,76E+09 m/kg

Variabel 4 (Tawas 120 gr/L)

Y = 3620,1x + 5748,6

Kp = 7240,2 s/m^6

P = 80 kg/cm^2 = 7845000 N/m^2

μ = 0,00104 Ndet/m^2

$$\alpha_4 = \frac{7240{,}2 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 7845000\ \text{N/m2}}{0{,}00104 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$$

= 1,43E+10 m/kg

Variabel 5 (Tawas 100 gr/L)

Y = 2973,5x + 4761,7

Kp = 5947 s/m^6

P = 70 kg/cm^2 = 6865000 N/m^2

μ = 0,00116 Ndet/m^2

$$\alpha_5 = \frac{5947 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 6865000\ \text{N/m2}}{0{,}00116 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$$

= 9,19E+09 m/kg

Variabel 6 (PAC 72 gr/L)

Y = 2952x + 5038,2

Kp = 5904 s/m^6

P = 70 kg/cm2 = 6865000 N/m^2

μ = 0,00115 Ndet/m^2

$$\alpha_6 = \frac{5904 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 6865000\ \text{N/m2}}{0{,}00115 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$$

= 9,2E+09 m/kg

Variabel 7 (PAC 128 gr/L)

Y = 2977x + 4714,9

Kp = 5954 s/m^6

P = 70 kg/cm^2 = 68650000 N/m^2

μ = 0,00103 Ndet/m^2

$$\alpha_7 = \frac{5954 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 6865000\ \mathrm{N/m2}}{0{,}00103 \frac{\mathrm{Ndet}}{\mathrm{m2}} x\ 186{,}9\ \mathrm{kg\ solid/m3}}$$

= 1,04E+10 m/kg

Variabel 8 (PAC 100 gr/L)

Y = 2422,4x + 2830,1

Kp = 4844,8 s/m^6

P = 56 kg/cm^2 = 5492000 N/m^2

μ = 0,00118 Ndet/m^2

$$\alpha_8 = \frac{4844{,}8 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 5492000\ \mathrm{N/m2}}{0{,}00118 \frac{\mathrm{Ndet}}{\mathrm{m2}} x\ 186{,}9\ \mathrm{kg\ solid/m3}}$$

= 5,89E+09 m/kg

Variabel 9 (PAC 100 gr/L)

Y = 3636,7x + 6224,4

Kp = 7273,4 s/m^6

P = 84 kg/cm^2 = 8235000 N/m^2

μ = 0,00113 Ndet/m^2

$$\alpha_9 = \frac{7273{,}4 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 8235000\ \mathrm{N/m2}}{0{,}00113 \frac{\mathrm{Ndet}}{\mathrm{m2}} x\ 186{,}9\ \mathrm{kg\ solid/m3}}$$

= 1,4E+10 m/kg

Variabel 10 (PAC 100 gr/L)

Y = 2964,5x + 4876,8

Kp = 5929 s/m^6

P = 70 kg/cm^2 = 6865000 N/m^2

μ = 0,00111 Ndet/m^2

$$\alpha_{10} = \frac{5929 \frac{s}{m6} x\ 0{,}048797\ m2\ x\ 6865000\ \mathrm{N/m2}}{0{,}00111 \frac{\mathrm{Ndet}}{\mathrm{m2}} x\ 186{,}9\ \mathrm{kg\ solid/m3}}$$

= 9,6E+09 m/kg

d. Rm

A = 0,2209 m

Massa lumpur = 6,489 kg

ρ = 721 kg/m^3

vol pelarut = 25 L

C = 259,56 kg/m^3

Variabel 1 (Tawas 80 gr/L)

Y = 2.952x +5.038,2

B = 5038,2 s/m3

P = 60 kg/cm^2 = 5884000 N/m^2

μ = 1,12 cp = 0,00112 Ndet/m^2

$Rm_1 = \frac{B\ A(-\Delta P)}{\mu}$

$= \frac{5038{,}2\ s/m3\ x\ 0{,}2209\ m\ x\ (5884000\ N/m2)}{0{,}00112 \frac{\text{Ndet}}{\text{m2}}}$

= 5,8E+12 m/kg

Variabel 2 (Tawas 80 gr/L)

Y = 3615x + 5920,5

B = 5920,5 s/m^3

P = 80 kg/cm^2 = 7845000 N/m^2

μ = 0,0011 Ndet/m^2

$Rm_2 = \frac{5920{,}5\ s/m3\ x\ 0{,}0488\ m2\ x\ (7845000\ N/m2)}{0{,}0011 \frac{\text{Ndet}}{\text{m2}}}$

= 9,33E+12 m/kg

Variabel 3 (Tawas 120 gr/L)

Y = 2333,9x + 3681,1

B = 3681,1 s/m^3

P = 60 kg/cm^2 = 5884000 N/m^2

μ = 0,00106 Ndet/m^2

$Rm_3 = \frac{3681{,}1 \frac{s}{m3} x\ 0{,}048797\ m2\ x\ 5884000\ \text{N/m2}}{0{,}00106 \frac{\text{Ndet}}{\text{m2}}}$

= 4,51E+12 m/kg

Variabel 4 (Tawas 120 gr/L)

Y = 3620,1x + 5748,6

B = 5748, s/m^3

P = 80 kg/cm^2 = 7845000 N/m^2

μ = 0,00104 Ndet/m^2

$Rm_4 = \frac{5748{,}6 \frac{s}{m3} x\ 0{,}048797\ m2\ x\ 7845000\ \text{N/m2}}{0{,}00104 \frac{\text{Ndet}}{\text{m2}}\ x\ 186{,}9\ \text{kg solid/m3}}$

= 9,58E+12 m/kg

Variabel 5 (Tawas 100 gr/L)

Y = 2973,5x + 4761,7

B = 4761,7 s/m^3

P = 70 kg/cm^2 = 6865000 N/m^2

μ = 0,00116 Ndet/m^2

$Rm_5 = \frac{4761{,}7 \frac{s}{m3} x\ 0{,}048797\ m2\ x\ 6865000\ \text{N/m2}}{0{,}00116 \frac{\text{Ndet}}{\text{m2}}}$

= 6,23E+12 m/kg

Variabel 6 (PAC 72 gr/L)

Y = 2952x + 5038,2

B = 5038,2 s/m^3

P = 70 kg/cm2 = 6865000 N/m^2

μ = 0,00115 Ndet/m^2

$Rm_6 = \frac{5038{,}2 \frac{s}{m3} x\ 0{,}048797\ m2\ x\ 6865000\ \text{N/m2}}{0{,}00115 \frac{\text{Ndet}}{\text{m2}}}$

= 6,64E+12 m/kg

Variabel 7 (PAC 128 gr/L)

Y = 2977x + 4714,9

B = 4714,9 s/m^3

P = 70 kg/cm^2 = 6865000 N/m^2

μ = 0,00103 Ndet/m^2

$$Rm_7 = \frac{4714{,}9\frac{s}{m6} x\ 0{,}048797\ m2\ x\ 6865000\ \mathrm{N/m2}}{0{,}00103\frac{\mathrm{Ndet}}{\mathrm{m2}}}$$

= 6,94E+12 m/kg

Variabel 8 (PAC 100 gr/L)

Y = 2422,4x + 2830,1

B = 2830,1 s/m^3

P = 56 kg/cm^2 = 5492000 N/m^2

μ = 0,00118 Ndet/m^2

$$\alpha_8 = \frac{2830{,}1\frac{s}{m3} x\ 0{,}048797\ m2\ x\ 5492000\ \mathrm{N/m2}}{0{,}00118\frac{\mathrm{Ndet}}{\mathrm{m2}}}$$

= 2,91E+12 m/kg

Variabel 9 (PAC 100 gr/L)

Y = 3636,7x + 6224,4

B = 6224,4 s/m^3

P = 84 kg/cm^2 = 8235000 N/m^2

μ = 0,00113 Ndet/m^2

$$Rm_9 = \frac{6224{,}4\frac{s}{m3} x\ 0{,}048797\ m2\ x\ 8235000\ \mathrm{N/m2}}{0{,}00113\frac{\mathrm{Ndet}}{\mathrm{m2}}}$$

= 1E+13 m/kg

Variabel 10 (PAC 100 gr/L)

Y = 2964,5x + 4876,8

B = 4876,8 s/m^3

P = 70 kg/cm^2 = 6865000 N/m^2

μ = 0,00111 Ndet/m^2

$$Rm_{10} = \frac{4876{,}8\frac{s}{m3} x\ 0{,}048797\ m2\ x\ 6865000\ \mathrm{N/m2}}{0{,}00111\frac{\mathrm{Ndet}}{\mathrm{m2}}}$$

= 6,66E+12 m/kg

2. Lampiran Gambar

Gambar 3. Alat filtrasi dan penimbangan sampel

Gambar 4. Alat Untuk Uji dari Hasil Proses Filtrasi

Gambar 5. Uji TSS pada sampel

Gambar 6. Hasil Proses Filtrasi