

**LAMPIRAN II**  
**PERHITUNGAN**

1. Perhitungan membuat larutan  $\text{Pb}(\text{NO}_3)_2$  50 ppm dari 1000 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 1000 \text{ ppm} = 100 \text{ ml} \times 50 \text{ ppm}$$

$$V_1 = 5 \text{ ml}$$

2. Perhitungan membuat larutan  $\text{Pb}(\text{NO}_3)_2$  100 ppm dari 1000 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 1000 \text{ ppm} = 100 \text{ ml} \times 100 \text{ ppm}$$

$$V_1 = 10 \text{ ml}$$

3. Perhitungan membuat larutan  $\text{Pb}(\text{NO}_3)_2$  150 ppm dari 1000 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 1000 \text{ ppm} = 100 \text{ ml} \times 150 \text{ ppm}$$

$$V_1 = 15 \text{ ml}$$

4. Perhitungan membuat larutan  $\text{Pb}(\text{NO}_3)_2$  200 ppm dari 1000 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 1000 \text{ ppm} = 100 \text{ ml} \times 200 \text{ ppm}$$

$$V_1 = 20 \text{ ml}$$

5. Perhitungan membuat larutan  $\text{Pb}(\text{NO}_3)_2$  250 ppm dari 1000 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 1000 \text{ ppm} = 100 \text{ ml} \times 250 \text{ ppm}$$

$$V_1 = 25 \text{ ml}$$

6. Perhitungan membuat larutan  $\text{Pb}(\text{NO}_3)_2$  300 ppm dari 1000 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 1000 \text{ ppm} = 100 \text{ ml} \times 300 \text{ ppm}$$

$$V_1 = 30 \text{ ml}$$

## 7. Isoterm Adsorpsi (Langmuir dan Freundlich)

### 7.1 Isoterm Langmuir

#### A. Tanpa Aktivasi

No	pH	massa (mg)	Volume (ml)	C awal (Co)	C akhir (Ce)(mg/L)	$\Delta C$	% Removal	langmuir		
								Qe (mg/g)	1/Qe	1/ce
1	3	400	50	53	3,83	49,175	92,78%	6,147	0,163	0,261
2		400	50	105,325	26,58	78,745	74,76%	9,843	0,102	0,038
3		400	50	152,845	41,72	111,12	72,70%	13,890	0,072	0,024
4		400	50	210,65	63,64	147,01	69,79%	18,376	0,054	0,016
5		400	50	252,96	106,60	146,36	57,86%	18,295	0,055	0,009
6		400	50	306,825	143,60	163,225	53,20%	20,403	0,049	0,007

#### B. Aktivasi

No	pH	Massa (mg)	V (ml)	C awal (Co)(mg/L)	C akhir (Ce)(mg/L)	$\Delta C$	% Removal	Langmuir		
								Qe (mg/g)	1/Qe	1/ce
1	3	400	50	53.00	3.33	49.67	93.72	6.21	0.16	0.30
2		400	50	105.33	21.82	83.50	79.28	10.43	0.09	0.04
3		400	50	152.85	36.06	116.78	76.41	14.59	0.06	0.03
4		400	50	210.65	54.20	156.45	74.27	19.55	0.05	0.02
5		400	50	252.96	93.65	159.31	62.98	19.91	0.05	0.01
6		400	50	306.83	139.70	167.12	54.47	20.89	0.04	0.007

Diketahui :

#### A. Tanpa Aktivasi

Massa Adsorben = 400 mg

Volume larutan = 50 ml

Cawal = 53 mg/L

Cakhir = 3,83 mg/L

$\Delta C$  = Cawal – Cakhir = 53 mg/L – 3,83 mg/ = 49,175 mg/L

(%) removal =  $(53 \text{ mg/L} - 3,83 \text{ mg/L}) / 53 \text{ mg/L} = 92,78 \%$

$$\begin{aligned}
 Q_e &= \frac{\Delta C \times V}{\text{Massa}} \\
 &= \frac{49,175 \times 50}{400} \\
 &= 6,147 \text{ mg/g}
 \end{aligned}$$

$$\begin{aligned} 1/Q_e &= 1/6,147 = 0,163 \\ 1/C_e &= 1/3,3275 = 0,261 \end{aligned}$$

No	1/C <sub>e</sub> (x)	1/Q <sub>e</sub> (y)	xy	x <sup>2</sup>	y <sup>2</sup>
1	0,261	0,163	0,0425	0,06835	0,0265
2	0,038	0,102	0,0038	0,00142	0,0103
3	0,024	0,072	0,0017	0,00057	0,0052
4	0,016	0,054	0,0009	0,00025	0,0030
5	0,009	0,055	0,0005	0,00009	0,0030
6	0,007	0,049	0,0003	0,00005	0,0024
Σ	0,355	0,494	0,050	0,071	0,050

Regresi linier  $y = 0,413x + 0,0579$  dan  $R^2 = 0,8844$   
 $y = bx + a$

$$b = \frac{\sum xy - (\sum x \sum y)/n}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$b = \frac{0,050 - (0,355 \times 0,494)/6}{0,071 - \frac{(0,355)^2}{6}} = 0,413$$

$$a = \frac{0,494 - (0,050 \times 0,355)}{6} = 0,0579$$

$$\begin{aligned} R^2 &= \frac{n \cdot (\sum XY) - (\sum X \cdot \sum Y)}{(n \cdot (\sum X^2) - (\sum X)^2)^{1/2} \cdot (n \cdot (\sum Y^2) - (\sum Y)^2)^{1/2}} \\ &= \frac{6 \cdot (0,050) - (0,355 \times 0,494)}{(6 \cdot (0,071^2) - (0,355)^2)^{1/2} \cdot (6 \cdot (0,050^2) - (0,494)^2)^{1/2}} \\ &= 0,8844 \end{aligned}$$

Sehingga, Q<sub>m</sub> = kemampuan maksimum adsorpsi adsorben daun ketapang  
(mg/gr)

$$= 1/0,0579 = 17,271 \text{ mg/g}$$

K = Konstanta yang berkaitan dengan kecepatan adsorpsi

$$= 1/(0,413 \times 17,271) = 0,140 \text{ l/mg}$$

### B. Teraktivasi

$$\text{Massa Adsorben} = 400 \text{ mg}$$

$$\text{Volume larutan} = 50 \text{ ml}$$

$$\text{Cawal} = 53 \text{ mg/L}$$

$$\text{Cakhir} = 3,3275 \text{ mg/L}$$

$$\Delta C = \text{Cawal} - \text{Cakhir} = 53 \text{ mg/L} - 3,3275 \text{ mg/L} = 49,6725 \text{ mg/L}$$

$$(\%) \text{ removal} = (53 \text{ mg/L} - 3,3275 \text{ mg/L}) / 53 \text{ mg/L} = 93,72 \%$$

$$\begin{aligned} Q_e &= \frac{\Delta C \times V}{\text{Massa}} \\ &= \frac{49,6825 \times 50}{400} \\ &= 6,209 \end{aligned}$$

$$1/Q_e = 1/6,209 = 0,161$$

$$1/C_e = 1/3,3275 = 0,301$$

No	1/Ce (x)	1/Qe (y)	xy	x <sup>2</sup>	y <sup>2</sup>
1	0.301	0.161	0.0484	0.09032	0.0259
2	0.046	0.096	0.0044	0.00210	0.0092
3	0.028	0.069	0.0019	0.00077	0.0047
4	0.018	0.051	0.0009	0.00034	0.0026
5	0.011	0.050	0.0005	0.00011	0.0025
6	0.007	0.048	0.0003	0.00005	0.0023
Σ	0.410	0.475	0.057	0.094	0.047

Regresi linier  $y = 0,3666x + 0,054$  dan  $R^2 = 0,909$

$$y = bx + a$$

$$b = \frac{\sum xy - (\sum x \sum y) / n}{\sum x^2 - (\frac{(\sum x)^2}{n})}$$

$$b = \frac{0,057 - (0,410 \times 0,475) / 6}{0,094^2 - (\frac{(0,410)^2}{6})} = 0,3666$$

$$a = \frac{0,475 - (0,3666 \times 0,410)}{6} = 0,054$$

$$R^2 = \frac{n \cdot (\sum XY) - (\sum X \cdot \sum Y)}{((n \cdot (\sum X^2) - (\sum X)^2)^{1/2} \cdot (n \cdot (\sum Y^2) - (\sum Y)^2)^{1/2}}$$

$$= \frac{6 \cdot (0,057) - (0,410 \times 0,475)}{(6 \cdot (0,094^2) - (0,410)^2)^{1/2} \cdot (6 \cdot (0,047^2) - (0,475)^2)^{1/2}}$$

$$= 0,909$$

Sehingga,  $Q_m$  = kemampuan maksimum adsorpsi adsorben daun ketapang  
(mg/gr)

$$= 1/0.054 = 18,52 \text{ mg/gr}$$

$$K = \text{Konstanta yang berkaitan dengan kecepatan adsorpsi}$$

$$= 1/(0,3666 \times 18,52) = 0,1475 \text{ l/mg}$$

## 7.2 Isoterm Freundlich

### A. Tanpa Aktivasi

No	C (mg/L)	C akhir (mg/L )	Qe (mg/g)	Freundlich	
				Log (Qe)	Log C
1	50	3,825	6,147	0,789	0,583
2	100	26,58	9,843	0,993	1,425
3	150	41,725	13,890	1,143	1,620
4	200	63,64	18,376	1,264	1,804
5	250	106,6	18,295	1,262	2,028
6	300	143,6	20,403	1,310	2,157

No	Log C (x)	Log Qe (y)	xy	x <sup>2</sup>	y <sup>2</sup>
1	0,583	0,789	0,459	0,339	0,622
2	1,425	0,993	1,415	2,029	0,986
3	1,620	1,143	1,852	2,626	1,306
4	1,804	1,264	2,280	3,253	1,598
5	2,028	1,262	2,560	4,112	1,593
6	2,157	1,310	2,825	4,653	1,715
	9,616	6,761	11,391	17,013	7,821

$$Y = 0,1507x + 0,5706$$

$$b = \frac{\sum xy - (\sum x \sum y)/n}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$b = \frac{11,391 - (9,616 \times 6,761)/6}{17,013^2 - \left(\frac{9,616^2}{6}\right)} = 0,1507$$

$$a = \frac{6,886 - (0,1524 \times 21,342)}{6} = 0,5706$$

$$R^2 = \frac{n \cdot (\sum XY) - (\sum X \cdot \sum Y)}{(n \cdot (\sum X^2) - (\sum X)^2)^{1/2} \cdot (n \cdot (\sum Y^2) - (\sum Y)^2)^{1/2}}$$

$$= \frac{6 \cdot (11,391) - (9,616 \times 6,761)}{(17,0,13 - (9,616)^2)^{1/2} \cdot (6 \cdot (7,821^2) - (6,761)^2)^{1/2}}$$

$$= 0,9492$$

Sehingga, Kf = konstanta Freundlich yang berkaitan dengan kapasitas adsorpsi

$$= 10^{0,6058} = 3,720/\text{g}$$

n = konstanta Freundlich yang berkaitan dengan afinitas adsorpsi

$$= 1/0,1507 = 6,635$$

## B. Aktivasi

No	C (mg/L)	C akhir (mg/L)	Qe (mg/g)	Freundlich	
				Log (Qe)	Log C
1	50	3.33	6.21	0.79	0,52
2	100	21.82	10.44	1.02	1,34
3	150	36.06	14.60	1.16	1,56
4	200	54.20	19.56	1.29	1,73
5	250	93.65	19.91	1.29	1,97
6	300	139.70	20.89	1.32	2,15

No	Log C (x)	Log Qe (y)	xy	x <sup>2</sup>	y <sup>2</sup>
1	0,522	0,793	0,414	0,273	0,629
2	1,339	1,019	1,364	1,793	1,038
3	1,557	1,164	1,813	2,424	1,356
4	1,734	1,291	2,239	3,007	1,667
5	1,972	1,299	2,561	3,887	1,688
6	2,145	1,320	2,832	4,602	1,742
	9,269	6,886	11,223	15,985	8,120

Diketahui :

$$Y = 0,1524x + 0,6058$$

$$b = \frac{\sum xy - (\sum x \sum y)/n}{\sum x^2 - (\frac{(\sum x)^2}{n})}$$

$$b = \frac{11,223 - (9,269 \times 6,886)/6}{15,985 - (\frac{(9,269)^2}{6})} = 0,1524$$

$$a = \frac{6,886 - (0,1524 \times 21,342)}{6} = 0,6058$$

$$R^2 = \frac{n \cdot (\sum XY) - (\sum X \cdot \sum Y)}{(n \cdot (\sum X^2) - (\sum X)^2)^{1/2} \cdot (n \cdot (\sum Y^2) - (\sum Y)^2)^{1/2}}$$

$$= \frac{6 \cdot (11,223) - (9,269 \times 6,886)}{(6 \cdot (15,985) - (9,269)^2)^{1/2} \cdot (6 \cdot (8,120) - (6,886)^2)^{1/2}}$$

$$= 0,9498$$

Sehingga, Kf = konstanta Freundlich yang berkaitan dengan kapasitas adsorpsi

$$= 10^{0,6058} = 4,034 \text{ l/g}$$

n = konstanta Freundlich yang berkaitan dengan afinitas adsorpsi

$$= 1/0,1524 = 6,561$$