LAMPIRAN I
PERHITUNGAN

1. Pembuatan Larutan Induk Pb(II) 1000 ppm

Melarutkan 0,156 gram $Pb(NO_3)_2$ kedalam 100 ml aquadest

2. Pengenceran Larutan Standar

Keterangan :

V1 = Volume larutan induk (ml)

M1 = Konsentrasi larutan induk (ppm)

V2 = Volume larutan yang diencerkan (ml)

M2 = Konsentrasi larutan yang diencerkan (ppm)

a. Larutan 10 ppm

V1 × M1 = V2 × M2

V1 = (V2 × M2) / M1

V1 = (100 ml × 10 ppm) / 1000 ppm

V1 = 1000 ppm.ml / 1000 ppm

V1 = 1 ml

b. Larutan 50 ppm

V1 × M1 = V2 × M2

V1 = (V2 × M2) / M1

V1 = (100 ml × 50 ppm) / 1000 ppm

V1 = 5000 ppm.ml / 1000 ppm

V1 = 5 ml

c. Larutan 100 ppm

V1 × M1 = V2 × M2

V1 = (V2 × M2) / M1

V1 = (100 ml × 100 ppm) / 1000 ppm

V1 = 10000 ppm.ml / 1000 ppm

V1 = 10 ml

d. Larutan 150 ppm

V1 × M1 = V2 × M2

V1 = (V2 × M2) / M1

V1 = (100 ml × 150 ppm) / 1000 ppm

V1 = 15000 ppm.ml / 1000 ppm

V1 = 15 ml

e. Larutan 200 ppm

V1 × M1 = V2 × M2

V1 = (V2 × M2) / M1

V1 = (100 ml × 200 ppm) / 1000 ppm

V1 = 20000 ppm.ml / 1000 ppm

V1 = 20 ml

f. Larutan 250 ppm

V1 × M1 = V2 × M2

V1 = (V2 × M2) / M1

V1 = (100 ml × 250 ppm) / 1000 ppm

V1 = 25000 ppm.ml / 1000 ppm

V1 = 25 ml

3. Perhitungan Presentase (%) *Removal*

% *Removal* = $\frac{Co-Ca}{CO} \times 100\%$

Keterangan :

C_0 = Konsentrasi awal (ppm)

Ca = Konsentrasi setelah diserap (ppm)

a. Variasi Massa

% *Removal* ACP = $\frac{Co-Ca}{CO} \times 100\%$

% *Removal* ACP = $\frac{12{,}85\ ppm-0{,}897\ ppm}{12{,}85\ ppm} \times 100\%$

% *Removal* ACP = 0,9302 × 100 % = 93,02 %

b. Variasi Waktu Kontak

- % *Removal* ACP = $\frac{Co-Ca}{CO} \times 100\%$

  % *Removal* ACP = $\frac{12{,}85\ ppm-1{,}131\ ppm}{12{,}85\ ppm} \times 100\%$

  % *Removal* ACP = 0,9120 × 100 % = 91,20 %

- % *Removal* FACP = $\frac{Co-Ca}{CO} \times 100\%$

  % *Removal* FACP = $\frac{14{,}82\ ppm-0{,}564\ ppm}{12{,}85\ ppm} \times 100\%$

  % *Removal* FACP = 0,9619 × 100 % = 96,19 %

c. Variasi Waktu pH

% *Removal* ACP pH 5= $\frac{Co-Ca}{CO} \times 100\%$

% *Removal* ACP pH 5= $\frac{12{,}85\ ppm-0{,}642\ ppm}{12{,}85\ ppm} \times 100\%$

% *Removal* ACP pH 5= 0,9500 × 100 % = 95,00 %

d. Variasi Konsentrasi

- % *Removal* NACP = $\frac{Co-Ca}{CO} \times 100\%$

  % *Removal* NACP = $\frac{12{,}85\ ppm-0{,}639\ ppm}{12{,}85\ ppm} \times 100\%$

  % *Removal* NACP = 0,9503 × 100 % = 95,03 %

- % *Removal* ACP = $\frac{Co-Ca}{CO} \times 100\%$

  % *Removal* ACP = $\frac{12{,}85\ ppm-2{,}06\ ppm}{12{,}85\ ppm} \times 100\%$

  % *Removal* ACP = 0,8397 × 100 % = 83,97 %

- % *Removal* FACP = $\frac{Co-Ca}{CO} \times 100\%$

  % *Removal* FACP = $\frac{12{,}85\ ppm-0{,}973\ ppm}{12{,}85\ ppm} \times 100\%$

  % *Removal* FACP = 0,9047 × 100 % = 90,47 %

4. Isoterm Adsorpsi

Jenis	pH	Massa	Volume	C awal	Ce	ΔC	% Removal	Qe	Langmuir		Freundlich	
		(mg)	(ml)	(ppm)	(ppm)	(ppm)		(mg/g)	1/Qe	1/ce	Log (Qe)	Log C
ACP	5	100	50	13	2,06	10,79	83,97%	5,395	0,185	0,485	0,732	0,314
		100	50	52	11,85	39,87	77,09%	19,935	0,050	0,084	1,300	1,074
		100	50	102	26,3	76,125	74,32%	38,063	0,026	0,038	1,580	1,420
		100	50	156	69,75	86,01	55,22%	43,005	0,023	0,014	1,634	1,844
		100	50	202	97,2	105,2	51,98%	52,600	0,019	0,010	1,721	1,988
		100	50	253	138,5	114,3	45,21%	57,150	0,017	0,007	1,757	2,141
Jenis	pH	Massa	Volume	C awal	Ce	ΔC	% Removal	Qe	Langmuir		Freundlich	
		(mg)	(ml)	(ppm)	(ppm)	(ppm)		(mg/g)	1/Qe	1/ce	Log (Qe)	Log C
NACP	5	100	50	13	0,639	12,211	95,03%	6,106	0,164	1,565	0,786	-0,194
		100	50	52	7,84	43,88	84,84%	21,940	0,046	0,128	1,341	0,894
		100	50	102	30,4	72,025	70,32%	36,013	0,028	0,033	1,556	1,483
		100	50	156	50,1	105,66	67,84%	52,830	0,019	0,020	1,723	1,700
		100	50	202	78,4	124	61,26%	62,000	0,016	0,013	1,792	1,894
		100	50	253	115,5	137,3	54,31%	68,650	0,015	0,009	1,837	2,063
Jenis	pH	Massa	Volume	C awal	Ce	ΔC	% Removal	Qe	Langmuir		Freundlich	
		(mg)	(ml)	(ppm)	(ppm)	(ppm)		(mg/g)	1/Qe	1/ce	Log (Qe)	Log C
FACP	5	100	50	13	0,973	11,877	92,43%	5,939	0,168	1,028	0,774	-0,012
		100	50	52	6,7	45,02	87,05%	22,510	0,044	0,149	1,352	0,826
		100	50	102	14,8	87,625	85,55%	43,813	0,023	0,068	1,642	1,170
		100	50	156	22,5	133,26	85,55%	66,630	0,015	0,044	1,824	1,352
		100	50	202	30,48	171,92	84,94%	85,960	0,012	0,033	1,934	1,484
		100	50	253	43,05	209,75	82,97%	104,875	0,010	0,023	2,021	1,634

a. Perhitungan Grafik Isoterm Langmuir dan Freundlich ACP

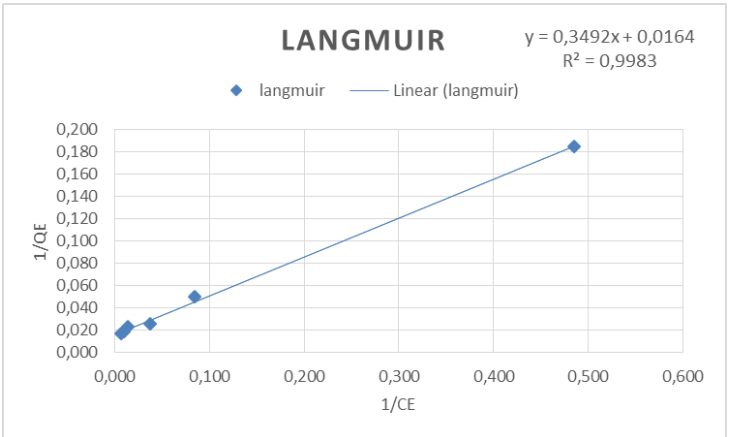
- ΔC = C_0 (awal) (ppm) – Ce (akhir) (ppm)

  ΔC = 13 ppm – 2,06 ppm = 10,79 mg/l

- Qe $= \frac{\Delta C\ (mg/l) \times \left(Voume\ (ml) \times {}^{1\ L}/_{1000\ ml}\right)}{\left(massa\ (mg) \times {}^{1\ g}/_{1000\ mg}\right)}$

  Qe $= \frac{10{,}79\ \frac{mg}{l} \times \left(50\ (ml) \times {}^{1\ L}/_{1000\ ml}\right)}{\left(100\ (mg) \times {}^{1\ g}/_{1000\ mg}\right)}$

  Qe = 5,395 mg/g



$y = bx + a$

$y = 0{,}3492x + 0{,}0164$

- **Perhitungan regresi linier Langmuir ACP**

No	1/Ce (x)	1/Qe (y)	xy	x^2	y^2
1	0,485	0,185	0,0900	0,23565	0,0344
2	0,084	0,050	0,0042	0,00712	0,0025
3	0,038	0,026	0,0010	0,00145	0,0007
4	0,014	0,023	0,0003	0,00021	0,0005
5	0,010	0,019	0,0002	0,00011	0,0004
6	0,007	0,017	0,0001	0,00005	0,0003
Σ	0,640	0,322	0,096	0,245	0,039

$$a = \frac{(\Sigma Y)(\Sigma X^2) - (\Sigma X)(\Sigma XY)}{\eta(\Sigma X^2) - (\Sigma X)^2} \quad b = \frac{\eta(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\eta(\Sigma X^2) - (\Sigma X)^2}$$

$$a = \frac{(0{,}322 \times 0{,}245) - (0{,}64 \times 0{,}096)}{(6 \times 0{,}245) - (0{,}64)^2}$$

$$a = \frac{0{,}07889 - 0{,}06144}{1{,}47 - 0{,}4096}$$

$$a = \frac{0{,}01745}{1{,}0604} = 0{,}01637$$

$$b = \frac{(6 \times 0{,}096) - (0{,}64 \times 0{,}322)}{(6 \times 0{,}245) - (0{,}64)^2}$$

$$b = \frac{0{,}576 - 0{,}20608}{1{,}47 - 0{,}4096}$$

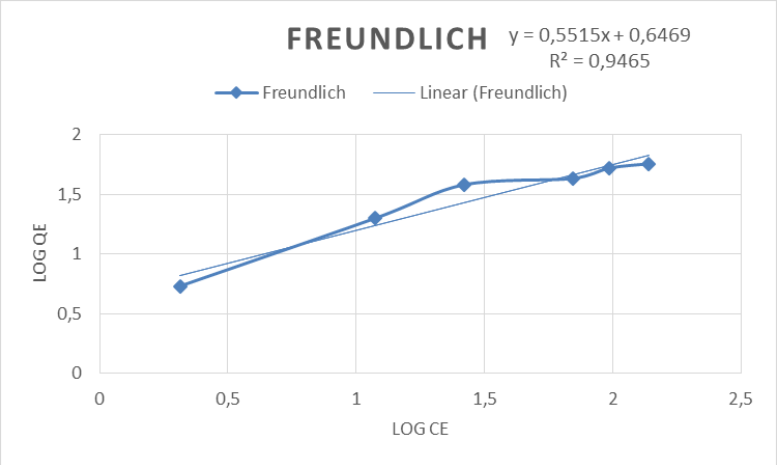
$$b = \frac{0{,}36992}{1{,}0604} = 0{,}349157$$

- $Qm = 1/a$

  $Qm = \frac{1}{0{,}0164} = 60{,}97\ mg/g$

- $K_L = {}^{1}/_{(b \times Qm)}$

  $K_L = {}^{1}/_{(0{,}3492 \times 60{,}97) = 0{,}05}$



  $y = bx + a$

  $y = 0{,}5515x + 0{,}6469$

- $Kf = 10^{a}$

  $Kf = 10^{0{,}6469} = 4{,}44$

- $n = 1/b$

- $n = \frac{1}{0{,}5515} = 1{,}813$

b. Perhitungan Grafik Isoterm Langmuir NACP

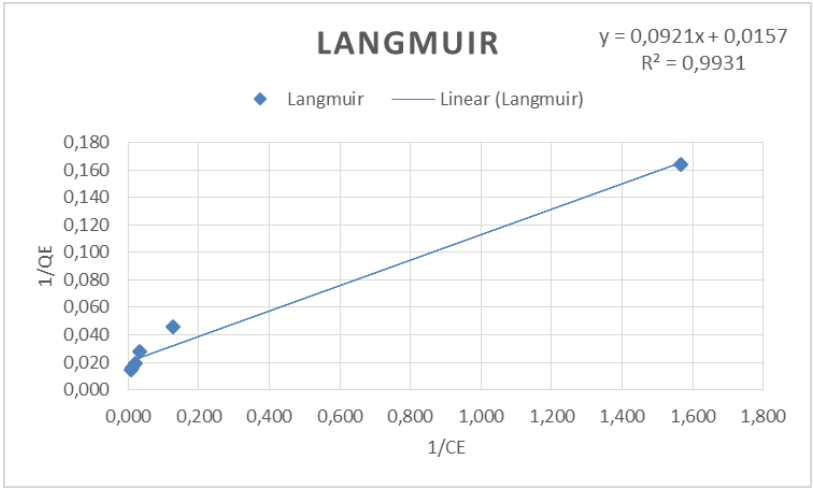
- ΔC = C_0 (awal) (ppm) – Ce (akhir) (ppm)

  ΔC = 13 ppm – 0,639 ppm = 12,211 mg/l

- Qe $= \frac{\Delta C\ (mg/l) \times \left(Voume\ (ml) \times {}^{1\ L}/_{1000\ ml}\right)}{\left(massa\ (mg) \times {}^{1\ g}/_{1000\ mg}\right)}$

  Qe $= \frac{12{,}211 \frac{mg}{l} \times \left(50\ (ml) \times {}^{1\ L}/_{1000\ ml}\right)}{\left(100\ (mg) \times {}^{1\ g}/_{1000\ mg}\right)}$

  Qe = 6,106 mg/g



$y = bx + a$

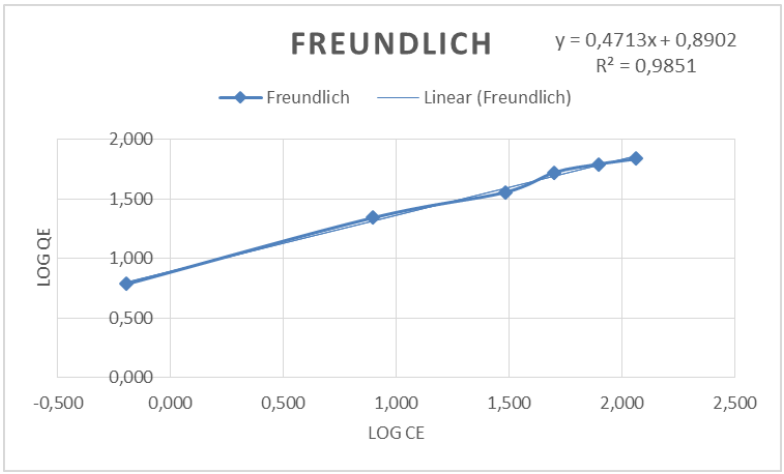
$y = 0{,}0921x + 0{,}0157$

- $Qm = 1/a$

  $Qm = \frac{1}{0{,}0157} = 63{,}69\ mg/g$

- $K_L = {}^{1}/_{(b \times Qm)}$

  $K_L = {}^{1}/_{(0{,}0921 \times 63{,}69)} = 0{,}17$



$y = bx + a$

$y = 0{,}4713x + 0{,}8902$

- $Kf = 10^{a}$

  $Kf = 10^{0{,}8902} = 7{,}77$

- $n = 1/b$

- $n = \frac{1}{0{,}4713} = 2{,}122$

c. Perhitungan Grafik Isoterm Langmuir FACP

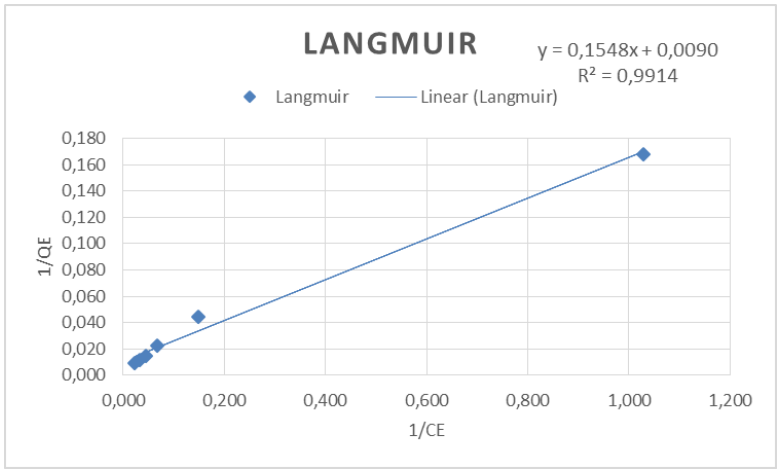
- ΔC = C_0 (awal) (ppm) – Ce (akhir) (ppm)

  ΔC = 13 ppm – 0,973 ppm = 11,877 mg/l

- Qe $= \frac{\Delta C\ (mg/l) \times \left(Voume\ (ml) \times {}^{1\ L}/_{1000\ ml}\right)}{\left(massa\ (mg) \times {}^{1\ g}/_{1000\ mg}\right)}$

  Qe $= \frac{11{,}877 \frac{mg}{l} \times \left(50\ (ml) \times {}^{1\ L}/_{1000\ ml}\right)}{\left(100\ (mg) \times {}^{1\ g}/_{1000\ mg}\right)}$

  Qe = 5,939 mg/g



$y = bx + a$

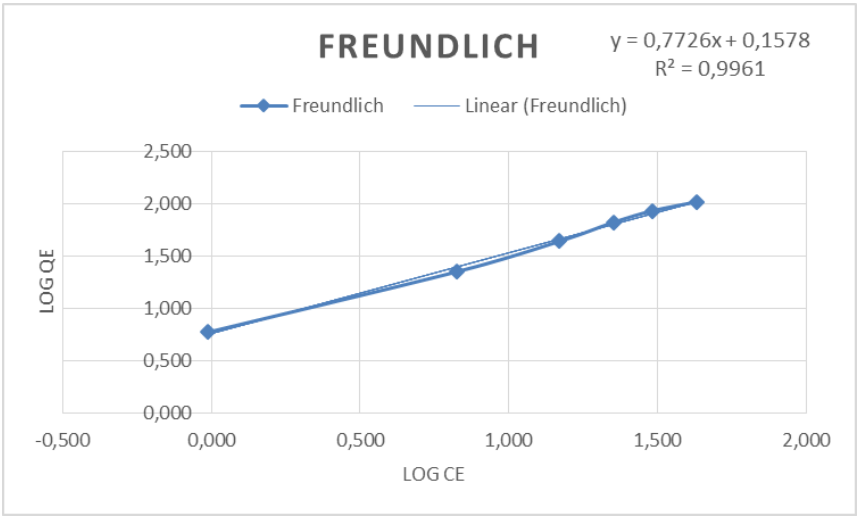
$y = 0{,}1548x + 0{,}0090$

- $Qm = 1/a$

$$Qm = \frac{1}{0{,}0090} = 111{,}11\ mg/g$$

- $K_L = {}^{1}/_{(b \times Qm)}$

$$K_L = {}^{1}/_{(0{,}1548 \times 111{,}11)} = 0{,}06$$



$y = bx + a$

$y = 0{,}7726x + 0{,}1578$

- $Kf = 10^{a}$

  $Kf = 10^{0{,}1578} = 1{,}44$

- $n = 1/b$

- $n = \frac{1}{0{,}1578} = 1{,}29$