LAMPIRAN B

PERHITUNGAN

1. Menghitung Massa KOH

$$\text{Massa (gram)} = M \times V \times Mr$$

a. Konsentrasi 2 M dalam 200 mL

M = 2 M

V = 200 mL= 0.2 L

Mr = 56 g/mol

Massa (gr) = M x V x Mr

= 2 M x 0.2 L x 56 g/mol

= 22.4 gram

b. Konsentrasi 3 M dalam 200 mL

M = 2 M

V = 200 mL=0.2 L

Mr = 56 g/mol

Massa (gr) = M x V x Mr

= 3 M x 0.2 L x 56 g/mol

= 33.6 gram

2. Menghitung Massa $FeCl_3$ 2M dan $FeSO_4$ 1M dan KOH sebagai pengendap

$$\text{Massa (gram)} = M \text{ x } V \text{ x } Mr$$

a. $Fecl_3$

Massa (gr) = M x V x Mr

= 2 mol/L x 0.1 L x 162.20 g/mol

= 32.44 gram

b. $FeSO_4$

Massa (gr) = M x V x Mr

= 1 mol/L x 0.1 L x 151.19 g/mol

= 15.19 gram

c. KOH 2M dalam 100 mL

Massa (gr) = M x V x Mr

= 2 mol/L x 0.1 L x 56 g/mol

= 11.2 gram

3. Perhitungan Kadar Air (%)

$$\%\text{Kadar Air} = \left(\frac{W1}{W2}\right) \text{x } 100$$

Dimana:

W1 = Kehilangan bobot (g)

W2 = Bobot awal sampel (g)

a. 2 M

Berat sampel (A) = 1 gram

Berat *Crusible* = 41.6514 gram

Berat *Crusible* + Sampel (B) = 42.6514 gram

Berat *Crusible* + Sampel setelah dipanaskan (C) = 42.6202 gram

$$\%\text{Kadar Air} = \left(\frac{B-C}{A}\right) \text{x } 100$$

$$\%\text{Kadar Air} = \left(\frac{42.6514-42.6202}{42.6514}\right) \text{x } 100$$

$$\%\text{Kadar Air} = 3.12\ \%$$

b. 3 M

Berat sampel (A) = 1 gram

Berat *Crusible* = 41.6514 gram

Berat *Crusible* + Sampel (B) = 42.6514 gram

Berat *Crusible* + Sampel setelah dipanaskan (C) = 42.6159 gram

$$\%\text{Kadar Air} = \left(\frac{B-C}{A}\right) \text{x } 100$$

$$\%\text{Kadar Air} = \left(\frac{42.6514-42.6159}{1}\right) \text{x } 100$$

$$\%\text{Kadar Air} = 3.55\ \%$$

4. Perhitungan Kadar Abu (%)

a. 2M

Berat sampel (A) = 1 gram

Berat *Crusible* = 41.6514 gram

Berat *Crusible* + Sampel (B) = 42.6514 gram

Berat *Crusible* + Sampel setelah dipanaskan (C) = 41.6964 gram

$$\%\text{Kadar Air} = \left(\frac{B-C}{A}\right) x\ 100$$

$$\%\text{Kadar Air} = \left(\frac{42.6514-41.6964}{1}\right) x\ 100$$

$$\%\text{Kadar Air} = 4.50\ \%$$

b. Berat sampel (A) = 1 gram

Berat *Crusible* = 41.6514 gram

Berat *Crusible* + Sampel (B) = 42.6514 gram

Berat *Crusible* + Sampel setelah dipanaskan (C) = 41.7034 gram

$$\%\text{Kadar Air} = \left(\frac{B-C}{A}\right) x\ 100$$

$$\%\text{Kadar Air} = \left(\frac{42.6514-41.7034}{1}\right) x\ 100$$

$$\%\text{Kadar Air} = 5.20\ \%$$

5. Perhitungan Daya Serap *Iodine* (I_2)

$$\frac{(10-\frac{V\ x\ N}{0.1})x\ 12.69\ x\ 5}{W}$$

Dimana:

V = Larutan natrium tio-sulfat yang diperlukan, (mL).

N = Normalitas larutan natrium tio-sulfat

12.69 = Jumlah Iod sesuai dengan 1 mL larutan natrium tio-sulfat 0.1N

W = Sampel, (gr)

a. 2 M

V = 6.3 mL

N = 0.1 N

12.69 = Jumlah Iod sesuai dengan 1 mL larutan natrium tio-sulfat 0.1N

W = 0.25, (gr)

$$\text{Daya serap terhadap larutan iod } \left(\frac{mg}{g}\right) = \frac{(10-\frac{V\ x\ N}{0.1})x\ 12.69\ x\ 5}{W}$$

$$= \frac{(10 - \frac{6.3 \text{ x } 0.1}{0.1}) \text{x } 12.69 \text{ x } 5}{0.25}$$

$$= 939.06 \text{ mg/g}$$

b. 3 M

V = 6.3 mL

N = 0.1 N

12.69 = Jumlah Iod sesuai dengan 1 mL larutan natrium tio-sulfat 0.1N

W = 0.25, (gr)

$$\text{Daya serap terhadap larutan iod } \left(\frac{\text{mg}}{\text{g}}\right) = \frac{(10 - \frac{\text{V x N}}{0.1}) \text{x } 12.69 \text{ x } 5}{\text{W}}$$

$$= \frac{(10 - \frac{6.1032 \text{ x } 0.1}{0.1}) \text{x } 12.69 \text{ x } 5}{0.25}$$

$$= 989.02 \text{ mg/g}$$

6. Perhitungan Kapasitas Adsorpsi (q)

$$q = \frac{(mt - m_0)}{mt}$$

Dimana:

q = Kapasitas Adsorpsi (mg/g)

mt = Massa Adsorben setelah adsorbsi (g)

m_0 = Massa Adsorben sebelum adsorbs (g)

E = Efisiensi Penyisihan (%)

a. 2 M

Konsentrasi KOH 2 M dan Massa Stearat 0.5 gr

Diketahui :

Massa Adsorben setelah adsorbsi (mt) = 9.44 gr

Massa adsorben sebelum adsorbsi (m_0) = 2.00 gr

$$q = \frac{(mt - m_0)}{mt}$$

$$q = \frac{(9.44 \text{ gr} - 2.00 \text{ gr})}{2.00 \text{gr}}$$

$q = 3.72$

b. 3 M

Konsentrasi KOH 3 M dan Massa Stearat 0.5 gr

Diketahui :

Massa Adsorben setelah adsorbsi (mt) = 9.44 gr

Massa adsorben sebelum adsorbsi (m_0) = 2.00 gr

$$q=\frac{(mt-m_0)}{mt}$$

$$q=\frac{(9.57\ gr-2.00\ gr)}{2.00gr}$$

$$q=3.78$$

Tabel B. 1 Data Kapasitas Adsorbsi (q)

Konsentrasi KOH	Massa Stearat (gr)	Massa Adsorben (gr)		Kapasitas Adsorpsi Minyak (q)
		Awal	Akhir	
2 M	0.5	2	9.44	3.72
	1		9.65	3.825
	1.5		9.69	3.845
	2		9.82	3.91
	2.5		10.15	**4.075**
3 M	0.5	2	9.57	3.785
	1		9.58	3.79
	1.5		9.64	3.82
	2		9.67	3.835
	2.5		9.74	3.87

7. Perhitungan Efisiensi Penyisihan (%)

$$E(\%)=\frac{mt-mo}{M0}x100\%$$

Dimana:

E = Efisiensi penyisihan (%)

M_0 = Massa awal minyak (gr)

mt = Massa adsorben setelah adsorbsi (gr)

mo = Massa adsorben sebelum adsorbs (gr)

a. 2 M

Konsentrasi 2 M dan massa stearat 0.5 gr

Diketahui :

Massa adsorben setelah adsorbsi (mt) = 9.44 gr

Massa adsorben sebelum adsorbsi (m_0) = 2.00 gr

Massa awal minyak (M_0) = 10 gr

$$E(\%)=\frac{mt-mo}{M0}x100\%$$

$$E(\%)=\frac{9.44-2.00}{10}x100\%$$

E (%) = 74.4%

b. 3 M

Konsentrasi 2 M dan massa stearat 0.5 gr

Diketahui :

Massa adsorben setelah adsorbsi (mt) = 9.57 gr

Massa adsorben sebelum adsorbsi (m_0) = 2.00 gr

Massa awal minyak (M_0) = 10 gr

$$E(\%)=\frac{mt-mo}{M0}x100\%$$

$$E(\%)=\frac{9.57-2.00}{10}x100\%$$

E (%) = 75.7%

Tabel B. 2 Data Efisiensi Penyisihan (%)

Konsentrasi KOH	Massa Stearat (gr)	Massa Adsorben (gr)		Efisiensi Penyisihan %
		Awal	Akhir	
2 M	0.5	2	9.44	74.4
	1		9.65	76.5
	1.5		9.69	76.9
	2		9.82	78.2
	2.5		10.15	**81.5**
3 M	0.5	2	9.57	75.7
	1		9.58	75.8
	1.5		9.64	76.4
	2		9.67	76.7
	2.5		9.74	77.4

8. Perhitungan Isoterm Adsorbsi
   a. Persamaan Umum
      1. Isoterm Langmuir:

$$\frac{C_e}{q_e}=\frac{1}{q_m \cdot b}+\frac{C_e}{q_m}$$

      2. Isoterm Freundlich:

$$\log q_e = \log K_f + \frac{1}{n} \log C_e$$

Dimana:

q_e : kapasitas adsorpsi kesetimbangan (mg/g)

C_e : konsentrasi kesetimbangan (mg/L)

q_m : kapasitas adsorpsi maksimum (mg/g)

b : konstanta Langmuir (L/mg)

K_f : konstanta Freundlich

n : intensitas adsorpsi

Tabel B. 3 Data dan Perhitungan Isoterm Freundlich

Waktu Kontak	Ce	Qe	1/Ce	1/Qe	log Ce	Log Qe
30	9.25	4.075	0.108108	0.245399	0.966142	0.610128
40	7.5	4.25	0.133333	0.235294	0.875061	0.628389
50	6.75	4.325	0.148148	0.231214	0.829304	0.635986
60	6.5	4.35	0.153846	0.229885	0.812913	0.638489
70	6.4	4.36	0.15625	0.229358	0.80618	0.639486
80	11.3	3.87	0.088496	0.258398	1.053078	0.587711
90	10.25	3.975	0.097561	0.251572	1.010724	0.599337
100	9.75	4.025	0.102564	0.248447	0.989005	0.604766
110	9.5	4.05	0.105263	0.246914	0.977724	0.607455
120	9.4	4.06	0.106383	0.246305	0.973128	0.608526

Setelah dilakukan perhitungan menggunakan Microsoft Excel, didapatkan persamaan isoterm sebagai berikut:

1. Langmuir: $y = -0.3943x + 0.2896$, $R^2 = 0.9721$

Dimana,

1. Perhitungan Kapasitas Adsorpsi Maksimum (Qm):

$$\frac{1}{Q_m} = 0.2896$$

$$Q_m = \frac{1}{0.2896}$$

$$Q_m = 3.453 \text{ mg/g}$$

2. Perhitungan Konstanta Langmuir (b):

$$\frac{1}{Q_m.b} = -0.3943$$

$$(\frac{1}{Q_m}) . \frac{1}{b} = -0.3943$$

$$0.2986 . \frac{1}{b} = -0.3943$$

$$\frac{1}{b} = \frac{-0.3943}{0.2896}$$

$$\frac{1}{b} = -1.3615$$

$$b = \frac{1}{-1.3615}$$

$$b = -0.734 \text{ L/mg}$$

Jadi, diperoleh Qm sebesar 3.453 mg/g dan nilai b sebesar -0.734 L/mg

2. Freundlich: $y = -0.2015x + 0.8033$, $R^2=0.9925$

Dimana,

1. Perhitungan Kapasitas Adsorpsi Freundlich (K_f):

$$\log K_f = 0.8033$$

$$K_f = 10^{0.8033}$$

$$K_f = 6.357$$

2. Perhitungan Intensitas Adsorpsi (n):

$$\frac{1}{n} = -0.2015$$

$$n = \frac{1}{-0.2015}$$

$$n = -4.962$$

Jadi, diperoleh K_f sebesar 6.357 dan nilai n sebesar -4.962

9. Perhitungan Parameter Pseudo-Orde 1

Berdasarkan plot grafik hubungan antara waktu (t) terhadap ln ($q_e - q_t$), diperoleh persamaan regresi linier sebagai berikut:

$$y = -0,1119x + 2,1827$$

$$R^2 = 0.9963$$

Diketahui:

Kemiringan garis (m) = $-0{,}1119$

Intersep (c) = $2{,}1827$

a) Menghitung Konstanta Laju Adsorpsi Orde 1 (k_1):

$k_1 = -m$

$k_1 = -(-0{,}1119)$

$k_1 = 0{,}1119 \text{ menit}^{-1}$

b) Menghitung Kapasitas Adsorpsi Teoritis ($q_{e,\text{cal}}$):

$c = \ln(q_e)$

$q_e = e^c$

$q_e = e^{2{,}1827}$

$q_{e,\text{cal}} = 8{,}87 \text{ mg/g}$

10. Perhitungan Parameter Pseudo-Orde 2

Berdasarkan plot grafik hubungan antara waktu (t) terhadap t/q_t, diperoleh persamaan regresi linier sebagai berikut:

$$y = 0{,}2144x + 0{,}8828$$

$$R^2 = 0.9996$$

Diketahui:

Kemiringan garis (m) = $0{,}2144$

Intersep (c) = $0{,}8828$

Menghitung Kapasitas Adsorpsi Teoritis ($q_{e,\text{cal}}$):

$$m = \frac{1}{q_e}$$

$$q_e = \frac{1}{m}$$

$$q_e = \frac{1}{0{,}2144}$$

$$q_{e,\text{cal}} = 4{,}664 \text{ mg/g}$$

Menghitung Konstanta Laju Adsorpsi Orde 2 (k_2):

$$c = \frac{1}{k_2 \times (q_e)^2}$$

$$k_2 = \frac{1}{c \times (q_e)^2}$$

$$k_2 = \frac{1}{0{,}8828 \times (4{,}664)^2}$$

$$k_2 = \frac{1}{0{,}8828 \times 21{,}753}$$

$$k_2 = \frac{1}{19{,}203}$$

$$k_2 = 0{,}052 \text{ g/mg·menit}$$

Tabel B. 4 Perbandingan Model Kinetika Adsorbsi

Parameter Kinetika	Pseudo-Orde 1	Pseudo-Orde 2
Persamaan Regresi Linier	y=−0,1119x+2,1827	y=0,2144x+0,8828
Koefisien Determinasi (R^2)	0.9963	0.9996
Kapasitas Eksperimen (q_e,exp)	4,36 mg/g	4,36 mg/g
Kapasitas Teoritis (q_e,cal)	8,87 mg/g	4,664 mg/g
Konstanta Laju Adsorpsi (k)	0,1119 menit−1	0,052 g/(mg· menit)