LAMPIRAN 1
DATA PENELITIAN

1. Data Volum Produk

Tabel L1.1 Data Volum Produk

Sampel	Temperatur (℃)	Tekanan (Bar)	Volum Produk (ml)
1	350		142
2	375		165
3	400	10	205
4	425		200
5	450		196
6	350		328
7	375		338
8	400	15	475
9	425		460
10	450		452
11	350		388
12	375		400
13	400	20	555
14	425		532
15	450		494

2. Data Densitas

Tabel L1.2 Data Densitas pada Produk

Sampel	Berat Piknometer Kosong (gr)	Berat Piknometer + *Aquadest* (gr)	Berat Piknometer + Sampel (gr)
1	11,85	16,85	15,673
2	11,85	16,85	15,675
3	11,85	16,85	15,678
4	11,85	16,85	15,682
5	11,85	16,85	15,684
6	11,85	16,85	15,674
7	11,85	16,85	15,676
8	11,85	16,85	15,679
9	11,85	16,85	15,683
10	11,85	16,85	15,686
11	11,85	16,85	15,675
12	11,85	16,85	15,677
13	11,85	16,85	15,681
14	11,85	16,85	15,685
15	11,85	16,85	15,687

3. Data Viskositas

Tabel L1.3 Data Viskositas pada Produk

Sampel	Massa Bola (gr)	Diameter Bola (cm)	Konstanta Bola ($mPascm^3/gs$)	Waktu (s)			
				t_1	t_2	t_3	Rata-Rata
1	15,05	1,5	0,09	3,41	3,41	3,43	3,42
2	15,05	1,5	0,09	3,56	3,58	3,57	3,57
3	15,05	1,5	0,09	3,85	3,84	3,87	3,85
4	15,05	1,5	0,09	3,93	3,93	3,95	3,94
5	15,05	1,5	0,09	4,00	4,02	4,02	4,01
6	15,05	1,5	0,09	3,44	3,45	3,45	3,45
7	15,05	1,5	0,09	3,62	3,60	3,61	3,61
8	15,05	1,5	0,09	3,87	3,87	3,86	3,87
9	15,05	1,5	0,09	3,95	3,94	3,97	3,95
10	15,05	1,5	0,09	4,03	4,02	4,03	4,03
11	15,05	1,5	0,09	3,46	3,46	3,48	3,47
12	15,05	1,5	0,09	3,66	3,68	3,64	3,66
13	15,05	1,5	0,09	3,87	3,90	3,89	3,89
14	15,05	1,5	0,09	3,97	3,97	4,00	3,98
15	15,05	1,5	0,09	4,05	4,06	4,08	4,06

4. Data Hasil Uji Analisa dan Perhitungan

Tabel L1.4 Data Hasil Uji Analisa dan Perhitungan

Sampel	% Yield (%)	Densitas (kg/m^3)	Viskositas (mm^2/s)	Titik Nyala (℃)	Angka Setana
1	6,10	763,90	3,12	59,8	88,8
2	7,10	764,30	3,26	60,0	88,7
3	8,82	764,90	3,51	60,3	88,6
4	8,62	765,70	3,58	60,5	88,4
5	8,45	766,10	3,65	60,6	88,2
6	14,10	764,10	3,14	60,2	88,4
7	14,54	764,50	3,29	60,3	88,3
8	20,45	765,10	3,52	60,5	88,1
9	19,82	765,90	3,60	60,7	87,9
10	19,49	766,50	3,66	60,9	87,8
11	16,68	764,30	3,16	60,5	88,2
12	17,21	764,70	3,34	60,6	88,0
13	23,90	765,50	3,54	60,8	87,9
14	22,94	766,30	3,62	60,9	87,7
15	21,31	766,70	3,69	61,0	87,5

LAMPIRAN II
PERHITUNGAN

1. Perhitungan Mol Hidrogen

T = 30 ˚C = 303,15 K

R = 0,082057 L.atm/mol.K

V = (V Reaktor 1 + V Reaktor + V Akumulator + V Kondensor + V Separator – V Bahan Baku)

- Reaktor 1

  D = 10,16 cm

  H = 52 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2($10,16^2$) x 52

  = 4217,503 cm^3

- Reaktor 2

  D Tube = 0,623 cm

  H Tube = 40 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2($0,623^2$) x 40

  = 12,1872 cm^3 x 11 Tube

  = 134,0598 cm^3

  D Pipa = 5,08 cm

  H Pipa = 20 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2($5,08^2$) x 20

  = 405,1604 cm^3

  Vol Total = Vol Tube + Vol Pipa

  = 539,2202 cm^3

- Reaktor 3

  D = 2,54 cm

  H = 50 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2($02,54^2$) x 50 = 1012,9 cm^3

- Akumulator

  D = 10,16 cm

  H = 20 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2($10,16^2$) x 20

  = 1620,6419 cm^3

- Kondensor

  D = 5 cm

  H = 30 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2(5^2) x 30

  = 589,2857 cm^3

- Separator

  D = 10,16 cm

  H = 52 cm

  Vol = $\pi r^2 h$

  = 22/7 x 1/2($10,16^2$) x 52

  = 4217,503 cm^3

  Vol Bahan Baku = 2000 cm^3

  Vol Total = 10198,53 cm^3

  = 10,18953 Liter

  1) Mol pada Tekanan 2 Bar

     P = 2 Bar = 1,9738 atm

     PV = nRT

     n = $\frac{PV}{RT}$

     = $\frac{1{,}9738\ atm\ .\ 10{,}18953\ \ Liter}{0{,}082057\ L\frac{atm}{molK}.303{,}15\ K}$

     = 0,8085 mol

2. *Percent Yield*

- Volum *feed* = 2000 ml
- ρ *feed* = 0,8887 gr/cm^3
- Volum produk = 142 ml
- P produk = 763,9 Kg/m^3 = 0,7639 gr/cm^3

$$\%\ yield = \frac{massa\ produk}{massa\ feed}\ x\ 100\%$$

$$\%\ yield = \frac{0{,}7639\ \frac{gr}{cm^3}\ x\ 142\ ml}{0{,}9169\ \frac{gr}{cm^3}\ x\ 2000\ ml}\ x\ 100\%$$

$$\%\ yield = 6{,}10\ \%$$

Tabel L2.1 Data percent yield pada sampel

Sampel	*Percent Yield*
1	6.10%
2	7.10%
3	8.82%
4	8.62%
5	8.45%
6	14.10%
7	14.54%
8	20.45%
9	19.82%
10	19.49%
11	16.68%
12	17.21%
13	23.90%
14	22.94%
15	21.31%

3. Densitas

a. Menghitung Volum Aquadest

Berat Piknometer Kosong (a) = 11,85 gr

Berat Piknometer + Aquadest (b) = 16,85 gr

Densitas Aquadest 15 ℃ (ρ) = 0,99909 gr/cm^3

Berat Aquadest (m) = b - a

Berat Aquadest (m) = 16,85 – 11,85 = 5 gr

Volume Aquadest $= \frac{m}{\rho}$

$$= \frac{5\ gr}{0{,}99909\ \frac{gr}{cm^3}}$$

$= 5{,}0045541\ cm^3$

b. Menghitung Densitas Sampel

Sampel 1

Berat Piknometer Kosong (a) = 11,85 gr

Berat Piknometer + Sampel (b) = 15,673 gr

Volume Piknometer = 5,0045541 cm^3

Berat Sampel (m) = b - a

Berat Sampel (m) = 15,673 – 11,85

= 3,823 gr

Densitas Sampel (ρ) $= \frac{m}{V}$

$$= \frac{3{,}823\ gr}{5{,}0045541\ cm^3}$$

$= 0{,}7639\ gr/cm^3 = 763{,}9\ Kg/m^3$

Tabel L2.2 Data densitas pada sampel

Sampel	Densitas (kg/m³)
1	763.9
2	764.3
3	764.9
4	765.7
5	766.1
6	764.1
7	764.5
8	765.1
9	765.9
10	766.5
11	764.3
12	764.7
13	765.5
14	766.3
15	766.7

4. Viskositas

Sampel 1

- Berat Bola Kecil = 15,05 gr
- Diameter Bola Kecil = 1,5 cm
- Jari – Jari = 0,75 cm
- Volume Bola = 1,7679 cm^3

- ρ Bola $= \frac{15{,}05\ gr}{1{,}7679\ \mathrm{cm3}}$

  $= 8{,}5131\ gr/cm^3$

- Konstanta Bola = 0,09 $mPa.s.cm^3/gr.s$
- ρ Sampel = 763,9 Kg/m^3

  $= 0{,}7639\ gr/cm^3$

- Rata-Rata Waktu Tempuh $= \frac{t1+t2+t3}{3}$

  $= \frac{3{,}41+3{,}41+3{,}43}{3}$

  $= 3{,}42\ s$

a. Viskositas Dinamik $= K\ (\rho 1 - \rho 2)\ t$

$= 0{,}09\ x\ (\ 8{,}5131\ -\ 0{,}7639)\ x\ 3{,}42$

$= 2{,}3852\ mPa.s = 0{,}0239\ gr/cm.s$

b. Viskositas Kinematik $= \frac{Viskositas\ dinamik}{Densitas\ (\rho 2)}$

$= \frac{0{,}0238\ \frac{gr}{cm}.S}{0{,}7639\ \frac{gr}{cm^3}}$

$= 0{,}0312\ cm^2/s\ = 3{,}1224\ mm^2/s$

Tabel L2.3 Data Viskositas pada sampel

Sampel	Viskositas (mm^2/s)
1	3,12
2	3,26
3	3,51
4	3,58
5	3,65
6	3,14
7	3,29
8	3,52
9	3,60
10	3,66
11	3,16
12	3,34
13	3,54
14	3,62
15	3,69

LAMPIRAN 3
DOKUMENTASI PENELITIAN

- **Bahan Baku dan Katalis**

Gambar L3.1 Minyak Jelantah

Gambar L3.2 *Bleaching Earth*

Gambar L3.3 Katalis Ni-Zn/γ Al_2O_3

Gambar L3.4 Gas Hidrogen

- **Alat yang Digunakan**

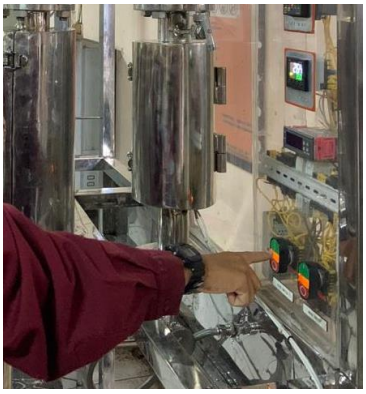
Gambar L3.5 Alat *Hydroprocessing*

- **Tahapan *Hydroprocessing***

Gambar L3.6 WCO dimasukkan

Gambar L3.7 Katalis dimasukkan

Gambar L3. 8 Gas hidrogen diinjeksikan



Gambar L3. 9 Alat dihidupkan

Gambar L3. 10 Sampling green diesel

- **Produk**

Gambar L3.11 Produk green diesel

- **Uji Analisa Sampel Produk**

Gambar L3.12 Viskositas

Gambar L3.13 Densitas

- **Kelompok *Green Diesel***

Gambar L3.14 Kelompok green diesel