

LAMPIRAN I

DATA PENELITIAN

I.1 Sintesis Katalis

Tabel I.1 Tabel Hasil Sintesis Katalis

Katalis	Massa Katalis Teori (gr)	Massa Katalis Aktual (gr)
60% Ni / 40% Al ₂ O ₃	131,416	104,66
45% Ni - 15% Zn / 40% Al ₂ O ₃	132,677	102,65

I.2 Karakterisasi Katalis

Tabel I.2 Tabel Hasil Karakterisasi Katalis

Katalis	Jumlah Pori	Total Luas Area (nm ²)	Rata-Rata Ukuran (nm ²)
60% Ni / 40% Al ₂ O ₃	684	51.575.511	75.403
45% Ni - 15% Zn/ 40% Al ₂ O ₃	363	26.126.531	71.974

I.3 Uji Kinerja Katalis

Uji Kinerja Katalis

Volume Bahan Baku = 2 liter

Temperatur = 400 °C

Tekanan Reaktor = 20 Bar

Tabel I.3 Tabel Persentase *Yield* Hasil Kinerja Katalis

Katalis	Pengulangan	Massa Botol Kosong (gr)	Massa Botol + Produk (gr)	Persentase <i>Yield</i> (%)
60% Ni / 40% Al ₂ O ₃	1	124,42	586,62	25,16
	2		583,13	24,97
	3		585,34	25,09
45% Ni - 15% Zn / 40% Al ₂ O ₃	1	124,42	573,52	24,44
	2		569,74	24,24
	3		572,12	24,37

I.4 Uji Kualitas Produk Solar Hidrokarbon

- Densitas Produk (ρ)

Tabel I.4 Tabel Densitas Produk Solar Hidrokarbon

Katalis	Pengulangan	Massa Piknometer Kosong (gr)	Massa Piknometer + Aquadest (gr)	Massa Piknometer + Sampel (gr)
60% Ni / 40% Al ₂ O ₃	1	11,85	16,85	15,678
	2			15,679
	3			15,681
45% Ni - 15% Zn / 40% Al ₂ O ₃	1	11,85	16,85	15,679
	2			15,682
	3			15,686

- Viskositas Produk (ν)

Tabel I.5 Tabel Viskositas Produk Solar Hidrokarbon

Katalis	Pengulangan	Massa Bola (gr)	Diameter Bola (cm)	Konstanta Bola (mPa.scm ³ /gs)	Waktu Tempuh (s)		
					t ₁	t ₂	t ₃
60% Ni / 40% Al ₂ O ₃	1	15,05	1,50	0,09	3,09	3,13	3,10
	2				3,15	3,20	3,17
	3				3,12	3,10	3,08
45% Ni - 15% Zn / 40% Al ₂ O ₃	1	15,05	1,50	0,09	3,58	3,57	4,00
	2				3,59	4,01	4,09
	3				4,10	4,02	3,57

- Titik Nyala

Tabel I.6 Tabel Titik Nyala Produk Solar Hidrokarbon

Katalis	Pengulangan	Temp. Titik Nyala (°C)
60% Ni / 40% Al ₂ O ₃	1	60,8
	2	60,9
	3	60,5
45% Ni - 15% Zn / 40% Al ₂ O ₃	1	62,3
	2	62,0
	3	61,5

- Angka Setana

Tabel I.7 Tabel Angka Setana Produk Solar Hidrokarbon

Katalis	Pengulangan	Angka Setana (CN)
60% Ni / 40% Al ₂ O ₃	1	88,4
	2	87,2
	3	88,7
45% Ni - 15% Zn / 40% Al ₂ O ₃	1	82,3
	2	84,1
	3	86,7

- Bilangan Asam

Tabel I.8 Tabel Bilangan Asam Produk Solar Hidrokarbon

Katalis	Pengulangan	Volume KOH (ml)	Massa Sampel (gr)
60% Ni / 40% Al ₂ O ₃	1	1,22	20,07
	2	1,04	20,05
	3	1,32	20,09
45% Ni - 15% Zn / 40% Al ₂ O ₃	1	0,15	20,10
	2	0,16	20,05
	3	0,13	20,03

LAMPIRAN II

DATA PERHITRUNGAN

II.1 Sintesis Katalis

1. Massa bahan baku katalis per kemasan

- $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$

Massa

$$\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} = 500 \text{ gr}$$

dalam kemasan

$$\text{Mr Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} = 290,8 \text{ gr/mol}$$

$$\text{Mr Ni}(\text{NO}_3)_2 = 182,7 \text{ gr/mol}$$

$$\text{Massa Ni}(\text{NO}_3)_2 \text{ dalam kemasan} = \frac{\text{Mr Ni}(\text{NO}_3)_2}{\text{Mr Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}} \times \text{Massa Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ dalam kemasan}$$

$$= \frac{182,7 \text{ gr/mol}}{290,8 \text{ gr/mol}} \times 500 \text{ gr}$$

$$= 314,1 \text{ gr}$$

- $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$

Massa

$$\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} = 500 \text{ gr}$$

dalam kemasan

$$\text{Mr Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} = 297,5 \text{ gr/mol}$$

$$\text{Mr Zn}(\text{NO}_3)_2 = 189,4 \text{ gr/mol}$$

$$\text{Massa Zn}(\text{NO}_3)_2 \text{ dalam kemasan} = \frac{\text{Mr Zn}(\text{NO}_3)_2}{\text{Mr Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}} \times \text{Massa Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ dalam kemasan}$$

$$= \frac{189,4 \text{ gr/mol}}{297,5 \text{ gr/mol}} \times 500 \text{ gr}$$

$$= 318,4 \text{ gr}$$

- $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$

Massa

$$\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O} = 500 \text{ gr}$$

dalam kemasan

$$\text{Mr Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O} = 375,1 \text{ gr/mol}$$

$$\text{Mr Al}(\text{NO}_3)_3 = 213,0 \text{ gr/mol}$$

$$\begin{aligned}
 \text{Massa Al(NO}_3)_3 \text{ dalam kemasan} &= \frac{\text{Mr Al(NO}_3)_3}{\text{Mr Al(NO}_3)_3 \cdot 9\text{H}_2\text{O}} \times \text{Massa Al(NO}_3)_3 \cdot 9\text{H}_2\text{O dalam kemasan} \\
 &= \frac{213,0 \text{ gr/mol}}{375,1 \text{ gr/mol}} \times 500 \text{ gr} \\
 &= 283,9 \text{ gr}
 \end{aligned}$$

2. Massa bahan katalis diambil

$$\text{Basis} = 500 \text{ gr}$$

a. Katalis 60% Ni / 40% Al₂O₃

Massa

$$\begin{aligned}
 - \text{Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ digunakan} &= 60\% \times \text{Basis} \\
 &= 60\% \times 500 \text{ gr} \\
 &= 300 \text{ gr}
 \end{aligned}$$

$$\frac{\text{Massa Ni(NO}_3)_2 \text{ dalam kemasan}}{\text{Massa Ni(NO}_3)_2 \text{ digunakan}} = \frac{\text{Massa Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O dalam kemasan}}{\text{Massa Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O digunakan}}$$

$$\frac{\text{Massa Ni(NO}_3)_2 \text{ digunakan}}{314,14 \text{ gr}} = \frac{500 \text{ gr}}{300 \text{ gr}}$$

$$\text{Massa Ni(NO}_3)_2 \text{ digunakan} = 300 \text{ gr}$$

$$\text{Massa Ni(NO}_3)_2 \text{ digunakan} = 188,5 \text{ gr}$$

$$\begin{aligned}
 \text{Mol Ni(NO}_3)_2 \text{ digunakan} &= \frac{\text{Massa Ni(NO}_3)_2 \text{ digunakan}}{\text{Mr Ni(NO}_3)_2} \\
 &= \frac{188,5 \text{ gr}}{182,7 \text{ gr/mol}} \\
 &= 1,032 \text{ mol}
 \end{aligned}$$

$$\begin{aligned}
 - \text{Al(NO}_3)_3 \cdot 9\text{H}_2\text{O} \text{ digunakan} &= 40\% \times \text{Basis} \\
 &= 40\% \times 500 \text{ gr} \\
 &= 200 \text{ gr}
 \end{aligned}$$

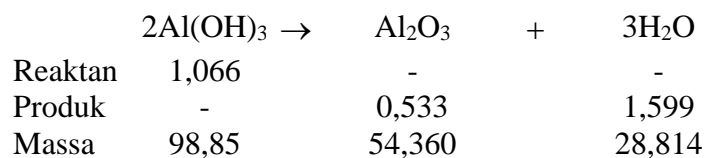
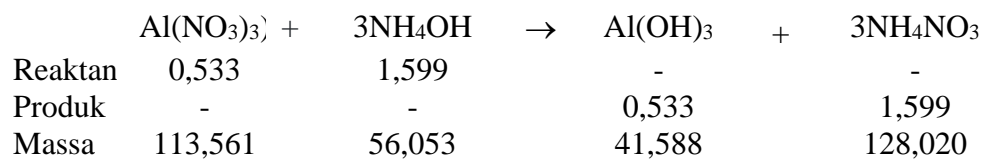
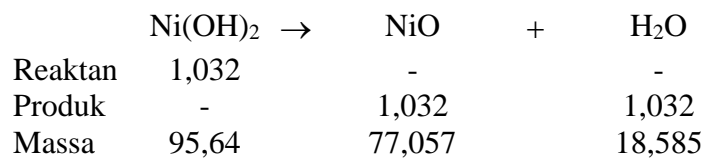
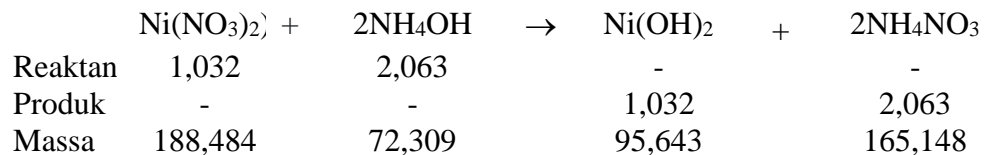
$$\frac{\text{Massa Al(NO}_3)_3 \text{ dalam kemasan}}{\text{Massa Al(NO}_3)_3 \text{ digunakan}} = \frac{\text{Massa Al(NO}_3)_3 \cdot 9\text{H}_2\text{O dalam kemasan}}{\text{Massa Al(NO}_3)_3 \cdot 9\text{H}_2\text{O digunakan}}$$

$$\frac{\text{Massa Al(NO}_3)_3 \text{ digunakan}}{283,90 \text{ gr}} = \frac{500 \text{ gr}}{200 \text{ gr}}$$

$$\text{Massa Al(NO}_3)_3 \text{ digunakan} = 200 \text{ gr}$$

$$\text{Massa Al(NO}_3)_3 \text{ digunakan} = 113,6 \text{ gr}$$

$$\begin{aligned} \text{Mol Al(NO}_3)_3 \text{ digunakan} &= \frac{\text{Massa Al(NO}_3)_3 \text{ digunakan}}{\text{Mr Al(NO}_3)_3} \\ &= \frac{113,6 \text{ gr}}{213,0 \text{ gr/mol}} \\ &= 0,533 \text{ mol} \end{aligned}$$



$$\begin{aligned} \text{Massa Produk Katalis} &= \text{NiO} + \text{Al}_2\text{O}_3 \\ &= 131,416 \text{ gr} \end{aligned}$$

b. Katalis 45% Ni - 15% Zn/ 40% Al_2O_3

$$\begin{aligned} \text{Massa Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ digunakan} &= 45\% \times \text{Basis} \\ &= 45\% \times 500 \text{ gr} \\ &= 225 \text{ gr} \end{aligned}$$

$$\begin{aligned} \frac{\text{Massa Ni(NO}_3)_2 \text{ dalam kemasan}}{\text{Massa Ni(NO}_3)_2 \text{ digunakan}} &= \frac{\text{Massa Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ dalam kemasan}}{\text{Massa Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ digunakan}} \end{aligned}$$

$$\begin{aligned}
 \frac{314,14 \text{ gr}}{\text{Massa Ni(NO}_3)_2 \text{ digunakan}} &= \frac{500 \text{ gr}}{225 \text{ gr}} \\
 \text{Massa Ni(NO}_3)_2 \text{ digunakan} &= 141,4 \text{ gr} \\
 \text{Mol Ni(NO}_3)_2 \text{ digunakan} &= \frac{\text{Massa Ni(NO}_3)_2 \text{ digunakan}}{\text{Mr Ni(NO}_3)_2} \\
 &= \frac{141,4 \text{ gr}}{182,7 \text{ gr/mol}} \\
 &= 0,774 \text{ mol} \\
 \\
 - \text{ Massa Zn(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ digunakan} &= 15\% \times \text{Basis} \\
 &= 15\% \times 500 \text{ gr} \\
 &= 75 \text{ gr} \\
 \frac{\text{Massa Zn(NO}_3)_2 \text{ dalam kemasan}}{\text{Massa Zn(NO}_3)_2 \text{ digunakan}} &= \frac{\text{Massa Zn(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ dalam kemasan}}{\text{Massa Zn(NO}_3)_2 \cdot 6\text{H}_2\text{O} \text{ digunakan}} \\
 \frac{318,37 \text{ gr}}{\text{Massa Zn(NO}_3)_2 \text{ digunakan}} &= \frac{500 \text{ gr}}{75 \text{ gr}} \\
 \text{Massa Zn(NO}_3)_2 \text{ digunakan} &= 47,76 \text{ gr} \\
 \text{Massa Zn(NO}_3)_2 \text{ digunakan} &= 47,76 \text{ gr} \\
 \text{Mol Zn(NO}_3)_2 \text{ digunakan} &= \frac{\text{Massa Zn(NO}_3)_2 \text{ digunakan}}{\text{Mr Zn(NO}_3)_2} \\
 &= \frac{47,76 \text{ gr}}{189,4 \text{ gr/mol}} \\
 &= 0,252 \text{ mol} \\
 \\
 - \text{ Massa Al(NO}_3)_3 \cdot 9\text{H}_2\text{O} \text{ digunakan} &= 40\% \times \text{Basis} \\
 &= 40\% \times 500 \text{ gr} \\
 &= 200 \text{ gr} \\
 \frac{\text{Massa Al(NO}_3)_3 \text{ dalam kemasan}}{\text{Massa Al(NO}_3)_3 \text{ digunakan}} &= \frac{\text{Massa Al(NO}_3)_3 \cdot 9\text{H}_2\text{O} \text{ dalam kemasan}}{\text{Massa Al(NO}_3)_3 \cdot 9\text{H}_2\text{O} \text{ digunakan}}
 \end{aligned}$$

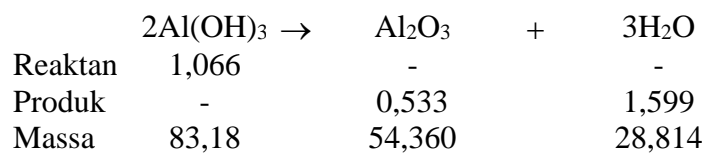
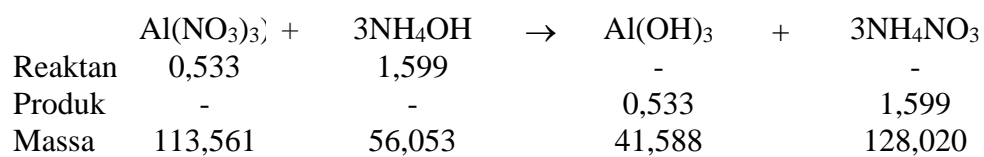
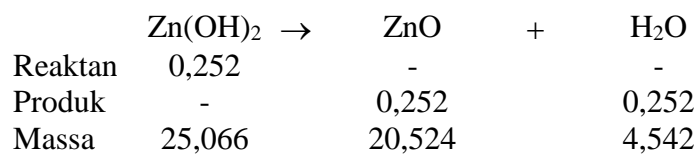
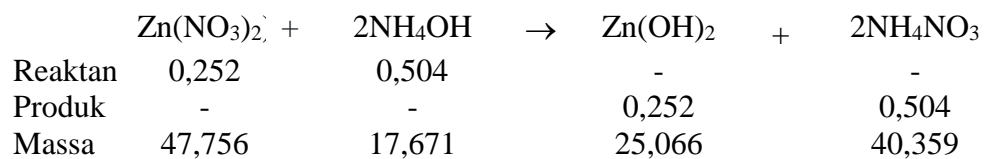
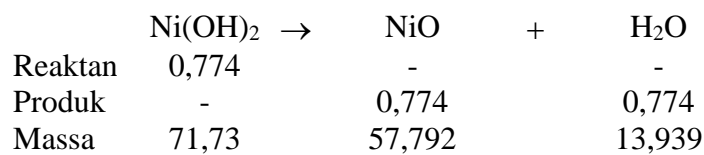
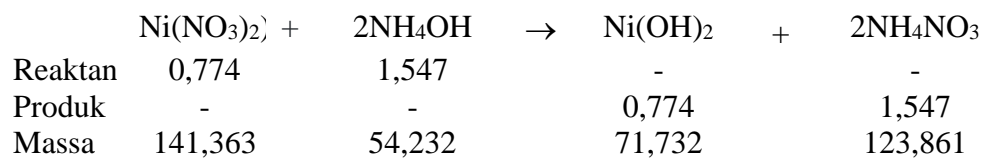
$$\frac{283,90 \text{ gr}}{\text{Massa Al(NO}_3)_3 \text{ digunakan}} = \frac{500 \text{ gr}}{200 \text{ gr}}$$

$$\text{Massa Al(NO}_3)_3 \text{ digunakan} = 113,6 \text{ gr}$$

$$\text{Mol Al(NO}_3)_3 \text{ digunakan} = \frac{\text{Massa Al(NO}_3)_3 \text{ digunakan}}{\text{Mr Al(NO}_3)_3}$$

$$= \frac{113,6 \text{ gr}}{213,0 \text{ gr/mol}}$$

$$= 0,533 \text{ mol}$$



$$\begin{aligned} \text{Massa Produk Katalis} &= \text{NiO} + \text{ZnO} + \text{Al}_2\text{O}_3 \\ &= 132,677 \text{ gr} \end{aligned}$$

II.2 Uji Kinerja Katalis

1. Persen *Yield* Produk Solar Hidrokarbon

Menghitung Massa Bahan Baku

$$\begin{aligned} \text{Densitas Minyak} &= 0,9186 \text{ gr/ml} && \text{Sumber : Irawan, dkk., 2013} \\ \text{Jelantah } (\rho) & \end{aligned}$$

$$\begin{aligned} \text{Volume Minyak} &= 2.000 \text{ ml} \\ \text{Jelantah } (V) & \end{aligned}$$

$$\begin{aligned} \text{Massa Minyak} &= \rho \times V \\ \text{Jelantah } (m) &= 0,9186 \text{ gr/ml} \times 2000 \text{ ml} \\ &= 1837,2 \text{ gr} \end{aligned}$$

Menghitung Persentase *Yield* Produk

^a Katalis 60% Ni / 40% Al₂O₃

Pengulangan 1

$$\begin{aligned} \text{Massa Botol} &= 124,42 \text{ gr} \\ \text{Kosong } (a) & \end{aligned}$$

$$\begin{aligned} \text{Massa Botol +} &= 586,62 \text{ gr} \\ \text{Produk } (b) & \end{aligned}$$

$$\begin{aligned} \text{Massa Produk} &= b - a \\ &= 586,62 \text{ gr} - 124,4 \text{ gr} \\ &= 462,2 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Persen } Yield &= \frac{\text{Massa Produk}}{\text{Massa Bahan Baku}} \times 100 \\ &= \frac{462,2 \text{ gr}}{1837,2 \text{ gr}} \times 100 \\ &= 25,16 \text{ \%} \end{aligned}$$

Pengulangan 2

$$\begin{aligned} \text{Massa Botol} &= 124,4 \text{ gr} \\ \text{Kosong } (a) & \end{aligned}$$

$$\begin{aligned} \text{Massa Botol +} &= 583,1 \text{ gr} \\ \text{Produk } (b) & \end{aligned}$$

$$\begin{aligned} \text{Massa Produk} &= b - a \\ &= 583,1 \text{ gr} - 124,4 \text{ gr} \\ &= 458,7 \text{ gr} \end{aligned}$$

$$\begin{aligned}
 \text{Persen Yield} &= \frac{\text{Massa Produk}}{\text{Massa Bahan Baku}} \times 100 \\
 &= \frac{458,7 \text{ gr}}{1837,2 \text{ gr}} \times 100 \\
 &= 24,97 \%
 \end{aligned}$$

Pengulangan 3

$$\begin{aligned}
 \text{Massa Botol Kosong (a)} &= 124,4 \text{ gr} \\
 \text{Massa Botol + Produk (b)} &= 585,3 \text{ gr} \\
 \text{Massa Produk} &= b - a \\
 &= 585,3 \text{ gr} - 124,4 \text{ gr} \\
 &= 460,9 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Persen Yield} &= \frac{\text{Massa Produk}}{\text{Massa Bahan Baku}} \times 100 \\
 &= \frac{460,9 \text{ gr}}{1837,2 \text{ gr}} \times 100 \\
 &= 25,09
 \end{aligned}$$

b. Katalis 45% Ni - 15% Zn / 40% Al₂O₃

Pengulangan 1

$$\begin{aligned}
 \text{Massa Botol Kosong (a)} &= 124,4 \text{ gr} \\
 \text{Massa Botol + Produk (b)} &= 573,5 \text{ gr} \\
 \text{Massa Produk} &= b - a \\
 &= 573,5 \text{ gr} - 124,4 \text{ gr} \\
 &= 449,1 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Persen Yield} &= \frac{\text{Massa Produk}}{\text{Massa Bahan Baku}} \times 100 \\
 &= \frac{449,1 \text{ gr}}{1837,2 \text{ gr}} \times 100 \\
 &= 24,44
 \end{aligned}$$

Pengulangan 2

$$\begin{aligned}
 \text{Massa Botol Kosong (a)} &= 124,4 \text{ gr} \\
 \text{Massa Botol + Produk (b)} &= 569,74 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Massa Produk} &= b - a \\
 &= 569,7 \text{ gr} - 124,4 \text{ gr} \\
 &= 445,3 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Persen Yield} &= \frac{\text{Massa Produk}}{\text{Massa Bahan Baku}} \times 100 \\
 &= \frac{445,3 \text{ gr}}{1837,2 \text{ gr}} \times 100 \\
 &= 24,24
 \end{aligned}$$

Pengulangan 3

$$\begin{aligned}
 \text{Massa Botol} \\
 \text{Kosong (a)} &= 124,4 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Massa Botol +} \\
 \text{Produk (b)} &= 572,12 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Massa Produk} &= b - a \\
 &= 572,1 \text{ gr} - 124,4 \text{ gr} \\
 &= 447,7 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Persen Yield} &= \frac{\text{Massa Produk}}{\text{Massa Bahan Baku}} \times 100 \\
 &= \frac{447,7 \text{ gr}}{1837,2 \text{ gr}} \times 100 \\
 &= 24,37
 \end{aligned}$$

II.3 Uji Kualitas Produk Solar Hidrokarbon

1. Densitas Produk (ρ)

Menghitung Volume Piknometer

$$\begin{aligned}
 \text{Massa Piknometer} \\
 \text{Kosong (a)} &= 11,85 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Massa Piknometer +} \\
 \text{Aquadest (b)} &= 16,85 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Densitas Aquadest} \\
 40^\circ\text{C} (\rho) &= 0,99 \text{ gr/cm}^3
 \end{aligned}$$

$$\begin{aligned}
 \text{Massa Aquadest (m)} &= b - a \\
 &= 16,85 \text{ gr} - 11,85 \text{ gr} \\
 &= 5,00 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Volume Aquadest (V)} &= \frac{m}{\rho} \\
 &= \frac{5,00 \text{ gr}}{0,99 \text{ gr/cm}^3} \\
 &= 5,00 \text{ cm}^3
 \end{aligned}$$

Menghitung Densitas Produk

a Katalis 60% Ni / 40% Al₂O₃

Pengulangan 1

$$\text{Massa Piknometer Kosong (a)} = 11,85 \text{ gr}$$

$$\text{Massa Piknometer + Sampel (b)} = 15,68 \text{ gr}$$

$$\text{Volume Piknometer (V)} = 5,00 \text{ cm}^3$$

$$\begin{aligned} \text{Massa Sampel (m)} &= b - a \\ &= 15,68 \text{ gr} - 11,85 \text{ gr} \\ &= 3,83 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Densitas Sampel } 40^\circ\text{C } (\rho) &= \frac{m}{V} \\ &= \frac{3,83 \text{ gr}}{5,00 \text{ cm}^3} \\ &= 0,7656 \frac{\text{gr}}{\text{cm}^3} \times \frac{1 \text{ kg}}{(10)^3 \text{ gr}} \times \frac{(10)^6 \text{ cm}^3}{1 \text{ m}^3} \\ &= 765,60 \text{ kg/m}^3 \end{aligned}$$

Pengulangan 2

$$\text{Massa Piknometer Kosong (a)} = 11,85 \text{ gr}$$

$$\text{Massa Piknometer + Sampel (b)} = 15,68 \text{ gr}$$

$$\text{Volume Piknometer (V)} = 5,00 \text{ cm}^3$$

$$\begin{aligned} \text{Massa Sampel (m)} &= b - a \\ &= 15,68 \text{ gr} - 11,85 \text{ gr} \\ &= 3,83 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Densitas Sampel } 40^\circ\text{C } (\rho) &= \frac{m}{V} \\ &= \frac{3,83 \text{ gr}}{5,00 \text{ cm}^3} \\ &= 0,7658 \frac{\text{gr}}{\text{cm}^3} \times \frac{1 \text{ kg}}{(10)^3 \text{ gr}} \times \frac{(10)^6 \text{ cm}^3}{1 \text{ m}^3} \\ &= 765,80 \text{ kg/m}^3 \end{aligned}$$

Pengulangan 3

$$\text{Massa Piknometer Kosong (a)} = 11,85 \text{ gr}$$

$$\text{Massa Piknometer + Sampel (b)} = 15,68 \text{ gr}$$

$$\text{Volume Piknometer (V)} = 5,00 \text{ cm}^3$$

$$\begin{aligned} \text{Massa Sampel (m)} &= b - a \\ &= 15,68 \text{ gr} - 11,85 \text{ gr} \\ &= 3,83 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Densitas Sampel } 40^\circ\text{C } (\rho) &= \frac{m}{V} \\ &= \frac{3,83 \text{ gr}}{5,00 \text{ cm}^3} \\ &= 0,7662 \frac{\text{gr}}{\text{cm}^3} \times \frac{1}{(10)^3} \frac{\text{kg}}{\text{gr}} \times \frac{(10)^6 \text{ cm}^3}{1 \text{ m}^3} \\ &= 766,20 \text{ kg/m}^3 \end{aligned}$$

b. Katalis 45% Ni - 15% Zn / 40% Al₂O₃

Pengulangan 1

$$\text{Massa Piknometer Kosong (a)} = 11,85 \text{ gr}$$

$$\text{Massa Piknometer + Sampel (b)} = 15,68 \text{ gr}$$

$$\text{Volume Piknometer (V)} = 5,00 \text{ cm}^3$$

$$\begin{aligned} \text{Massa Sampel (m)} &= b - a \\ &= 15,68 \text{ gr} - 11,85 \text{ gr} \\ &= 3,83 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Densitas Sampel } 40^\circ\text{C } (\rho) &= \frac{m}{V} \\ &= \frac{3,83 \text{ gr}}{5,00 \text{ cm}^3} \\ &= 0,7658 \frac{\text{gr}}{\text{cm}^3} \times \frac{1}{(10)^3} \frac{\text{kg}}{\text{gr}} \times \frac{(10)^6 \text{ cm}^3}{1 \text{ m}^3} \\ &= 765,80 \text{ kg/m}^3 \end{aligned}$$

Pengulangan 2

$$\text{Massa Piknometer Kosong (a)} = 11,85 \text{ gr}$$

$$\text{Massa Piknometer + Sampel (b)} = 15,68 \text{ gr}$$

$$\text{Volume Piknometer (V)} = 5,00 \text{ cm}^3$$

$$\begin{aligned} \text{Massa Sampel (m)} &= b - a \\ &= 15,68 \text{ gr} - 11,85 \text{ gr} \\ &= 3,83 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Densitas Sampel } 40^\circ\text{C } (\rho) &= \frac{m}{V} \\ &= \frac{3,83 \text{ gr}}{5,00 \text{ cm}^3} \\ &= 0,7664 \frac{\text{gr}}{\text{cm}^3} \times \frac{1}{(10)^3} \frac{\text{kg}}{\text{gr}} \times \frac{(10)^6 \text{ cm}^3}{1 \text{ m}^3} \\ &= 766,40 \text{ kg/m}^3 \end{aligned}$$

Pengulangan 3

$$\text{Massa Piknometer Kosong (a)} = 11,85 \text{ gr}$$

$$\text{Massa Piknometer + Sampel (b)} = 15,69 \text{ gr}$$

$$\text{Volume Piknometer (V)} = 5,00 \text{ cm}^3$$

$$\begin{aligned} \text{Massa Sampel (m)} &= b - a \\ &= 15,69 \text{ gr} - 11,85 \text{ gr} \\ &= 3,84 \text{ gr} \end{aligned}$$

$$\begin{aligned} \text{Densitas Sampel } 40^\circ\text{C } (\rho) &= \frac{m}{V} \\ &= \frac{3,84 \text{ gr}}{5,00 \text{ cm}^3} \\ &= 0,7672 \frac{\text{gr}}{\text{cm}^3} \times \frac{1}{(10)^3} \frac{\text{kg}}{\text{gr}} \times \frac{(10)^6 \text{ cm}^3}{1 \text{ m}^3} \\ &= 767,20 \text{ kg/m}^3 \end{aligned}$$

2. Viskositas Produk (v)

Menghitung Densitas Bola

$$\text{Massa Bola (m)} = 15,05 \text{ gr}$$

$$\text{Diameter Bola (D)} = 1,50 \text{ cm}$$

$$\text{Jari-Jari Bola (r)} = 0,75 \text{ cm}$$

$$\begin{aligned} \text{Volume Bola (V)} &= \frac{4}{3} \times \pi \times r^3 \\ &= \frac{4}{3} \times 3,14 \times (0,75)^3 \\ &= 1,766 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Densitas Bola } (\rho_1) &= \frac{m}{v} \\ &= \frac{15,05 \text{ gr}}{1,766 \text{ gr/cm}^3} \\ &= 8,52 \text{ cm}^3 \end{aligned}$$

Menghitung Viskositas (v)

$$\text{Konstanta Bola (K)} = 0,09 \text{ m.Pa.s.cm}^3$$

a. Katalis 60% Ni / 40% Al₂O₃

Pengulangan 1

$$\text{Densitas Sampel } (\rho_2) = 0,7656 \text{ gr/cm}^3$$

$$\text{Waktu Tempuh 1 } (t_1) = 3,09 \text{ s}$$

$$\text{Waktu Tempuh 2 } (t_2) = 3,13 \text{ s}$$

$$\text{Waktu Tempuh 3 } (t_3) = 3,10 \text{ s}$$

$$\begin{aligned} \text{Rata-Rata Waktu Tempuh (t)} &= \frac{3,09 + 3,13 + 3,10}{3} \\ &= 3,11 \text{ s} \end{aligned}$$

$$\begin{aligned} \text{Viskositas Dinamik } (\mu) &= K \times (\rho_1 - \rho_2) \times t \\ &= 0,09 \times (8,52 - 0,7656) \times 3 \\ &= 2,1684 \text{ m.Pa.s} \times \frac{0,01 \text{ gr/cm.s}}{1 \text{ m.Pa.s}} \\ &= 0,02168 \text{ gr/cm.s} \end{aligned}$$

$$\text{Viskositas Kinematik pada 40C (v)} = \frac{\text{Viskositas Dinamik } (\mu)}{\text{Densitas } (\rho_2)}$$

$$\begin{aligned}
 &= \frac{0,02168 \text{ gr/cm.s}}{0,7656 \text{ gr/cm}^3} \\
 &= 0,02832 \text{ cm}^2 / \text{s} \\
 &= 2,83226 \text{ mm}^2 / \text{s}
 \end{aligned}$$

Pengulangan 2

$$\text{Densitas Sampel } (\rho_2) = 0,7658 \text{ gr/cm}^3$$

$$\text{Waktu Tempuh 1 } (t_1) = 3,15 \text{ s}$$

$$\text{Waktu Tempuh 2 } (t_2) = 3,2 \text{ s}$$

$$\text{Waktu Tempuh 3 } (t_3) = 3,17 \text{ s}$$

$$\begin{aligned}
 \text{Rata-Rata Waktu Tempuh } (t) &= \frac{3,15 + 3,2 + 3,17}{3} \\
 &= 3,17 \text{ s}
 \end{aligned}$$

Viskositas Dinamik (μ)

$$\begin{aligned}
 &= K \times (\rho_1 - \rho_2) \times t \\
 &= 0,09 \times (8,52 - 0,7658) \times 3,17 \\
 &= 2,2149 \text{ m.Pa.s} \times \frac{0,01 \text{ gr/cm.s}}{1 \text{ m.Pa.s}} \\
 &= 0,02215 \text{ gr/cm.s}
 \end{aligned}$$

Viskositas Kinematik pada 40C (ν)

$$\begin{aligned}
 &= \frac{\text{Viskositas Dinamik } (\mu)}{\text{Densitas } (\rho_2)} \\
 &= \frac{0,02215 \text{ gr/cm.s}}{0,7658 \text{ gr/cm}^3} \\
 &= 0,02892 \text{ cm}^2 / \text{s} \\
 &= 2,89220 \text{ mm}^2 / \text{s}
 \end{aligned}$$

Pengulangan 3

$$\text{Densitas Sampel } (\rho_2) = 0,7662 \text{ gr/cm}^3$$

$$\text{Waktu Tempuh 1 } (t_1) = 3,12 \text{ s}$$

$$\text{Waktu Tempuh 2 } (t_2) = 3,1 \text{ s}$$

$$\text{Waktu Tempuh 3 } (t_3) = 3,08 \text{ s}$$

$$\begin{aligned}
 \text{Rata-Rata Waktu Tempuh } (t) &= \frac{3,12 + 3,1 + 3,08}{3} \\
 &= 3,10 \text{ s}
 \end{aligned}$$

$$\begin{aligned}
 \text{Viskositas Dinamik } (\mu) &= K \times (\rho_1 - \rho_2) \times t \\
 &= 0,09 \times (8,52 - 0,7662) \times 3,10 \\
 &= 2,1636 \text{ m.Pa.s} \times \frac{0,01 \text{ gr/cm.s}}{1 \text{ m.Pa.s}} \\
 &= 0,02164 \text{ gr/cm.s}
 \end{aligned}$$

$$\begin{aligned}
 \text{Viskositas Kinematik } (\nu) &= \frac{\text{Viskositas Dinamik } (\mu)}{\text{Densitas } (\rho_2)} \\
 &= \frac{0,02164 \text{ gr/cm.s}}{0,7662 \text{ gr/cm}^3} \\
 &= 0,02824 \text{ cm}^2 / \text{s} \\
 &= 2,82375 \text{ mm}^2 / \text{s}
 \end{aligned}$$

b. Katalis 45% Ni - 15% Zn / 40% Al₂O₃

Pengulangan 1

$$\text{Densitas Sampel } (\rho_2) = 0,7658 \text{ gr/cm}^3$$

$$\text{Waktu Tempuh 1 } (t_1) = 3,58 \text{ s}$$

$$\text{Waktu Tempuh 2 } (t_2) = 3,57 \text{ s}$$

$$\text{Waktu Tempuh 3 } (t_3) = 4,00 \text{ s}$$

$$\begin{aligned}
 \text{Rata-Rata Waktu Tempuh } (t) &= \frac{3,58 + 3,57 + 4,00}{3} \\
 &= 3,72 \text{ s}
 \end{aligned}$$

$$\begin{aligned}
 \text{Viskositas Dinamik } (\mu) &= K \times (\rho_1 - \rho_2) \times t \\
 &= 0,09 \times (8,52 - 0,7658) \times 3,72 \\
 &= 2,5941 \text{ m.Pa.s} \times \frac{0,01 \text{ gr/cm.s}}{1 \text{ m.Pa.s}} \\
 &= 0,02594 \text{ gr/cm.s}
 \end{aligned}$$

$$\begin{aligned}
 \text{Viskositas Kinematik } (\nu) &= \frac{\text{Viskositas Dinamik } (\mu)}{\text{Densitas } (\rho_2)} \\
 &= \frac{0,02594 \text{ gr/cm.s}}{0,7658 \text{ gr/cm}^3} \\
 &= 0,03387 \text{ cm}^2 / \text{s} \\
 &= 3,38740 \text{ mm}^2 / \text{s}
 \end{aligned}$$

Pengulangan 2

$$\text{Densitas Sampel } (\rho_2) = 0,7664 \text{ gr/cm}^3$$

$$\text{Waktu Tempuh 1 } (t_1) = 3,59 \text{ s}$$

$$\text{Waktu Tempuh 2 } (t_2) = 4,01 \text{ s}$$

$$\text{Waktu Tempuh 3 } (t_3) = 4,09 \text{ s}$$

$$\begin{aligned} \text{Rata-Rata Waktu Tempuh } (t) &= \frac{3,59 + 4,01 + 4,09}{3} \\ &= 3,90 \text{ s} \end{aligned}$$

$$\begin{aligned} \text{Viskositas Dinamik } (\mu) &= K \times (\rho_1 - \rho_2) \times t \\ &= 0,09 \times (8,52 - 0,7664) \times 3,90 \\ &= 2,7195 \text{ m.Pa.s} \times \frac{0,01 \text{ gr/cm.s}}{1 \text{ m.Pa.s}} \\ &= 0,02719 \text{ gr/cm.s} \end{aligned}$$

$$\begin{aligned} \text{Viskositas Kinematik } (v) &= \frac{\text{Viskositas Dinamik } (\mu)}{\text{Densitas } (\rho_2)} \\ &= \frac{0,02719 \text{ gr/cm.s}}{0,7664 \text{ gr/cm}^3} \\ &= 0,03548 \text{ cm}^2 / \text{s} \\ &= 3,54840 \text{ mm}^2 / \text{s} \end{aligned}$$

Pengulangan 3

$$\text{Densitas Sampel } (\rho_2) = 0,7672 \text{ gr/cm}^3$$

$$\text{Waktu Tempuh 1 } (t_1) = 4,10 \text{ s}$$

$$\text{Waktu Tempuh 2 } (t_2) = 4,02 \text{ s}$$

$$\text{Waktu Tempuh 3 } (t_3) = 3,57 \text{ s}$$

$$\begin{aligned} \text{Rata-Rata Waktu Tempuh } (t) &= \frac{4,10 + 4,02 + 3,57}{3} \\ &= 3,90 \text{ s} \end{aligned}$$

$$\begin{aligned} \text{Viskositas Dinamik } (\mu) &= K \times (\rho_1 - \rho_2) \times t \\ &= 0,09 \times (8,52 - 0,7672) \times 3,90 \\ &= 2,7192 \text{ m.Pa.s} \times \frac{0,01 \text{ gr/cm.s}}{1 \text{ m.Pa.s}} \\ &= 0,02719 \text{ gr/cm.s} \end{aligned}$$

$$\begin{aligned}
 \text{Viskositas Kinematik (v)} &= \frac{\text{Viskositas Dinamik } (\mu)}{\text{Densitas } (\rho_2)} \\
 &= \frac{0,02719 \text{ gr/cm.s}}{0,7672 \text{ gr/cm}^3} \\
 &= 0,03544 \text{ cm}^2 / \text{s} \\
 &= 3,54434 \text{ mm}^2 / \text{s}
 \end{aligned}$$

3. Bilangan Asam

Menghitung bilangan asam

$$\text{Normalitas Larutan KOH Standar (N)} = 0,1 \text{ N} = 0,1 \text{ mek/ml}$$

$$\text{Mr KOH} = 56,11 \text{ gr/ek}$$

a. Katalis 60% Ni / 40% Al₂O₃

Pengulangan 1

$$\text{Volume KOH (V)} = 1,22 \text{ ml}$$

$$\text{Massa Sampel (W)} = 20,07 \text{ gr}$$

$$\begin{aligned}
 \text{Bilangan Asam} &= \frac{V \times N \times \text{Mr KOH}}{W} \\
 &= \frac{1,22 \text{ ml} \times 0,1 \text{ mek/ml} \times 56,11 \text{ mg/mek}}{20,07 \text{ gr}} \\
 &= 0,341 \text{ mg KOH/gr}
 \end{aligned}$$

Pengulangan 2

$$\text{Volume KOH (V)} = 1,04 \text{ ml}$$

$$\text{Massa Sampel (W)} = 20,05 \text{ gr}$$

$$\begin{aligned}
 \text{Bilangan Asam} &= \frac{V \times N \times \text{Mr KOH}}{W} \\
 &= \frac{1,04 \text{ ml} \times 0,1 \text{ mek/ml} \times 56,11 \text{ mg/mek}}{20,05 \text{ gr}} \\
 &= 0,291 \text{ mg KOH/gr}
 \end{aligned}$$

Pengulangan 3

$$\text{Volume KOH (V)} = 1,32 \text{ ml}$$

$$\text{Massa Sampel (W)} = 20,09 \text{ gr}$$

$$\begin{aligned}
 \text{Bilangan Asam} &= \frac{V \times N \times \text{Mr KOH}}{W} \\
 &= \frac{1,32 \text{ ml} \times 0,1 \text{ mek/ml} \times 56,11 \text{ mg/mek}}{20,09 \text{ gr}} \\
 &= 0,369 \text{ mg KOH/gr}
 \end{aligned}$$

b. Katalis 45% Ni - 15% Zn / 40% Al₂O₃

Pengulangan 1

Volume KOH (V) = 0,15 ml

Massa Sampel (W) = 20,10 gr

$$\begin{aligned} \text{Bilangan Asam} &= \frac{V \times N \times \text{Mr}_{\text{KOH}}}{W} \\ &= \frac{0,15 \text{ ml} \times 0,1 \text{ mek/ml} \times 56,11 \text{ mg/mek}}{20,10 \text{ gr}} \\ &= 0,042 \text{ mg KOH/gr} \end{aligned}$$

Pengulangan 2

Volume KOH (V) = 0,16 ml

Massa Sampel (W) = 20,05 gr

$$\begin{aligned} \text{Bilangan Asam} &= \frac{V \times N \times \text{Mr}_{\text{KOH}}}{W} \\ &= \frac{0,16 \text{ ml} \times 0,1 \text{ mek/ml} \times 56,11 \text{ mg/mek}}{20,05 \text{ gr}} \\ &= 0,045 \text{ mg KOH/gr} \end{aligned}$$

Pengulangan 3

Volume KOH (V) = 0,13 ml

Massa Sampel (W) = 20,03 gr

$$\begin{aligned} \text{Bilangan Asam} &= \frac{V \times N \times \text{Mr}_{\text{KOH}}}{W} \\ &= \frac{0,13 \text{ ml} \times 0,1 \text{ mek/ml} \times 56,11 \text{ mg/mek}}{20,03 \text{ gr}} \\ &= 0,036 \text{ mg KOH/gr} \end{aligned}$$

II.4 Konsumsi Energi dan Keekonomian Penggunaan Energi

1. Menghitung konsumsi listrik (kWh)

Jumlah Waktu
Running = 120 menit

a. *Band Heater* pada *Heater*

Daya (P₁) = 940 Watt

$$= 940 \text{ Watt} \times \frac{1 \text{ kW}}{1000 \text{ Watt}} \times \frac{120 \text{ mnt}}{60 \text{ mnt/h}}$$

= 1,88 kWh

b. *Band Heater* pada *Reaktor*

$$\begin{aligned} \text{Daya (P}_2\text{)} &= 940 \text{ Watt} \\ &= 940 \text{ Watt} \times \frac{1 \text{ kW}}{1000 \text{ Watt}} \times \frac{120 \text{ mnt}}{60 \text{ mnt/h}} \\ &= 1,88 \text{ kWh} \end{aligned}$$

c. *Cooler Box* untuk *Kondensor*

$$\begin{aligned} \text{Daya (P}_3\text{)} &= 1400 \text{ Watt} \\ &= 1400 \text{ Watt} \times \frac{1 \text{ kW}}{1000 \text{ Watt}} \times \frac{120 \text{ mnt}}{60 \text{ mnt/h}} \\ &= 2,80 \text{ kWh} \end{aligned}$$

Total Daya Energi

$$\begin{aligned} &= (P_1) + (P_2) + (P_3) \\ &= 1,88 \text{ kWh} + 1,88 \text{ kWh} + 2,80 \text{ kWh} \\ &= 6,56 \text{ kWh} \end{aligned}$$

2. Menghitung *Specific Energy Consume*

a. Katalis 60% Ni / 40% Al₂O₃

$$\begin{aligned} \text{Rata-Rata Massa} &= 460,6 \text{ gr} \\ \text{Green Diesel} & \\ \text{Rata-Rata} & \\ \text{Densitas Green} &= 0,766 \text{ gr/cm}^3 \\ \text{Diesel} & \\ \text{Rata-Rata} &= \frac{m}{\rho} \\ \text{Volume Green} & \\ \text{Diesel} & \\ &= \frac{460,6 \text{ gr}}{0,766 \text{ gr/cm}^3} \\ &= 601,4 \text{ cm}^3 \\ &= 601,4 \text{ ml} \end{aligned}$$

$$\begin{aligned} \text{Specific Energy} &= \frac{\text{Total Daya Energi}}{\text{Jumlah Produk}} \\ \text{Consume} & \\ &= \frac{6,56 \text{ kWh}}{601,4 \text{ ml}} \\ &= 0,0109 \text{ kWh/ml} \end{aligned}$$

b. Katalis 45% Ni - 15%Zn / 40% Al₂O₃

$$\begin{aligned} \text{Rata-Rata Massa} &= 447,4 \text{ gr} \\ \text{Green Diesel} & \\ \text{Rata-Rata} & \\ \text{Densitas Green} &= 0,766 \text{ gr/cm}^3 \\ \text{Diesel} & \\ \text{Rata-Rata} &= \frac{m}{\rho} \\ \text{Volume Green} & \\ \text{Diesel} & \end{aligned}$$

$$\begin{aligned}
 &= \frac{447,4 \text{ gr}}{0,766 \text{ gr/cm}^3} \\
 &= 583,7 \text{ cm}^3 \\
 &= 583,7 \text{ ml} \\
 \textit{Spesific Energy} &= \frac{\textit{Total Daya}}{\textit{Energi}} \\
 \textit{Consume} &= \frac{\textit{Jumlah Produk}}{\textit{Jumlah Produk}} \\
 &= \frac{6,56 \text{ kWh}}{583,7 \text{ ml}} \\
 &= 0,0112 \text{ kWh/ml}
 \end{aligned}$$

2. Menghitung Keekonomian Penggunaan Energi

$$\begin{aligned}
 \text{Harga listrik PLN} &= \text{Rp1.444,7 per kWh} && \text{Sumber : PLN, 2022} \\
 \text{Bulan Juli - Sep 2022} &
 \end{aligned}$$

$$\begin{aligned}
 \text{Harga Konsumsi} &= \frac{\text{Total Daya}}{\text{Energi}} \times \text{Harga listrik PLN Bulan} \\
 \text{Energi per 2 Jam} &= 6,56 \text{ kWh} \times \text{Rp1.444,7} \\
 &= \text{Rp9.477,23}
 \end{aligned}$$

a. Katalis 60% Ni / 40% Al₂O₃

$$\begin{aligned}
 \text{Harga Konsumsi} &= \frac{\textit{Spesific Energy}}{\textit{Consume}} \times \text{Harga listrik PLN Bulan} \\
 \text{Energi per Volume} &= 0,0109 \text{ kWh/ml} \times \text{Rp1.444,7} \\
 &= \text{Rp15,76 per ml}
 \end{aligned}$$

b. Katalis 45% Ni - 15%Zn / 40% Al₂O₃

$$\begin{aligned}
 \text{Harga Konsumsi} &= \frac{\textit{Spesific Energy}}{\textit{Consume}} \times \text{Harga listrik PLN Bulan} \\
 \text{Energi per Volume} &= 0,0112 \text{ kWh/ml} \times \text{Rp1.444,7} \\
 &= \text{Rp16,24 per ml}
 \end{aligned}$$

LAMPIRAN III

DOKUMENTASI PENELITIAN

III.1 Sintesis Katalis

- Penimbangan Bahan Katalis



$\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$

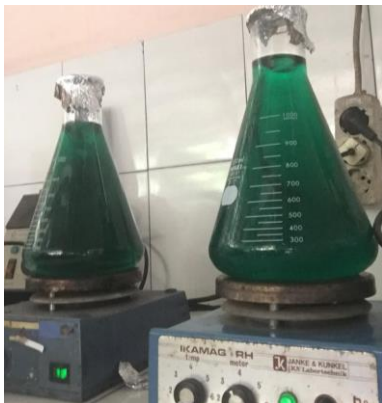


$\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$



$\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$

- Pelarutan dan Pengadukan Larutan Katalis



- Proses Kopresipitasi



- Penyaringan Katalis



- Pencetakan Katalis

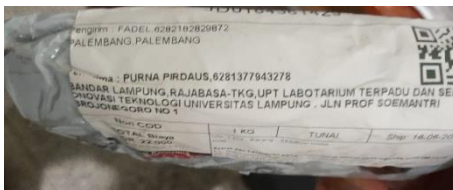


- Produk Katalis Ni/ γ Al₂O₃ dan Ni-Zn/ γ Al₂O₃



III.2 Karakterisasi Katalis

- Pengiriman Sampel ke UPT. LTSIT Unila



III.3 Uji Kinerja Katalis

- Bahan dan Alat



Minyak Jelantah



Gas Hidrogen



Reaktor *Hydrotreating*

- Tahapan *Hydroprocessing*



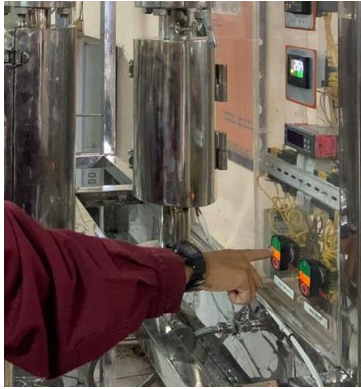
Memasukkan Minyak
Jelantah



Memasukkan Katalis



Menginjeksi Gas Hidrogen



Menghidupkan Alat



Mengeluarkan Produk *Green Diesel*



Produk *Green Diesel*

III.4 Uji Kualitas *Green Diesel*

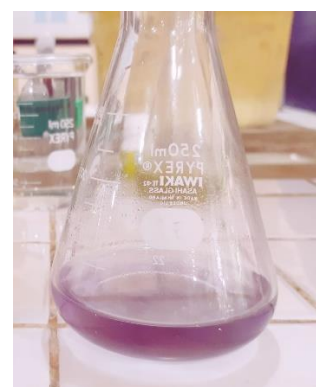
- Uji Densitas



- Uji Densitas



- Uji Bilangan Asam





REKOMENDASI SEMINAR LAPORAN TUGAS AKHIR

Pembimbing Laporan Tugas Akhir Memberi Rekomendasi Kepada :

Nama : Arrafi Khoirunnisa
NIM : 061840411409
Jurusan/Program Studi : Teknik Kimia/DIV Teknik Energi
Judul Penelitian : Sintesis dan Uji Kinerja Katalis Ni / γ -Al₂O₃ pada
Proses *Hydrotreating* Minyak Jelantah Menjadi
Solar Hidrokarbon D100

Mahasiswa tersebut telah memenuhi persyaratan dan dapat mengikuti Seminar
Laporan Tugas Akhir (TA) pada Tahun Akademik 2021/2022.

Menyetujui,
Pembimbing I,

Ir. Sahrul Effendy, A., M.T.
NIDN 0023126309

Palembang, Juli 2022

Pembimbing II,

Ahmad Zikri, S.T., M.T.
NIDN 0007088601



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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KESEPAKATAN BIMBINGAN TUGAS AKHIR (TA)

Kami yang bertanda tangan di bawah ini,

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Pada hari ini, Senin tanggal 21 Maret 2022 telah sepakat untuk melakukan konsultasi bimbingan Tugas Akhir.

Isi Kesepakatan:

1. Konsultasi bimbingan sekurang-kurangnya tiga kali dalam satu minggu.
2. Pelaksanaan bimbingan pada setiap hari Senin, Kamis, dan Jumat pada jam kuliah secara tatap muka di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Tugas Akhir.

Pihak Pertama,

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KESEPAKATAN BIMBINGAN TUGAS AKHIR (TA)

Kami yang bertanda tangan di bawah ini,

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Pada hari ini, Senin tanggal 16 Maret 2022 telah sepakat untuk melakukan konsultasi bimbingan Tugas Akhir.

Isi Kesepakatan:

1. Konsultasi bimbingan sekurang-kurangnya satu kali dalam satu minggu.
2. Pelaksanaan bimbingan pada setiap hari kerja pada jam kuliah secara daring atau tatap muka di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Tugas Akhir.

Palembang, 16 Maret 2022

Pihak Pertama,

Pihak Kedua,

Arrafi Khoirunnisa
NIM 061840411409

Ahmad Zikri, S.T., M.T.
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KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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LEMBAR ASISTENSI TUGAS AKHIR

NAMA : Arrafi Khoirunnisa
NIM : 061840411409
JUDUL : Sintesis dan Uji Kinerja Katalis Ni/ γ -Al₂O₃ dan Ni-Zn/ γ -Al₂O₃ Pada Proses *Hydrotreating* Minyak Jelantah menjadi Solar Hidrokarbon D100
PEMBIMBINGI : Ir. Sahrul Effendy A., M.T.

No	Tanggal	Materi/Topik	Paraf	Keterangan
1.	4 Juli 2022	Bab 1	1)	Revisi
2.	7 Juli 2022	Bab 1	2)	Acc
3.	11 Juli 2022	Bab 2	3)	Acc
4.	14 Juli 2022	Bab 3	4)	Acc
5.	18 Juli 2022	Lampiran I	5)	Lanjutkan
6.	21 Juli 2022	Lampiran II	6)	Acc
7.	26 Juli 2022	Bab 4	7)	Revisi
8.	28 Juli 2022	Bab 4 dan Bab 5	8)	Acc
9.	2 Agustus 2022	Keseluruhan	9)	Acc
10.	4 Agustus 2022	Cek Seluruh (Cover s.d. Lampiran)	10)	Acc
11.			11)	
12.			12)	
13.			13)	

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Jelantah menjadi Solar Hidrokarbon D100
PEMBIMBINGI : Ahmad Zikri, S.T., M.T.

No	Tanggal	Materi/Topik	Paraf	Keterangan
1.	5 Juli 2022	Bab 1	1)	Revisi
2.	8 Juli 2022	Bab 1	2)	Revisi
3.	12 Juli 2022	Bab 2	3)	Revisi
4.	15 Juli 2022	Bab 3	4)	Revisi
5.	19 Juli 2022	Bab 3	5)	Revisi
6.	22 Juli 2022	Lampiran 1	6)	Lengkap
7.	26 Juli 2022	Lampiran 2	7)	Revisi
8.	29 Juli 2022	Bab 4	8)	Revisi
9.	3 Juli 2022	Bab 4 dan Bab 5	9)	Lengkap
10.	4 Juli 2022	Cek keseluruhan	10)	Revisi
11.			11)	
12.			12)	
13.			13)	

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SURAT PERNYATAAN

Saya yang bertanda tangan dibawah ini :
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NIM : 061840411409
Jurusan : Teknik Kimia
Program Studi : DIV Teknik Energi

Menyatakan bahwa dalam penelitian :

**“Sintesis dan Uji Kinerja Katalis Ni / γ -Al₂O₃ pada Proses *Hydrotreating* Minyak
Jelantah Menjadi Solar Hidrokarbon D100)”**

Data pada penelitian ini tidak mengandung unsur “**PLAGIAT**” sesuai dengan
PERMENDIKNAS No. 17 Tahun 2010.

Bila dikemudian hari ada unsur – unsur “**PLAGIAT**” dalam penelitian ini, saya bersedia
diberikan sanksi sesuai peraturan yang berlaku. Demikian pernyataan ini saya buat dengan
sebenar – benarnya dan tidak ada paksaan.

Disetujui Oleh,
Pembimbing I,

Ir. Sahrul Effendy, A., M.T.
NIDN 0023126309

Palembang, Juli 2022



Arrafi Khoirunnisa
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Pembimbing II,

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