LAMPIRAN

A. Perhitungan

1. Menghitung Jumlah Reaktan

Perhitungan dalam menentukan jumlah metanol yang akan digunakan pada variasi proses transesterifikasi :

Perbandingan molar minyak jelantah : metanol = 1 : 7

Volume minyak jelantah = 140 mL

Densitas metanol = 0,7692 g/mL

Densitas minyak jelantah = 0,910 g/mL

Berat molekul minyak jelantah = 870 g/mol

Berat molekul metanol = 32 g/mol

1. Menentukkan mol minyak jelantah

Massa minyak $= V \times \rho$

$= 125\ mL \times 0{,}856\ gr/mL$

$= 107\ gr$

Mol minyak $= \frac{\text{massa minyak}}{\text{BM minyak}}$

$= \frac{107\ gr}{870\ gr/mol}$

$= 0{,}122989\ mol$

2. Menentukan Mol Metanol

Mol metanol $= \frac{\text{mol reaksi metanol}}{\text{mol reaksi minyak}} \times (mol\ minyak)$

$= (\frac{3}{1}) \times (0{,}122989\ mol)$

$= 0{,}368966\ mol$

Perbandingan 7 : 1 = mol metanol × 7

$= 0{,}368966\ mol \times 7$

= 2,582759 mol

3. Menetukan Massa Metanol

Massa metanol = mol metanol × BM metanol

= 2,582759 mol × 32 gr/mol

= 82,64828 gr

4. Menentukan Volume Metanol

$$\text{Volume} = \frac{\text{massa metanol}}{\rho \text{ metanol}}$$

$$= \frac{82{,}64828 \text{ gr}}{0{,}79 \frac{\text{gr}}{\text{mL}}}$$

= 105 mL

2. Menghitung Jumlah Katalis

Katalis yang digunakan pada penelitian ini yaitu 3% dari massa minyak. Perhitungan jumlah katalis sebagai berikut :

Massa katalis = 3% × 107 gr

= 3,2 gr

3. Perhitungan Asam Lemak Bebas (FFA)

$$\%FFA = \frac{\boldsymbol{N\ KOH \times V\ KOH \times BM\ asam\ lemak}}{\boldsymbol{massa\ sampel \times 1000}} \times \mathbf{100}\%$$

$$= \frac{\mathbf{0{,}1\ N \times 3\ mL \times 282 \frac{g}{mol}}}{\mathbf{5\ gram \times 1000}} \times \mathbf{100}\%$$

$$= \mathbf{1{,}69\%}$$

4. Densitas Biodiesel

Tabel 1. Densitas Biodiesel

Kondisi Operasi		KOH/ 100 ml Aquades			
Suhu	**Waktu**	**22.5**	**27.5**	**32.5**	**37.5**
50	**1**	910	910	905	905
	2	896	894	894	893
	3	890	891	895	894
60	**1**	910	908	907	905
	2	894	878	865	890
	3	885	865	860	875
65	**1**	910	905	905	905
	2	892	887	882	889
	3	885	882	865	880

5. Viskositas Biodiesel

Berdasarkan hasil analisa pengukuran viskositas dengan menggunakan Viscometer Brookfield NDJ-8S, maka data analisa viskositas adalah sebagai berikut :

Tabel 2. Viskositas Biodiesel

Kondisi Operasi		KOH/ 100 ml Aquades			
Suhu	**Waktu**	**22.5**	**27.5**	**32.5**	**37.5**
50	**1**	21.872	28.1602	20.505	24.3326
	2	14.4902	14.4902	9.569	8.202
	3	14.4902	15.8572	14.7636	15.5838
60	**1**	21.0518	28.1602	20.505	23.239
	2	10.3892	6.2882	4.3744	4.9212
	3	7.3818	3.8276	3.5542	4.9212
65	**1**	21.0518	21.0518	19.138	22.6922
	2	12.303	10.3892	7.3818	9.569
	3	9.569	7.3818	4.101	5.468

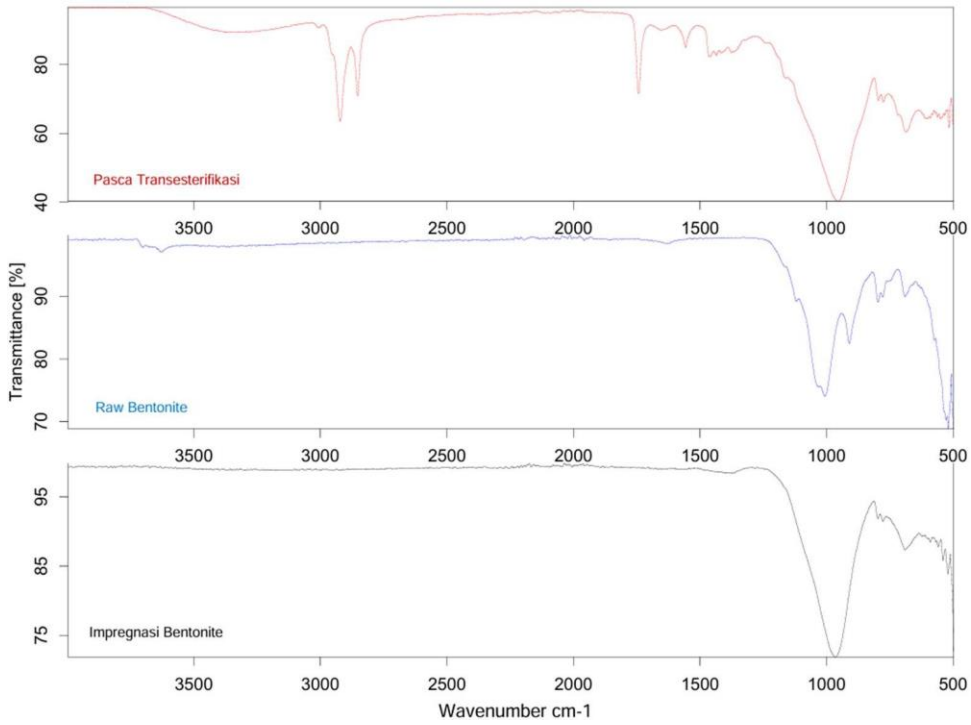
6. *Yield* Biodiesel

Tabel 3 *Yield* Biodiesel

Kondisi Operasi		KOH/ 100 ml Aquades			
Suhu	**Waktu**	**22.5**	**27.5**	**32.5**	**37.5**
50	**1**	67.66355	73.79439	74.04673	69.59813
	2	78.71963	80.70093	81.4486	80.82243
	3	80.70093	82.2243	81.76636	83.81308
60	**1**	80.8972	83.11215	83.20561	79.00935
	2	83.35514	85.4486	83.68224	82.02804
	3	84.88785	85.85981	86.48598	84.04673
65	**1**	80.83178	83.47664	83.60748	77.34579
	2	82.90654	84.4486	85.33645	84.07477
	3	81.80374	83.35514	83.39252	82.95327

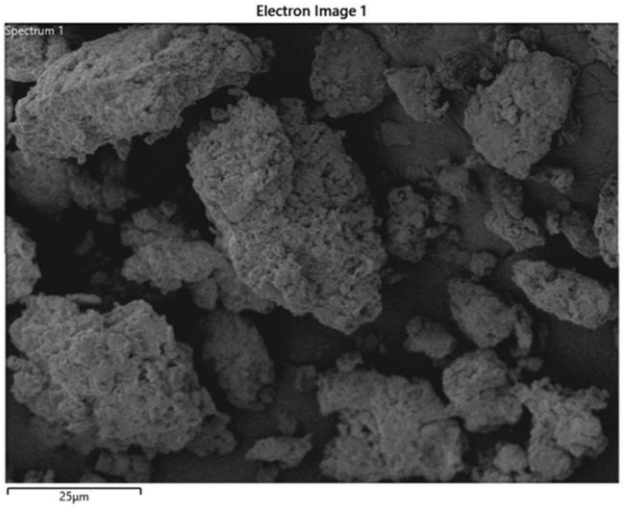
B. Hasil Uji Laboratorium

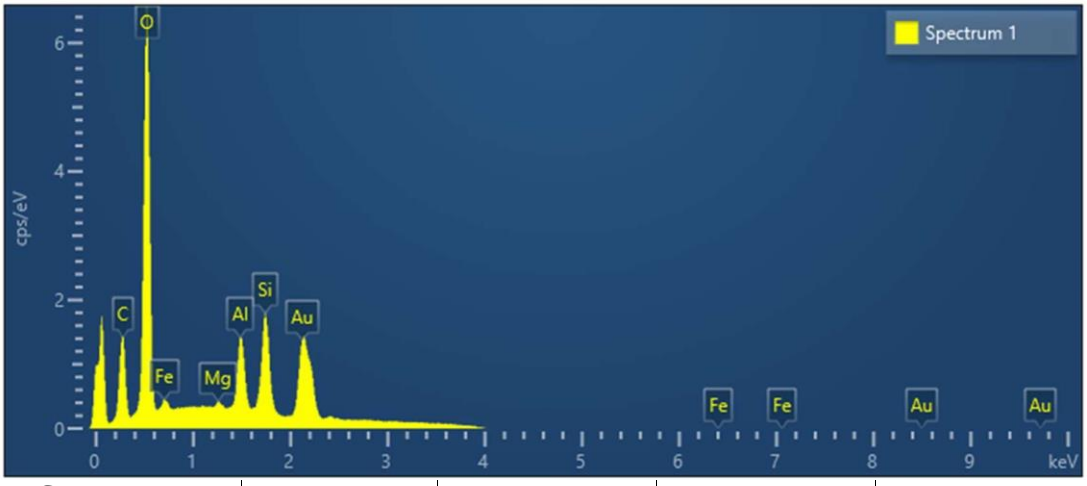
1. Fourier Transform Infra Red



2. SEM-EDX

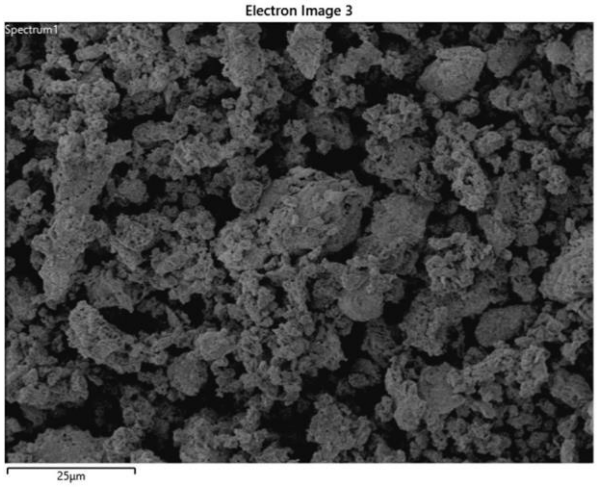
A. Raw Bentonit

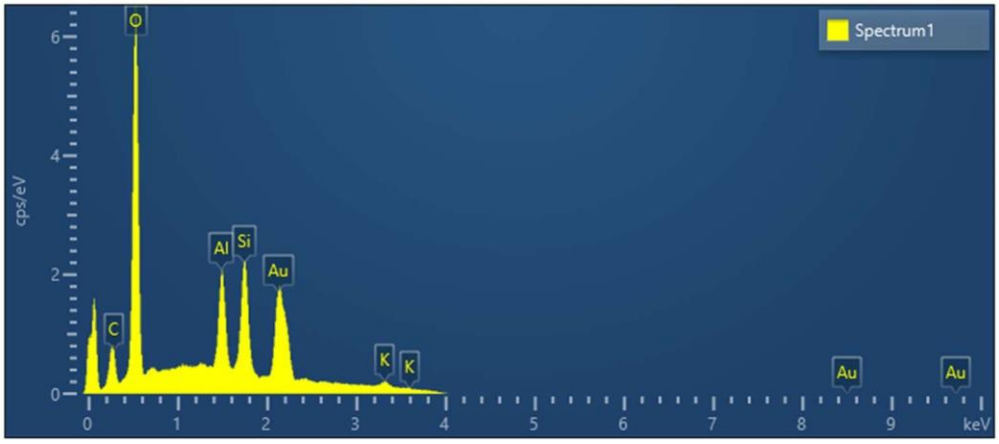




Spectrum 1				
Element	**Line Type**	**Weight %**	**Weight % Sigma**	**Atomic %**
C	K series	17.88	0.24	27.29
O	K series	41.33	0.28	47.35
Mg	K series	0.62	0.09	0.47
Al	K series	11.88	0.17	8.07
Si	K series	23.22	0.25	15.15
Fe	L series	5.06	0.39	1.66
Total		100.00		100.00

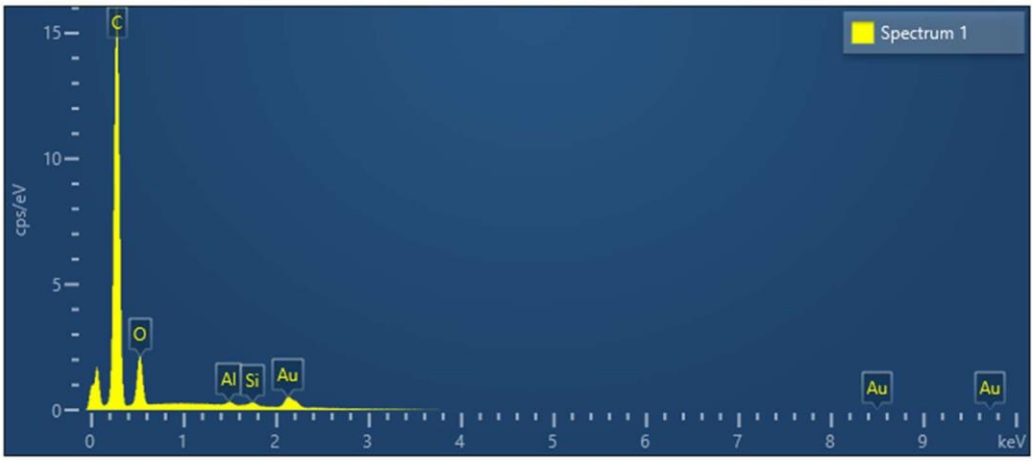
B. Bentonit Impregnasi





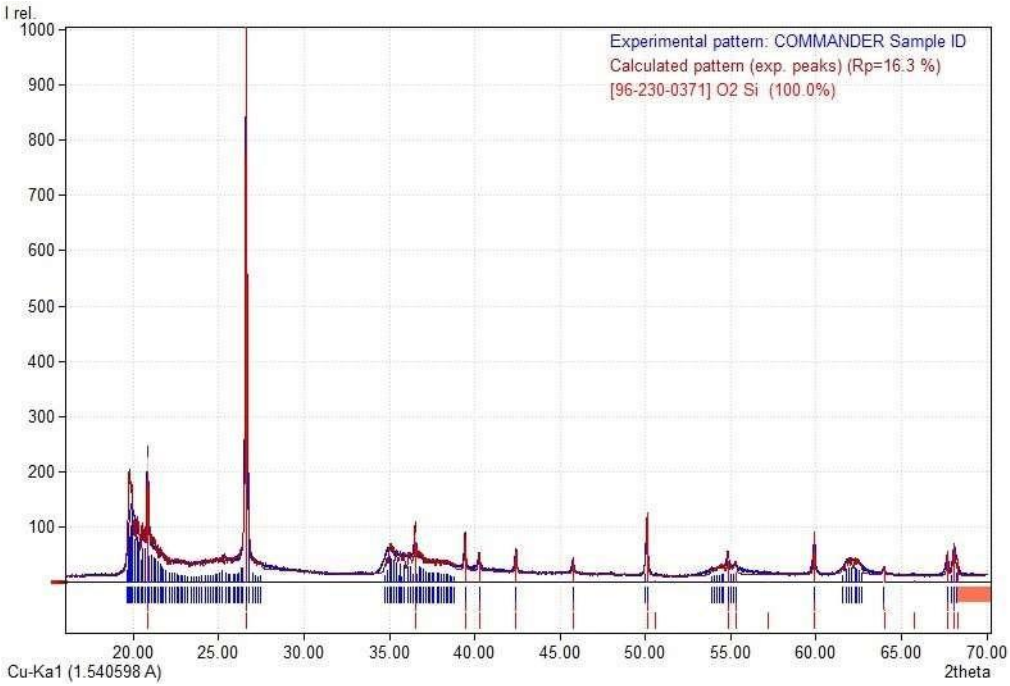
Spectrum1				
Element	**Line Type**	**Weight %**	**Weight % Sigma**	**Atomic %**
C	K series	0.57	0.07	1.56
O	K series	9.87	0.78	20.30
Al	K series	2.97	0.24	3.63
Si	K series	4.95	0.40	5.80
K	K series	81.64	1.45	68.71
Total		100.00		100.00

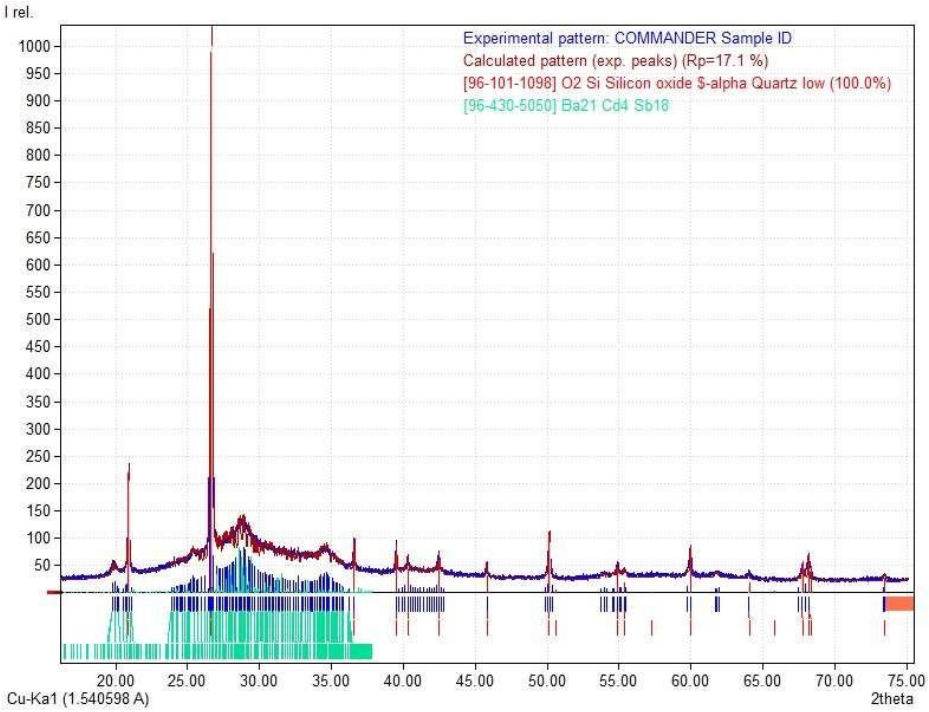
C. Pasca Transesterifikasi

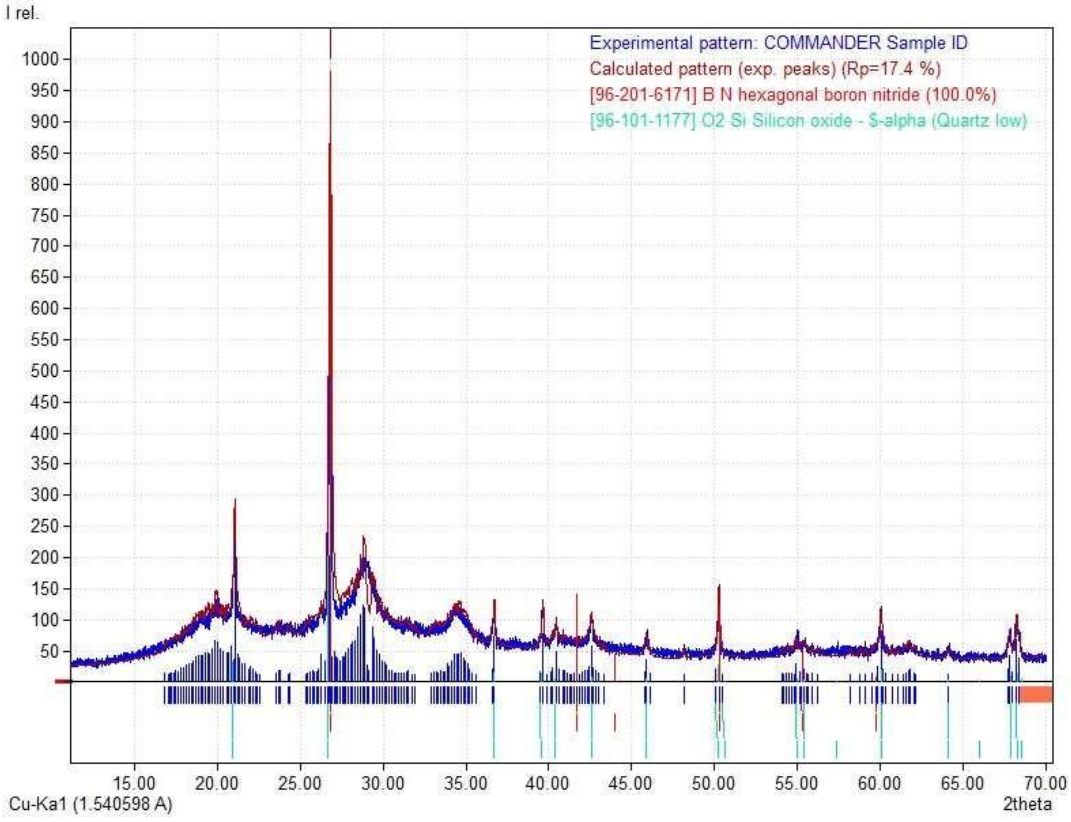


Spectrum 1				
Element	**Line Type**	**Weight %**	**Weight % Sigma**	**Atomic %**
C	K series	88.69	0.13	91.88
O	K series	9.26	0.10	7.20
Al	K series	0.77	0.06	0.35
Si	K series	1.28	0.08	0.57
Total		100.00		100.00

3. XRD


I rel.
Experimental pattern: COMMANDER Sample ID
Calculated pattern (exp. peaks) (Rp=16.3 %)
[96-230-0371] O2 Si (100.0%)
Cu-Ka1 (1.540598 A)
2theta


I rel.
Experimental pattern: COMMANDER Sample ID
Calculated pattern (exp. peaks) (Rp=17.1 %)
[96-101-1098] O2 Si Silicon oxide $-alpha Quartz low (100.0%)
[96-430-5050] Ba21 Cd4 Sb18
Cu-Ka1 (1.540598 A)
2theta


I rel.
Experimental pattern: COMMANDER Sample ID
Calculated pattern (exp. peaks) (Rp=17.4 %)
[96-201-6171] B N hexagonal boron nitride (100.0%)
[96-101-1177] O2 Si Silicon oxide - $-alpha (Quartz low)
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
55.00
60.00
65.00
70.00
Cu-Ka1 (1.540598 A)
2theta

DOKUMENTASI KEGIATAN

Gambar penghancuran bentonit

Gambar hasil bentonit 60 Mesh

Gambar Pemnasan Bentonit

Gambar KOH 22,5 gr

Gambar KOH 27,5 gr

Gambar KOH 32,5 gr

Gambar KOH 37,5 gr

Gambar Impregnasi

Gambar penyaringan bentonit

Gambar kalsinasi

Gambar Pemanasan Minyak Jelantah

Gambar Transesterifikasi

Gambar Pemisahan Biodiesel

Gambar Pemanasan Biodiesel

Gambar Hasil Biodiesel

Gambar Uji Viskositas Biodiesel

Gambar Uji Densitas Biodiesel

Gambar Uji Flash Point Biodiesel