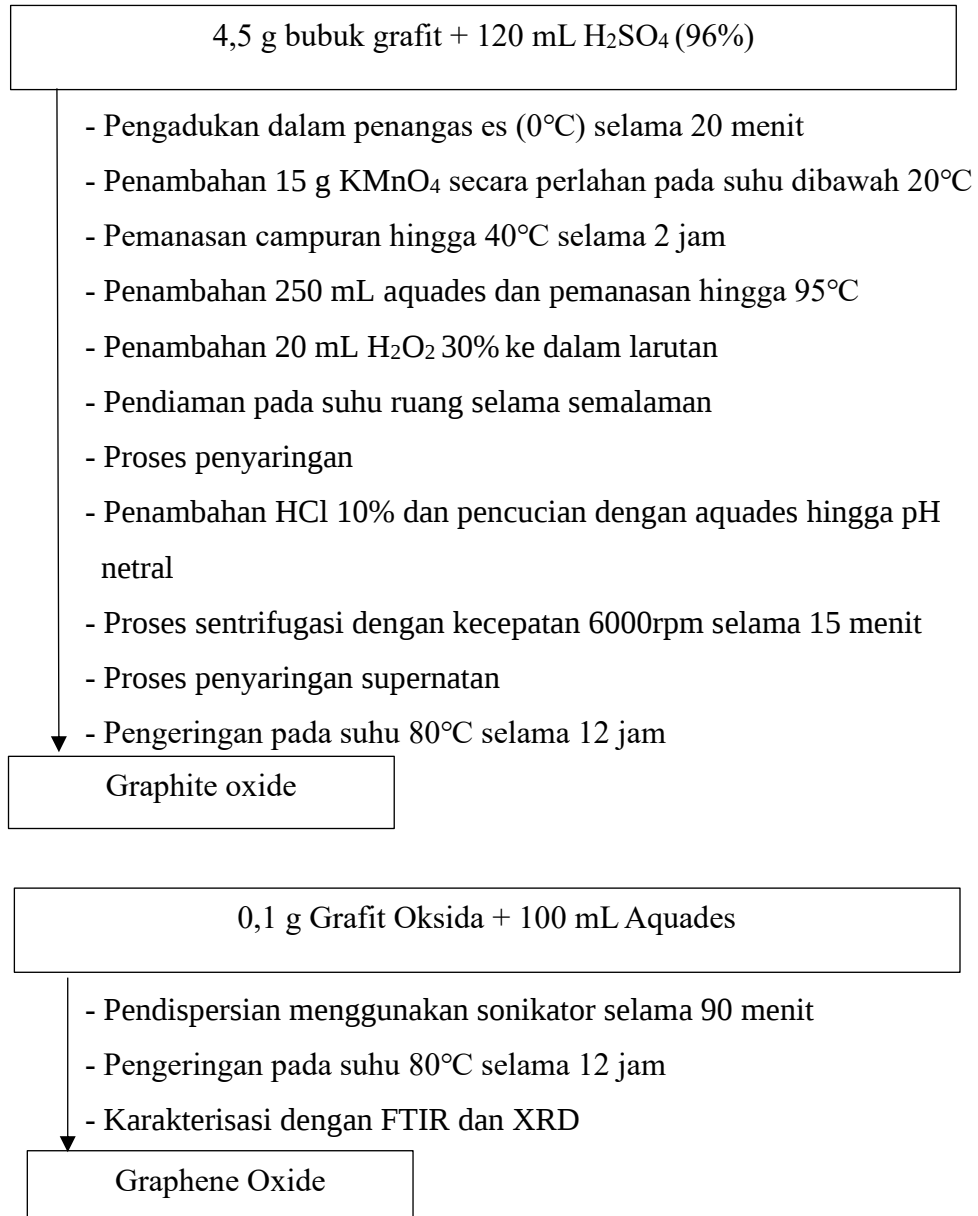


LAMPIRAN

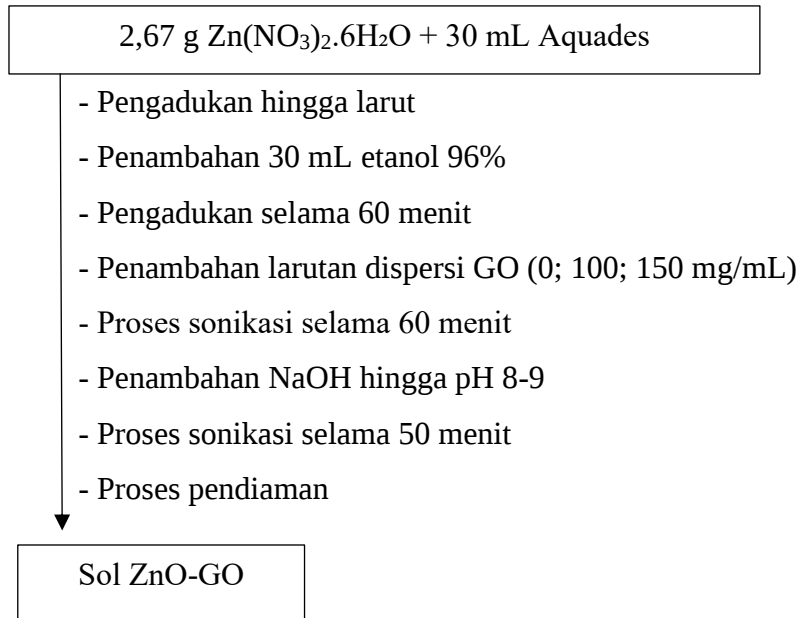
Lampiran 1: Skema Kerja Penelitian

1.1 Sintesis *Graphene Oxide* (GO)

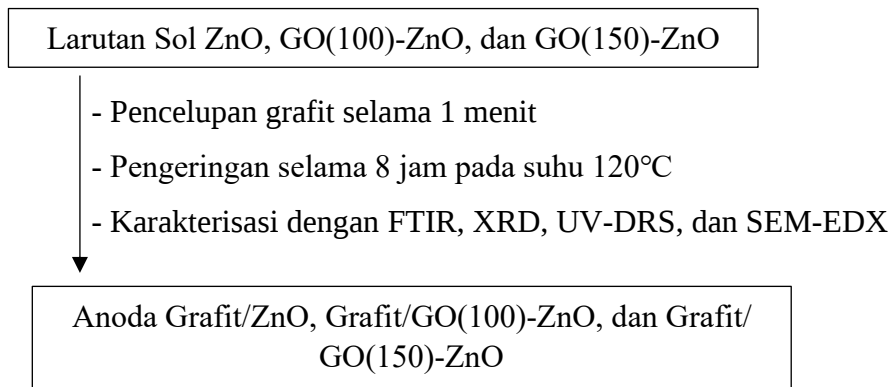


1.2 Sintesis Elektroda Grafit/GO-ZnO

- Sintesis Komposit GO-ZnO



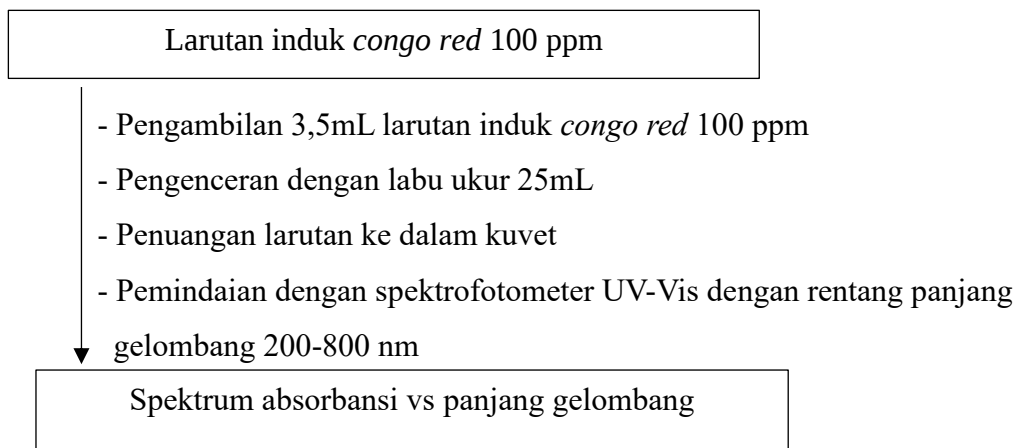
- Pelapisan GO-ZnO Pada Substrat Grafit



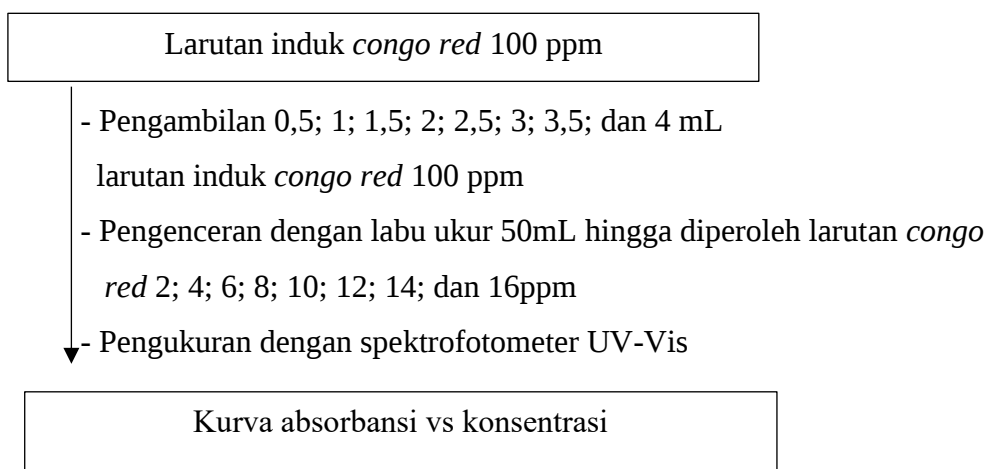
1.3 Pengujian Fotoelektrokatalisis Elektroda Grafit/GO-ZnO pada Larutan

Congo Red

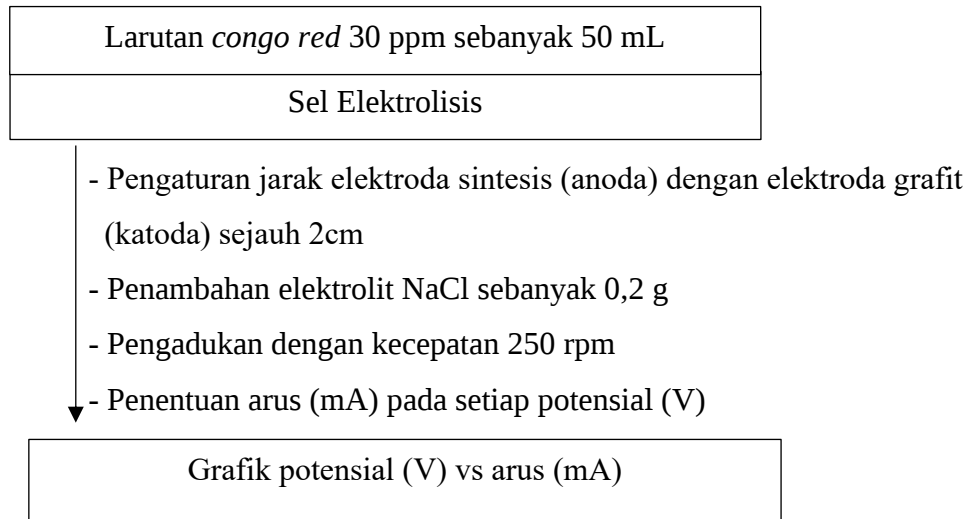
- Penentuan Panjang Gelombang Maksimum *Congo Red*



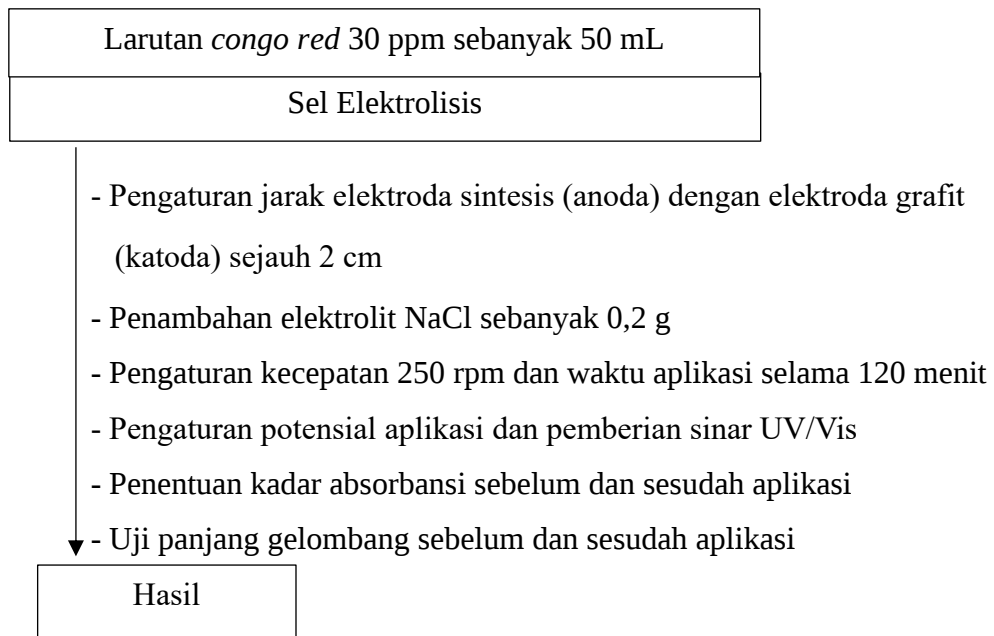
- Pembuatan Kurva Standar Larutan *Congo Red*



- Penentuan Potensial Kerja



- Pengujian Fotoelektrokatalisis



Lampiran 2: Perhitungan Massa $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ 0,3 M dan massa NaOH2.1 Massa $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ 0,3 M

$$\text{Massa molar } \text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} = 297,49 \text{ g/mol}$$

$$\text{Volume aquades} = 30 \text{ mL}$$

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

$$n = 0,3 \text{ M} \times 0,03 \text{ L}$$

$$n = 0,009 \text{ mol}$$

$$\text{massa} = n \times \text{Mr}$$

$$\text{massa} = 0,009 \text{ mol} \times 297,49 \text{ g/mol}$$

$$\text{massa} = 2,67 \text{ g}$$

2.2 Massa NaOH

$$\text{Massa molar NaOH} = 40 \text{ g/mol}$$

$$\text{Volume aquades} = 100 \text{ mL}$$

$$\text{Mol NaOH}$$

$$n = 0,6 \text{ M} \times 0,1 \text{ L}$$

$$n = 0,06 \text{ mol}$$

$$\text{massa} = n \times \text{Mr}$$

$$\text{massa} = 0,06 \text{ mol} \times 40 \text{ g/mol}$$

$$\text{massa} = 2,4 \text{ g}$$

Lampiran 3: Perhitungan *d-spacing* graphene oxide (GO)

$2\theta(^{\circ})$	FWHM	<i>d-spacing</i> (Å)
11,04	2,03	8
24,94	0,47	3,56
26,35	1,91	3,37

$$n \lambda = 2 d \sin \theta$$

$$d = \frac{\lambda}{2 \times \sin \theta}$$

- Puncak 11,04°

$$d = \frac{1,540562}{2 \times \sin \left(\frac{11,04}{2} \right)}$$

$$= 8 \text{ Å}$$

- Puncak 24,94°

$$d = \frac{1,540562}{2 \times \sin \left(\frac{24,94}{2} \right)}$$

$$= 3,56 \text{ Å}$$

- Puncak 26,35°

$$d = \frac{1,540562}{2 \times \sin \left(\frac{26,35}{2} \right)}$$

$$= 3,37 \text{ Å}$$

Lampiran 4: Perhitungan Struktur Kisi Grafit/ZnO

$2\theta(^{\circ})$	$\theta(^{\circ})$	Indeks Miller			FWHM	$d(\text{\AA})$
		h	k	l		
31,54	15,77	1	0	0	0,4427	2,83
34,14	17,07	0	0	2	0,4534	2,62
35,96	17,98	1	0	1	0,4891	2,49

4.1 Penentuan Nilai Parameter Kisi (a,c, dan a/c)

$$\frac{1}{d^2} = \frac{4}{3} \left(\frac{h^2 + hk + k^2}{a^2} \right) + \frac{l^2}{c^2}$$

- Penentuan nilai a pada hkl (100)

$$\frac{1}{2,83^2} = \frac{4}{3} \left(\frac{1^2 + (1 \cdot 0) + 0^2}{a^2} \right) + \frac{0^2}{c^2}$$

$$\frac{1}{2,83^2} = \frac{4}{3} \cdot \frac{1}{a^2}$$

$$a = 3,26 \text{ \AA}$$

- Penentuan nilai c pada hkl (101)

$$\frac{1}{2,49^2} = \frac{4}{3} \left(\frac{1^2 + (1 \cdot 0) + 0^2}{3,26^2} \right) + \frac{1^2}{c^2}$$

$$\frac{1}{2,49^2} = \frac{4}{3} \cdot \frac{1}{3,26^2} + \frac{1}{c^2}$$

$$c = 5,28 \text{ \AA}$$

- Penentuan rasio c/a

$$\frac{c}{a} = \frac{5,28}{3,26} = 1,61$$

4.2 Penentuan Ukuran Kristal

$$D = \frac{K\lambda}{\beta \cos \theta}$$

- Pada puncak 2theta 31,54°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,4427) \cos(\text{rad}(15,77))} = 18,63 \text{ nm}$$

- Pada puncak 2theta 34,14°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,4524) \cos(\text{rad}(17,07))} = 18,32 \text{ nm}$$

- Pada puncak 2theta 35,96°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,4891) \cos(\text{rad}(17,98))} = 17,07 \text{ nm}$$

- Ukuran rata-rata diameter kristal

$$D = \frac{(18,63 + 18,32 + 17,07)}{3} = 18 \text{ nm}$$

Lampiran 5 Perhitungan Struktur Kisi Grafit/GO(100)-ZnO

$2\theta(^{\circ})$	$\theta(^{\circ})$	Indeks Miller			FWHM	$d(\text{\AA})$
		h	K	l		
31,78	15,89	1	0	0	0,4436	2,81
34,44	17,22	0	0	2	0,2866	2,60
36,28	18,14	1	0	1	0,4243	2,47

5.1 Penentuan Nilai Parameter Kisi (a,c, dan a/c) GO(100)-ZnO/Grafit

$$\frac{1}{d^2} = \frac{4}{3} \left(\frac{h^2 + hk + k^2}{a^2} \right) + \frac{l^2}{c^2}$$

- Penentuan nilai a pada hkl (100)

$$\frac{1}{2,81^2} = \frac{4}{3} \left(\frac{1^2 + (1 \cdot 0) + 0^2}{a^2} \right) + \frac{0^2}{c^2}$$

$$\frac{1}{2,81^2} = \frac{4}{3} \cdot \frac{1}{a^2}$$

$$a = 3,24 \text{ \AA}$$

- Penentuan nilai c pada hkl (101)

$$\frac{1}{2,47^2} = \frac{4}{3} \left(\frac{1^2 + (1 \cdot 0) + 0^2}{3,24^2} \right) + \frac{1^2}{c^2}$$

$$\frac{1}{2,47^2} = \frac{4}{3} \cdot \frac{1}{3,24^2} + \frac{1}{c^2}$$

$$c = 5,20 \text{ \AA}$$

- Penentuan rasio c/a

$$\frac{a}{c} = \frac{4,82}{3,24} = 1,48$$

5.2 Penentuan Ukuran Kristal

$$D = \frac{K\lambda}{\beta \cos \theta}$$

- Pada puncak 2theta 31,78°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,4436) \cos(\text{rad}(15,89))} = 18,61 \text{ nm}$$

- Pada puncak 2theta 34,44°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,2866) \cos(\text{rad}(17,22))} = 29 \text{ nm}$$

- Pada puncak 2theta 36,28°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,4243) \cos(\text{rad}(18,14))} = 19,69 \text{ nm}$$

- Ukuran rata-rata diameter kristal

$$D = \frac{(18,61 + 29 + 19,61)}{3} = 22,43 \text{ nm}$$

Lampiran 6: Perhitungan Struktur Kisi Grafit/GO(150)-ZnO

$2\theta(^{\circ})$	$\theta(^{\circ})$	Indeks Miler			FWHM	$d(\text{\AA})$
		H	K	l		
31,68	15,84	1	0	0	0,5917	2,82
34,3	17,15	0	0	2	0,3679	2,61
36,16	18,08	1	0	1	0,4134	2,48

6.1 Penentuan Nilai Parameter Kisi (a,c, dan a/c)

$$\frac{1}{d^2} = \frac{4}{3} \left(\frac{h^2 + hk + k^2}{a^2} \right) + \frac{l^2}{c^2}$$

- Penentuan nilai a pada hkl (100)

$$\frac{1}{2,82^2} = \frac{4}{3} \left(\frac{1^2 + (1.0) + 0^2}{a^2} \right) + \frac{0^2}{c^2}$$

$$\frac{1}{2,82^2} = \frac{4}{3} \cdot \frac{1}{a^2}$$

$$a = 3,25 \text{ \AA}$$

- Penentuan nilai c pada hkl (101)

$$\frac{1}{2,48^2} = \frac{4}{3} \left(\frac{1^2 + (1.0) + 0^2}{3,25^2} \right) + \frac{1^2}{c^2}$$

$$\frac{1}{2,48^2} = \frac{4}{3} \cdot \frac{1}{3,25^2} + \frac{1}{c^2}$$

$$c = 5,24 \text{ \AA}$$

- Penentuan rasio c/a

$$\frac{c}{a} = \frac{5,24}{3,25} = 1,61$$

6.2 Penentuan Ukuran Kristal

$$D = \frac{K\lambda}{\beta \cos \theta}$$

- Pada puncak 2theta 31,68°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,5917) \cos(\text{rad}(15,84))} = 13,95 \text{ nm}$$

- Pada puncak 2theta 34,3°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,3679) \cos(\text{rad}(17,15))} = 22,58 \text{ nm}$$

- Pada puncak 2theta 36,16°

$$D = \frac{0,9 (0,15406 \text{ nm})}{\text{rad} (0,4134) \cos(\text{rad}(18,08))} = 20,20 \text{ nm}$$

- Ukuran rata-rata diameter kristal

$$D = \frac{(13,95 + 22,58 + 20,20)}{3} = 18,91 \text{ nm}$$

Lampiran 7: Perhitungan *Band Gap* dan Panjang Gelombang Maksimum Grafit/ZnO

7.1 Persamaan linear hasil eksplorasi fungsi *Tauc Plot*

$$y = 2634,76x - 8690,98$$

$$(\alpha h\nu)^2 = A (h\nu - E_g)$$

$$(\alpha h\nu)^2 = Ah\nu - AE_g$$

$$y = mx + c$$

$$0 = mx + c$$

$$x = - \frac{(-8690,98)}{2634,76}$$

$$x = 3,29 \text{ eV}$$

7.2 Persamaan energi foton

$$h = \text{Konstanta Planck } (6,62 \times 10^{-34} \text{ J.s})$$

$$E = \text{Energi } (1\text{eV} = 1,60 \times 10^{-19} \text{ J})$$

$$c = \text{Kecepatan cahaya } (2,99 \times 10^8 \text{ m.s}^{-1})$$

$$E = h\nu$$

$$\nu = \frac{c}{\lambda}$$

$$\lambda = \frac{hc}{E}$$

$$\lambda = \frac{(6,62 \times 10^{-34} \text{ J.s})(2,99 \times 10^8 \text{ m.s}^{-1})}{(3,29 \text{ eV})(1,60 \times 10^{-19} \text{ J})}$$

$$\lambda = 376 \text{ nm}$$

Lampiran 8: Perhitungan *Band Gap* dan Panjang Gelombang Maksimum Grafit/GO(100)-ZnO

8.1 Persamaan linear hasil eksplorasi fungsi *Tauc Plot*

$$y = 207,85x - 603,10$$

$$(\alpha h\nu)^2 = A (h\nu - E_g)$$

$$(\alpha h\nu)^2 = Ah\nu - AE_g$$

$$y = mx + c$$

$$0 = mx + c$$

$$x = - \frac{(603,10)}{207,85}$$

$$x = 2,90 \text{ eV}$$

8.2 Persamaan energi foton

$$h = \text{Konstanta Planck } (6,62 \times 10^{-34} \text{ J.s})$$

$$E = \text{Energi } (1\text{eV} = 1,60 \times 10^{-19} \text{ J})$$

$$c = \text{Kecepatan cahaya } (2,99 \times 10^8 \text{ m.s}^{-1})$$

$$E = h\nu$$

$$\nu = \frac{c}{\lambda}$$

$$\lambda = \frac{hc}{E}$$

$$\lambda = \frac{(6,62 \times 10^{-34} \text{ J.s})(2,99 \times 10^8 \text{ m.s}^{-1})}{(2,90 \text{ eV})(1,60 \times 10^{-19} \text{ J})}$$

$$\lambda = 426 \text{ nm}$$

Lampiran 9: Perhitungan *Band Gap* dan Panjang Gelombang Maksimum Grafit/GO(150)-ZnO

9.1 Persamaan linear hasil eksplorasi fungsi *Tauc Plot*

$$y = 24,595x - 68,800$$

$$(\alpha h\nu)^2 = A (h\nu - E_g)$$

$$(\alpha h\nu)^2 = Ah\nu - AE_g$$

$$y = mx + c$$

$$0 = mx + c$$

$$x = - \frac{(-68,800)}{24,595}$$

$$x = 2,79 \text{ eV}$$

9.2 Persamaan energi foton

$$h = \text{Konstanta Planck } (6,62 \times 10^{-34} \text{ J.s})$$

$$E = \text{Energi } (1\text{eV} = 1,60 \times 10^{-19} \text{ J})$$

$$c = \text{Kecepatan cahaya } (2,99 \times 10^8 \text{ m.s}^{-1})$$

$$E = h\nu$$

$$\nu = \frac{c}{\lambda}$$

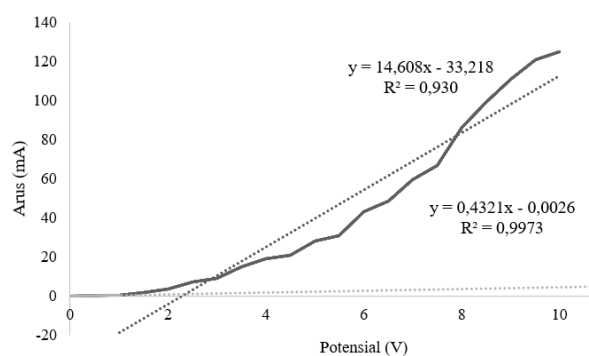
$$\lambda = \frac{hc}{E}$$

$$\lambda = \frac{(6,62 \times 10^{-34} \text{ J.s})(2,99 \times 10^8 \text{ m.s}^{-1})}{(2,79 \text{ eV})(1,60 \times 10^{-19} \text{ J})}$$

$$\lambda = 443 \text{ nm}$$

Lampiran 10 Penentuan Potensial Kerja Elektroda Grafit/ZnO

Potensial (V)	Arus (mA)
0	0
0,5	0,33
1	0,44
1,5	1,64
2	3,29
2,5	7,06
3	9,14
3,5	15,07
4	19,01
4,5	21
5	28,1
5,5	30,7
6	43,3
6,5	48,4
7	59,4
7,5	66,9
8	86,3
8,5	99,1
9	110,8
9,5	120,8
1	125



Persamaan : $y_1 = 14,608x - 33,218$

$y_2 = 0,4321x - 0,0026$

Titik Belok (E_o) sebagai E_{app} :

$y_1 = y_2$

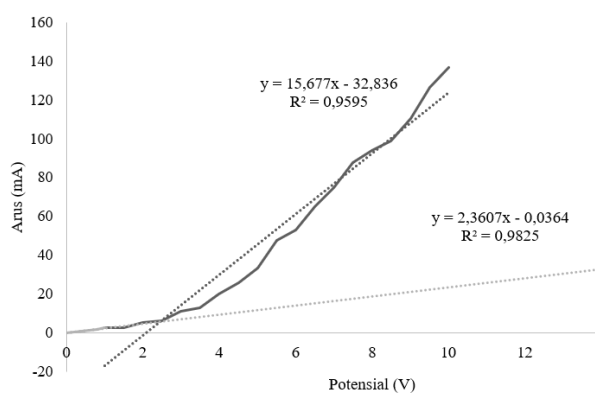
$14,608x - 33,218 = 0,4321x - 0,0026$

$14,1759 x = 32,2154$

$x = 2,27 \text{ V}$

Lampiran 11: Penentuan Potensial Kerja Elektroda Grafit/GO(100)-ZnO

Potensial (V)	Arus (mA)
0	0
0,5	1,67
1	2,47
1,5	2,74
2	5,42
2,5	6,25
3	11,02
3,5	12,66
4	20,09
4,5	25,8
5	33,3
5,5	47,6
6	52,8
6,5	64,9
7	74,8
7,5	87,8
8	93,8
8,5	99,1
9	110,6
9,5	126,4
1	136,8



$$\text{Persamaan: } y_1 = 15,677x - 32,836$$

$$y_2 = 2,360x - 0,0364$$

Titik Belok (E_o) sebagai E_{app} :

$$y_1 = y_2$$

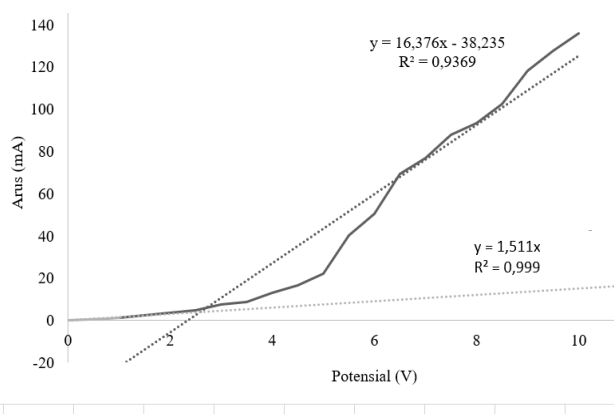
$$15,677x - 32,836 = 2,360x - 0,0364$$

$$13,317 x = 32,7996$$

$$x = 2,46 \text{ V}$$

Lampiran 12: Penentuan Potensial Kerja Elektroda Grafit/GO(150)-ZnO

Potensial (V)	Arus (mA)
0	0
0,5	1,16
1	1,55
1,5	2,73
2	3,8
2,5	5,1
3	7,47
3,5	8,89
4	13,3
4,5	16,6
5	22,3
5,5	40,2
6	50,5
6,5	69,5
7	76,8
7,5	88,1
8	93,4
8,5	102,7
9	118,2
9,5	127,7
1	136



$$\text{Persamaan : } y_1 = 16,376x - 38,235$$

$$y_2 = 1,511x$$

Titik Belok (E_o) sebagai E_{app} :

$$y_1 = y_2$$

$$16,376x - 38,235 = 1,511x$$

$$14,865 x = 38,235$$

$$x = 2,57 \text{ V}$$

Lampiran 13 : Perhitungan Pembuatan Larutan *Congo Red*

13.1 Larutan induk *congo red* 100 ppm

$$\text{Konsentrasi} = \frac{\text{massa zat (mg)}}{V \text{ pelarut (L)}}$$

$$\text{Konsentrasi} = \frac{100 \text{ mg}}{1 \text{ L}}$$

$$\text{Konsentrasi} = 100 \text{ mg/L}$$

$$100 \text{ mg/L sama dengan } 100 \text{ ppm}$$

13.2 Larutan Standar Congo Red

$$\text{Konsentrasi awal congo red} = 100 \text{ ppm}$$

$$\text{Volume yang dibutuhkan} = 25 \text{ mL}$$

- Larutan *congo red* 2 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 2 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 2 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 0,5 \text{ mL}$$

- Larutan *congo red* 4 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 4 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 4 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 1 \text{ mL}$$

- Larutan *congo red* 6 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 6 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 6 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 1,5 \text{ mL}$$

- Larutan *congo red* 8 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 8 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 8 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 2 \text{ mL}$$

- Larutan *congo red* 10 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 10 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 10 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 2,5 \text{ mL}$$

- Larutan *congo red* 12 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 12 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 12 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 3 \text{ mL}$$

- Larutan *congo red* 14 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 14 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 14 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 3,5 \text{ mL}$$

- Larutan *congo red* 16 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 25 \text{ mL} \times 16 \text{ ppm}$$

$$V_1 = \frac{25 \text{ mL} \times 16 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 4 \text{ mL}$$

13.3 Larutan *Congo Red* 30 ppm

$$V_1 \times M_1 = V_2 \times M_2$$

$$V_1 \times 100 \text{ ppm} = 50 \text{ mL} \times 30 \text{ ppm}$$

$$V_1 = \frac{50 \text{ mL} \times 30 \text{ ppm}}{100 \text{ ppm}}$$

$$V_1 = 15 \text{ mL}$$

13.4 Perhitungan kurva standar larutan *congo red*

Konsentrasi (ppm)	Abs ₁	Abs ₂	Abs ₃	Abs _{rata-rata}
2	0,121	0,121	0,121	0,121
4	0,202	0,202	0,202	0,202
6	0,299	0,299	0,299	0,299
8	0,395	0,395	0,395	0,395
10	0,487	0,487	0,487	0,487
12	0,587	0,587	0,587	0,587
14	0,678	0,678	0,678	0,678
16	0,775	0,775	0,775	0,775

Lampiran 14 : Perhitungan Efisiensi Dekolorisasi Larutan *Congo Red*

D = Persentase dekolorisasi larutan *congo red*

C_o = Konsentrasi awal larutan *congo red*

C_t = Konsentrasi akhir larutan *congo red*

$$\text{Dekolorisasi} = \frac{C_o - C_t}{C_o} \times 100\%$$

14.1 Efisiensi Dekolorisasi Larutan *Congo Red* dengan Lampu UV

Variasi	Abs ₁	Abs ₂	Abs ₃	Abs _{rata-rata}	C _o	C _t	%D
Grafit/ZnO	0,366	0,366	0,366	0,366	30	7,384	75,38
Grafit/GO(100)-ZnO	0,188	0,188	0,188	0,188	30	3,61	87,95
Grafit/GO(150)-ZnO	0,177	0,177	0,177	0,177	30	3,38	88,71

14.2 Efisiensi Dekolorisasi Larutan *Congo Red* dengan Lampu Vis

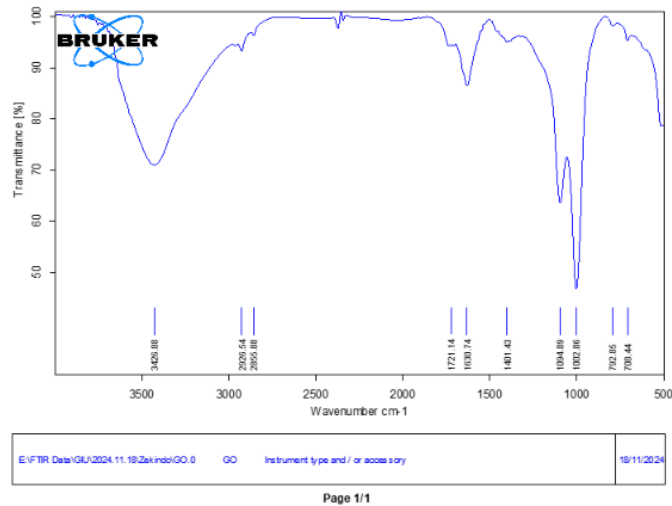
Variasi	Abs ₁	Abs ₂	Abs ₃	Abs _{rata-rata}	C _o	C _t	%D
Grafit/ZnO	0,375	0,375	0,375	0,375	30	7,57	74,75
Grafit/GO(100)-ZnO	0,131	0,131	0,131	0,131	30	2,42	91,92
Grafit/GO(150)-ZnO	0,073	0,073	0,073	0,073	30	1,2	95,99

14.3 Pengaruh Penambahan Potensial Eksternal

Variasi	Abs ₁	Abs ₂	Abs ₃	Abs _{rata-rata}	C _o	C _t	%D
Elektrolisis (grafit)	0,554	0,554	0,554	0,554	30	11,34	62,17
Elektrokatalisis	0,412	0,412	0,412	0,412	30	8,35	72,13
Fotokatalisis (UV)							
Grafit/ZnO	1,25	1,25	1,25	1,25	30	26,14	12,85
Grafit/GO(100)-ZnO	1,31	1,31	1,31	1,31	30	27,47	9,11
Grafit/GO(150)-ZnO	1,24	1,24	1,24	1,24	30	26,04	13,18
Fotokatalisis (Vis)							
Grafit/ZnO	1,29	1,29	1,29	1,29	30	27,03	9,89
Grafit/GO(100)-ZnO	1,30	1,30	1,30	1,30	30	27,22	9,24
Grafit/GO(150)-ZnO	1,23	1,23	1,23	1,23	30	25,81	13,96

Lampiran 15 : Data Karakterisasi

15.1 Karakterisasi *graphene oxide* (GO) dengan FTIR



15.2 Karakterisasi *graphene oxide* (GO) dengan XRD

Peak List

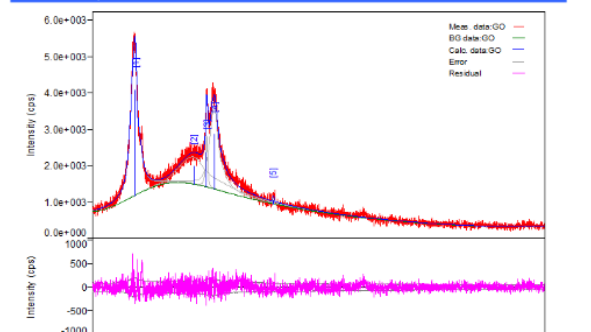
General information

Analysis date: 2024/11/26 16:05:53
 Sample name: GO.ras
 File name: GO.ras
 Comment: Measurement date: 2024/11/26 14:50:55
 Operator: administrator

Peak list

No.	2-theta(deg)	d(ang.)	Height(cps)	FWHM(deg)	Int. I(cps deg)	Int. W(deg)	Asym. factor
1	11.190(14)	7.901(10)	2910(156)	1.45(2)	6892(79)	2.37(15)	1.88(10)
2	22.5(3)	3.95(5)	500(65)	6.07(19)	4557(338)	9.1(19)	1.08(12)
3	24.91(3)	3.672(4)	974(90)	0.42(4)	596(83)	0.61(14)	0.7(3)
4	26.43(5)	3.370(6)	1511(112)	1.98(8)	4692(414)	3.1(5)	1.18(15)
5	37.75(4)	2.381(2)	106(30)	0.29(11)	32(15)	0.3(2)	0.7(15)

Measurement profile



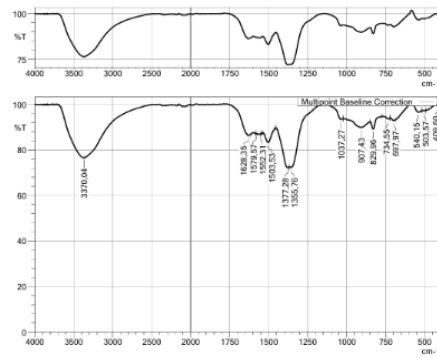
15.3 Karakterisasi GO-ZnO dengan FTIR

10/03/2025
10:47:20



System Administrator

Item	Value
Acquired Date/Time	10/03/2025 10:45:13
Acquired By	System Administrator
Filename	C:\3255\Main\Enggag-1003GO-150-ZnO1.appt
Measure Parameter File	C:\Programmer\Parameter\15.7.1.appt
Report Template	
Spectrum name	Multipoint Baseline Correction
Sample name	GO 150 ZnO
Sample ID	GO 150 ZnO
Option	
Comment	
No. of Scans	25
Resolution	2 cm ⁻¹
Apodization	Happ-Genzel



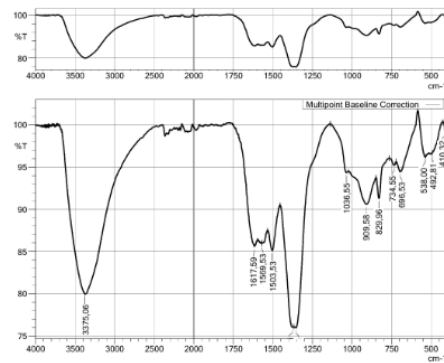
GO(100)-ZnO

10/03/2025
10:51:41



System Administrator

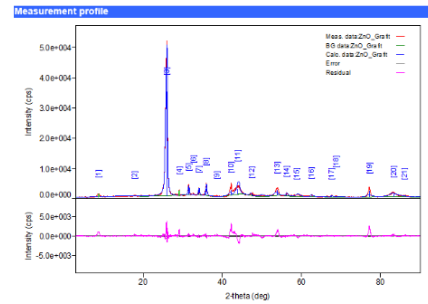
Item	Value
Acquired Date/Time	10/03/2025 10:48:02
Acquired By	System Administrator
Filename	C:\3255\Main\Enggag-1003GO-150-ZnO1.appt
Measure Parameter File	C:\Programmer\Parameter\15.7.1.appt
Report Template	
Spectrum name	Multipoint Baseline Correction
Sample name	GO 150 ZnO
Sample ID	GO 150 ZnO
Option	
Comment	
No. of Scans	25
Resolution	2 cm ⁻¹
Apodization	Happ-Genzel



GO(150)-ZnO

15.4 Karakterisasi Grafit/GO-ZnO dengan XRD

Peak List							
General information							
Analysis date	2025/02/23 21:10:24			Measurement date	2025/02/23 17:08:56		
Sample name	ZnO_Grafit.ras			Operator	administrator		
File name							
Comment							
Peak list							
No.	2-theta(deg)	d(ang.)	Height(cps)	FWHM(deg)	Int. I(cps deg)	Int. W(deg)	Avmt. factor
1	8.81(3)	10.03(3)	796(77)	0.67(3)	584(20)	0.83(12)	2.1(5)
2	17.83(7)	4.95(2)	2224(9)	0.52(7)	1434(9)	0.52(2)	1.8(8)
3	26.077(3)	3.420(3)	3449(536)	0.54(2)	22514(59)	0.833(12)	1.8(8)
4	29.135(15)	3.062(15)	1319(105)	0.167(16)	298(14)	0.23(3)	2.3(6)
5	31.572(13)	2.8315(11)	2426(142)	0.357(10)	1056(26)	0.43(4)	2.6(4)
6	32.88(4)	2.730(3)	379(86)	0.25(5)	174(21)	0.45(12)	3.0(7)
7	34.095(17)	2.6275(13)	159(115)	0.303(14)	612(22)	0.39(4)	3.0(6)
8	35.938(12)	2.496(9)	2417(142)	0.433(10)	1287(26)	0.53(4)	0.83(11)
9	38.87(6)	2.325(3)	2734(8)	0.19(3)	21144	0.26(10)	1.8(12)
10	42.208(9)	2.1384(4)	1769(121)	0.552(14)	1052(39)	0.60(6)	1.57(10)
11	43.87(3)	2.0575(12)	1786(122)	1.97(4)	3818(49)	2.14(17)	1.8(12)
12	47.53(2)	1.9118(9)	3135(11)	0.74(8)	252(16)	0.89(18)	1.57(10)
13	53.942(19)	1.6964(5)	1783(122)	0.890(17)	1028(35)	1.08(9)	0.78(16)
14	56.25(4)	1.6342(11)	662(74)	0.47(3)	350(30)	0.54(11)	0.8(16)
15	58.78(12)	1.579(3)	2224(9)	1.91(12)	451(28)	2.0(5)	1.7(16)
16	62.516(14)	1.4845(3)	3645(7)	0.44(4)	196(27)	0.49(14)	0.7(6)
17	67.65(7)	1.3837(13)	335(53)	0.33(6)	118(41)	0.35(18)	0.8(16)
18	68.87(16)	1.362(3)	198(41)	2.6(2)	710(69)	3.6(11)	2.4(7)
19	77.217(17)	1.2345(2)	2102(132)	0.558(16)	1362(25)	0.65(5)	2.7(5)
20	83.32(5)	1.1588(6)	626(83)	1.54(4)	1533(37)	1.9(2)	2.0(3)
21	85.88(4)	1.1295(4)	2404(5)	1.54(18)	701(38)	2.8(7)	1.5(6)



Grafit/ZnO

Peak List

General information

Analysis date

2025/02/23 19:59:59

Sample name

GO(100)_ZnO_Grafit.ras

File name

Comment

Measurement date

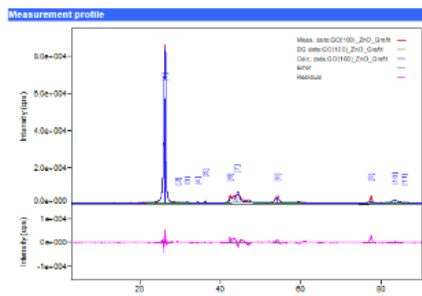
2025/02/23 17:10:42

Operator

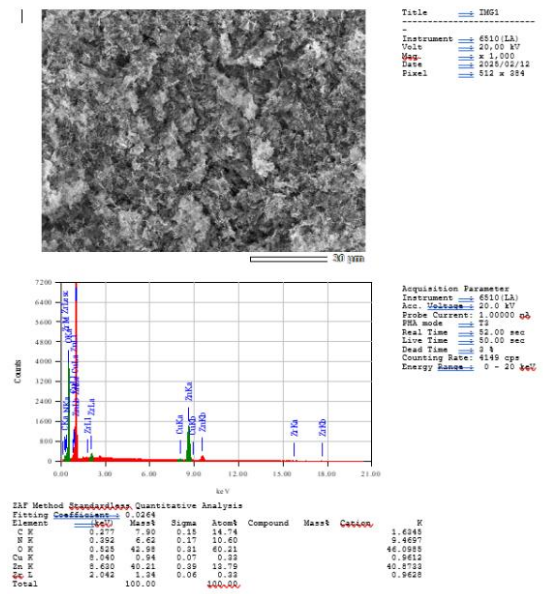
administrator

Peak list

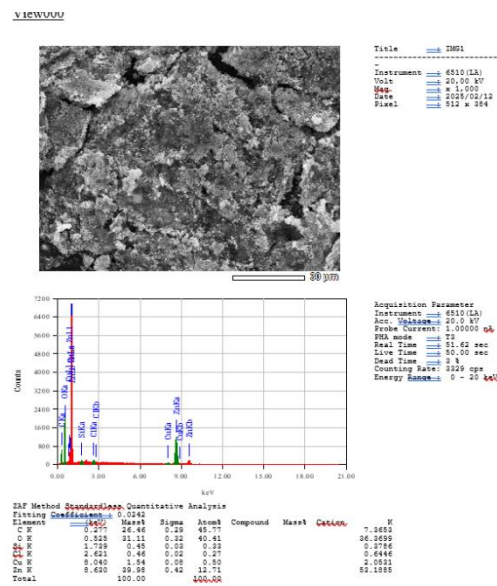
No.	2-theta(deg)	d(ang.)	Height(cps)	FWHM(deg)	Int. I(cps deg)	Int. W(deg)	Asym. factor
1	20.330(2)	3.3810(3)	59372(558)	0.4500(18)	35206(77)	0.637(5)	2.24(8)
2	29.452(2)	3.220(2)	379(131)	0.55(12)	411(36)	1.3(3)	2.5(3)
3	31.133(11)	3.1177(10)	627(123)	0.33(3)	231(17)	0.45(8)	0.5(2)
4	34.383(8)	2.8054(6)	507(84)	0.16(2)	100(14)	0.20(5)	0.6(5)
5	36.323(12)	2.4713(8)	825(83)	0.33(2)	377(19)	0.46(7)	3.7(9)
6	42.389(16)	2.1303(7)	2940(148)	0.31(4)	2384(41)	0.8(2)	0.94(18)
7	46.17(3)	1.9488(11)	2035(148)	2.28(5)	6350(41)	2.4(5)	0.07(10)
8	54.193(16)	1.6911(5)	2433(142)	0.813(14)	2857(37)	1.09(8)	1.81(14)
9	77.471(13)	1.23285(18)	2895(154)	0.440(18)	20452(71)	0.71(5)	2.2(4)
10	83.29(5)	1.1914(5)	679(139)	2.24(4)	1859(43)	2.3(5)	0.09(11)
11	86.70(5)	1.1327(5)	287(47)	1.55(5)	444(25)	1.7(6)	0.5(5)



15.5 Karakterisasi Grafit/GO-ZnO dengan SEM-EDX

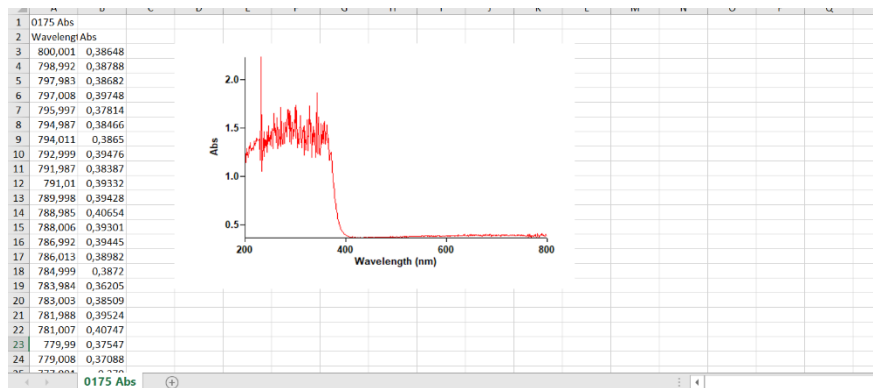


Grafit/ZnO

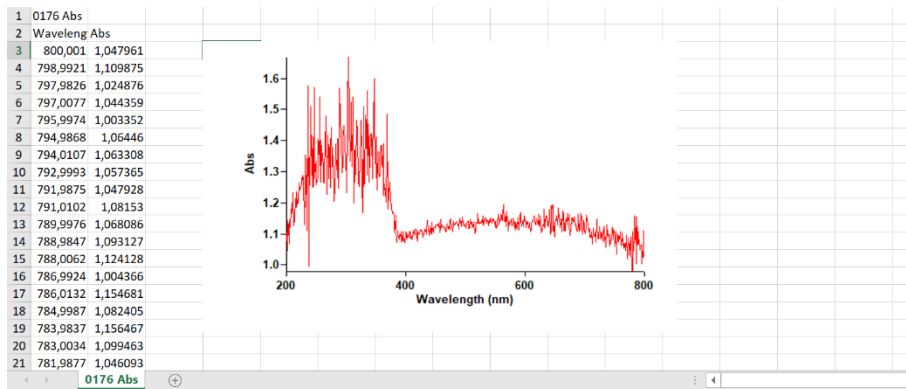


Grafit/GO(150)-ZnO

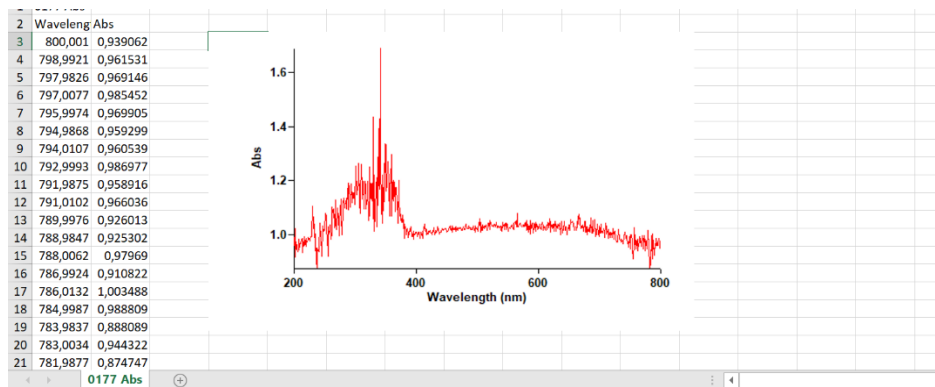
15.6 Karakterisasi Grafit/GO-ZnO dengan UV-Vis DRS



Grafit/ ZnO



Grafit/GO(100)-ZnO



Grafit/GO(150)-ZnO

Lampiran 16 : Dokumentasi Penelitian

16.1 Sintesis *Graphene Oxide* (GO)



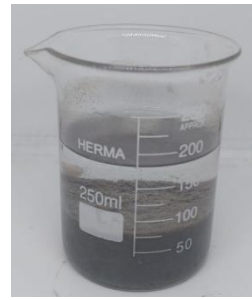
16.2 Sintesis Grafit/GO-ZnO



Sol ZnO



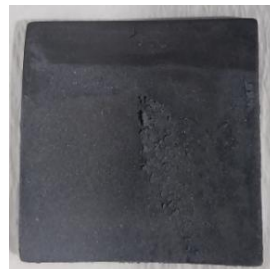
Sol GO(100)-ZnO



Sol GO(150)-ZnO



Grafit/ZnO



Grafit/GO(100)-ZnO



Grafit/GO(150)-ZnO

16.3 Rangkaian Reaktor Fotoelektrokatalisis



Reaktor lampu UV



Reaktor lampu Vis



Penentuan potensial kerja

16.4 Hasil Pengujian Fotoelektrokatalisis dan Fotokatalisis

Fotokatalisis

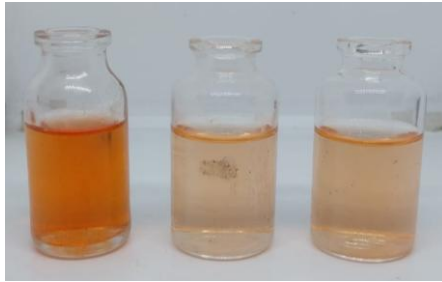


Pengujian dibawah lampu UV



Pengujian dibawah lampu *Visible*

Fotoelektrokatalisis



Pengujian dibawah lampu UV



Pengujian dibawah lampu *Visible*