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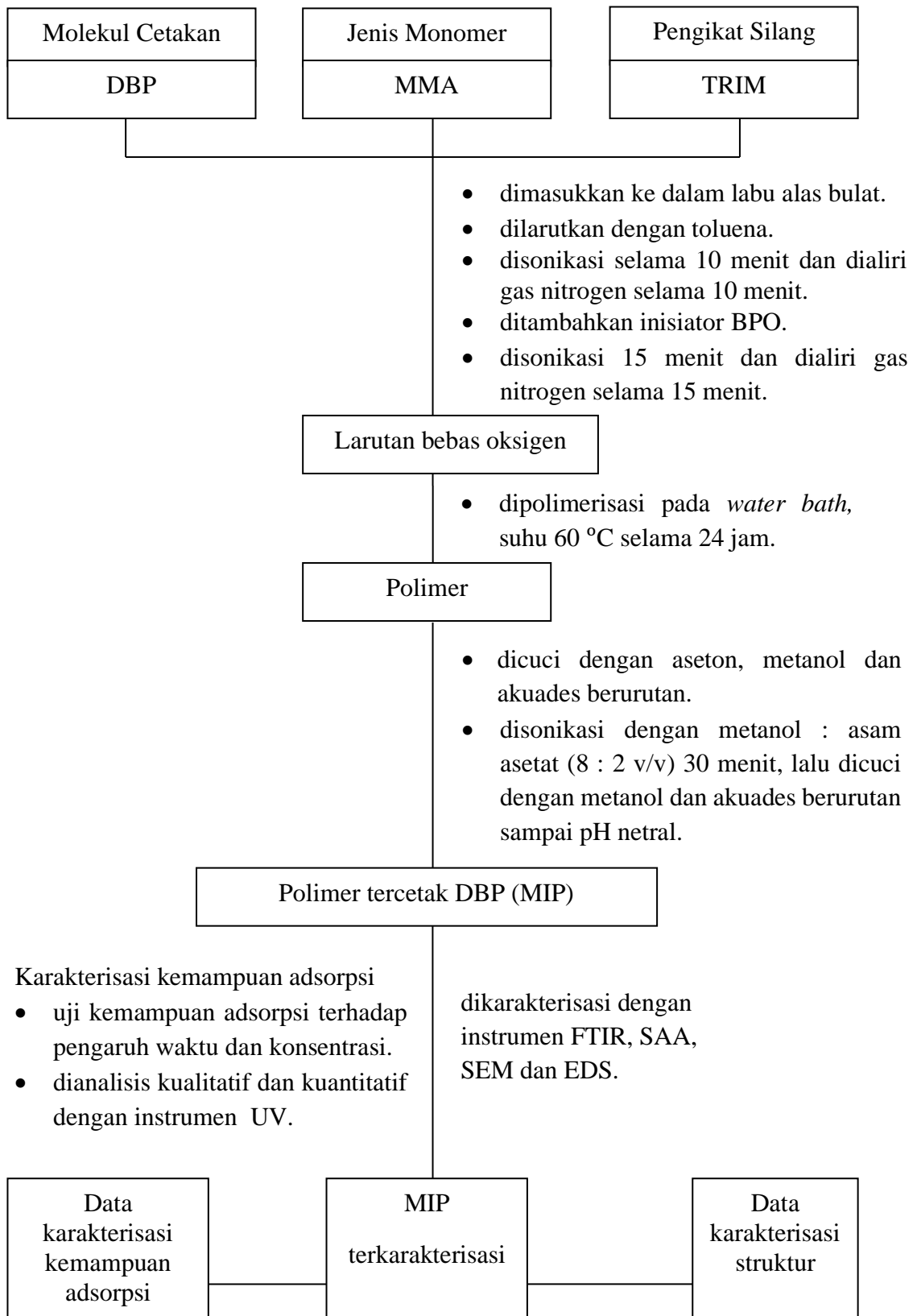Hadi, S., dan Widiarto, S., 2006, *Aplikasi dan Metode Analisis Kimia*, Kimia Press, Bandar Lampung.

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Lampiran 1. Skema Sintesis Polimer Bercetakan Molekul DBP menggunakan Metode Polimerisasi Presipitasi

Molekul Cetakan	Jenis Monomer	Pengikat Silang
DBP	MMA	TRIM

- dimasukkan ke dalam labu alas bulat.
- dilarutkan dengan toluena.
- disonikasi selama 10 menit dan dialiri gas nitrogen selama 10 menit.
- ditambahkan inisiator BPO.
- disonikasi 15 menit dan dialiri gas nitrogen selama 15 menit.

Larutan bebas oksigen

- dipolimerisasi pada *water bath,* suhu 60 ºC selama 24 jam.

Polimer

- dicuci dengan aseton, metanol dan akuades berurutan.
- disonikasi dengan metanol : asam asetat (8 : 2 v/v) 30 menit, lalu dicuci dengan metanol dan akuades berurutan sampai pH netral.

Polimer tercetak DBP (MIP)

Karakterisasi kemampuan adsorpsi
- uji kemampuan adsorpsi terhadap pengaruh waktu dan konsentrasi.
- dianalisis kualitatif dan kuantitatif dengan instrumen UV.

dikarakterisasi dengan instrumen FTIR, SAA, SEM dan EDS.

Data karakterisasi kemampuan adsorpsi	MIP terkarakterisasi	Data karakterisasi struktur

Catatan: Sintesis NIP dibuat dengan metode yang sama dengan MIP, tapi tanpa DBP dan proses ekstraksi.

Lampiran 2. Bagan Alir Prosedur Penelitian

1. Sintesis MIP dan NIP

Cairan DBP

- dipipet sebanyak 0,2651 mL (1 mmol) dalam labu alas bulat
- ditambahkan dengan monomer MMA sebanyak 0,4260 mL (4 mmol), didiamkan 5 menit
- ditambahkan pengikat silang TRIM sebanyak 2,5539 mL (8 mmol)
- dilarutkan dengan toluena sebanyak 50 mL, didiamkan 5 menit
- disonikasi selama 10 menit
- dialiri gas nitrogen selama 10 menit
- ditambahkan BPO sebanyak 0,2423 gram (1 mmol)
- disonikasi selama 15 menit
- dialiri gas nitrogen selama 15 menit

Larutan bebas oksigen

- dipolimerisasi dengan cara dimasukkan dalam *water bath* suhu 60°C selama 24 jam

Polimer

- dicuci dengan aseton, metanol, dan akuades secara berurutan
- disonikasi dengan campuran metanol : asetat (8:2 v/v) selama 30 menit

Polimer tercetak molekul DBP	Filtrat

- dicuci dengan metanol dan akuades berurutan sampai pH netral
- dikeringkan

- diuji kualitatif dan kuantitatif untuk mengekstraksi molekul cetakan dengan instrumen spektrofotometer UV pada $\lambda = 261{,}6$ nm

MIP	Data

Catatan : Sintesis NIP dibuat dengan metode yang sama, tetapi tanpa menggunakan molekul cetakan (DBP).

2. Pembuatan Larutan Standar DBP 100 mgL⁻¹

```
┌─────────────────────┐
│     Cairan DBP      │
└─────────────────────┘
         │
         │  − dipipet sebanyak 0,001 mL ke dalam labu ukur 10 mL
         │  − ditambahkan metanol sampai tanda batas
         │  − dihomogenkan
┌──────────────────────────────────┐
│ Larutan Standar DBP 100 mgL⁻¹   │
└──────────────────────────────────┘
         │
         │  − divariasikan konsentrasinya menjadi 3, 6, 9, 18 dan 24 mgL⁻¹
┌─────────────────────┐
│  Deret Standar DBP  │
└─────────────────────┘
```
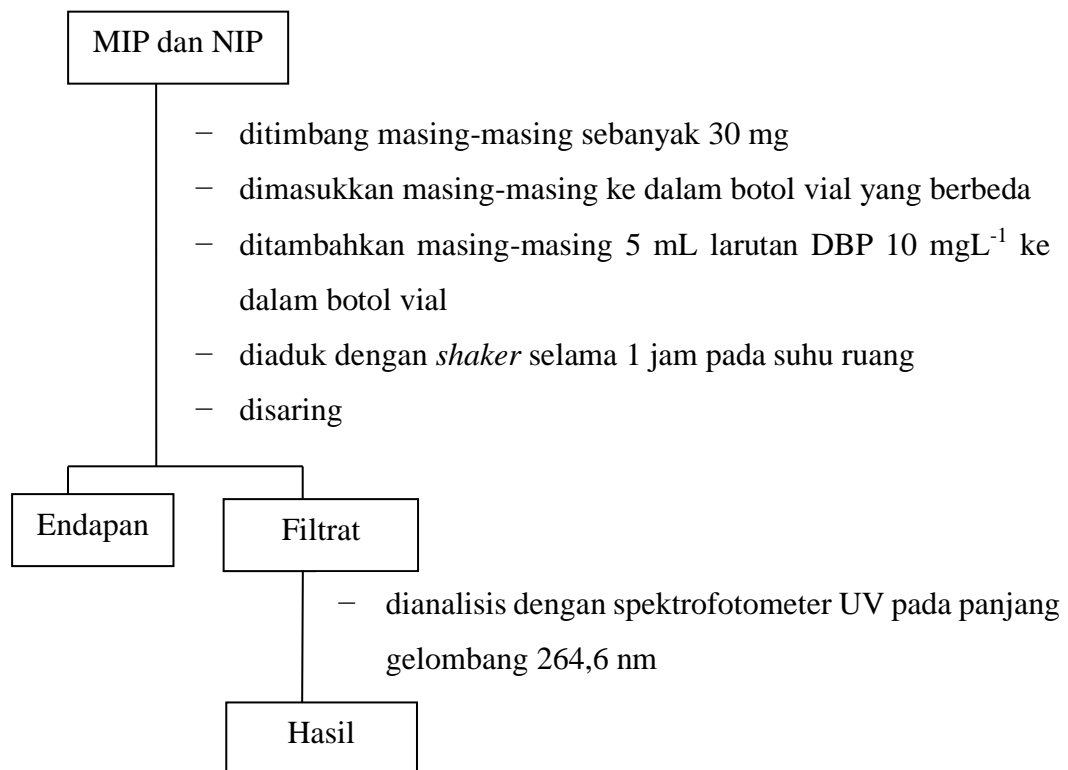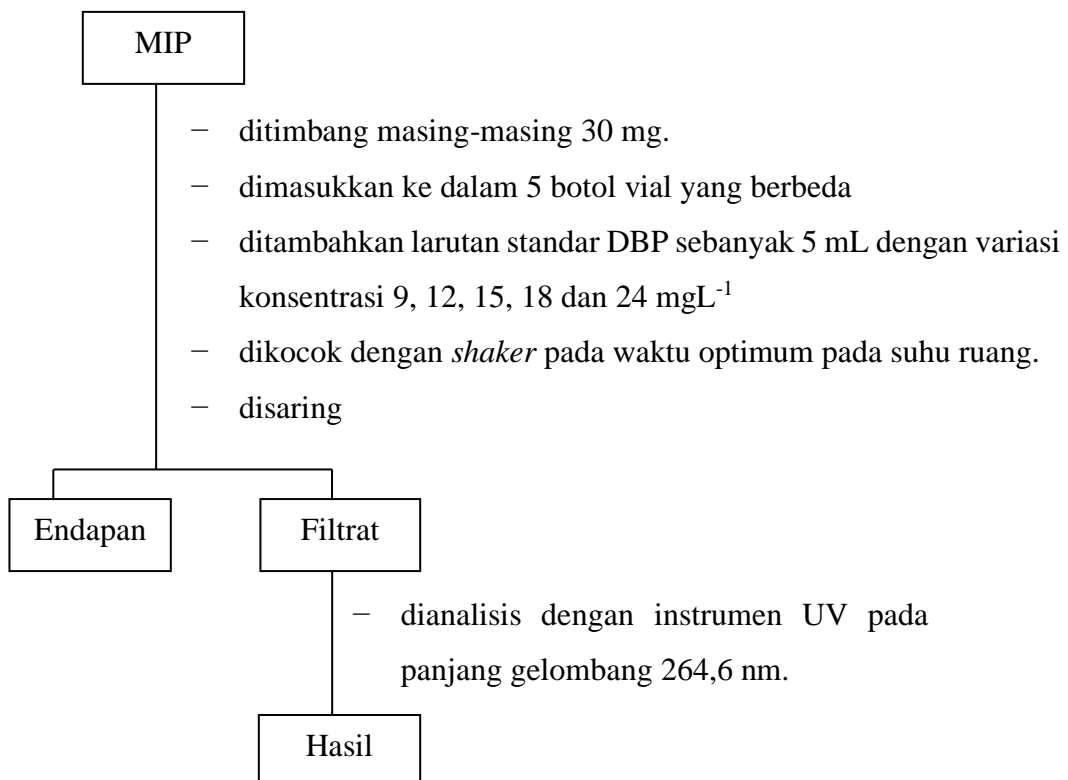
3. Uji Kemampuan Adsorpsi MIP dan NIP

```
┌─────────────────┐
│   MIP dan NIP   │
└─────────────────┘
         │
         │  − ditimbang masing-masing sebanyak 30 mg
         │  − dimasukkan masing-masing ke dalam botol vial yang berbeda
         │  − ditambahkan masing-masing 5 mL larutan DBP 10 mgL⁻¹ ke
         │    dalam botol vial
         │  − diaduk dengan shaker selama 1 jam pada suhu ruang
         │  − disaring
    ┌────┴─────┐
┌────────┐  ┌─────────┐
│Endapan │  │ Filtrat │
└────────┘  └─────────┘
                 │
                 │  − dianalisis dengan spektrofotometer UV pada panjang
                 │    gelombang 264,6 nm
            ┌─────────┐
            │  Hasil  │
            └─────────┘
```

The standard solution DBP is made by:
- dipipet sebanyak 0,001 mL ke dalam labu ukur 10 mL
- ditambahkan metanol sampai tanda batas
- dihomogenkan

Larutan Standar DBP 100 mgL⁻¹ then:
- divariasikan konsentrasinya menjadi 3, 6, 9, 18 dan 24 mgL⁻¹

MIP dan NIP:
- ditimbang masing-masing sebanyak 30 mg
- dimasukkan masing-masing ke dalam botol vial yang berbeda
- ditambahkan masing-masing 5 mL larutan DBP 10 mgL⁻¹ ke dalam botol vial
- diaduk dengan shaker selama 1 jam pada suhu ruang
- disaring

Filtrat:
- dianalisis dengan spektrofotometer UV pada panjang gelombang 264,6 nm

4. Pengaruh Waktu terhadap Kemampuan Adsorpsi DBP oleh MIP

```
┌──────────┐
│   MIP    │
└────┬─────┘
     │
```

- ditimbang masing-masing 30 mg
- dimasukkan ke dalam 5 botol vial yang berbeda
- ditambahkan larutan standar DBP 10 mgL^{-1} sebanyak 5 mL ke dalam masing-masing botol vial
- diaduk dengan variasi waktu 10, 30, 90, 150 dan 180 menit pada suhu ruang
- disaring.

```
┌──────────┐        ┌──────────┐
│ Endapan  │        │ Filtrat  │
└──────────┘        └────┬─────┘
```

- dianalisis dengan spektrofotometer UV pada panjang gelombang 264,6 nm.

```
        ┌──────────┐
        │  Hasil   │
        └──────────┘
```

5. Pengaruh Konsentrasi terhadap Kemampuan Adsorpsi MIP

```
┌──────────┐
│   MIP    │
└────┬─────┘
     │
```

- ditimbang masing-masing 30 mg.
- dimasukkan ke dalam 5 botol vial yang berbeda
- ditambahkan larutan standar DBP sebanyak 5 mL dengan variasi konsentrasi 9, 12, 15, 18 dan 24 mgL^{-1}
- dikocok dengan *shaker* pada waktu optimum pada suhu ruang.
- disaring

```
┌──────────┐        ┌──────────┐
│ Endapan  │        │ Filtrat  │
└──────────┘        └────┬─────┘
```

- dianalisis dengan instrumen UV pada panjang gelombang 264,6 nm.

```
        ┌──────────┐
        │  Hasil   │
        └──────────┘
```

Lampiran 3. Data Spektrofotometer UV-Vis

1. **Data absorbansi larutan standar DBP**

No.	Sampel	Konsentrasi (mg/L)	Absorbansi
1	DBP 1	3	1,112
2	DBP 2	6	1,478
3	DBP 3	9	1,835
4	DBP 4	18	2,942
5	DBP 5	24	3,99

2. **Kurva hubungan antara absorbansi vs konsentrasi larutan standar DBP**

$y = 0,1345x + 0,6576$
$R^2 = 0,994$
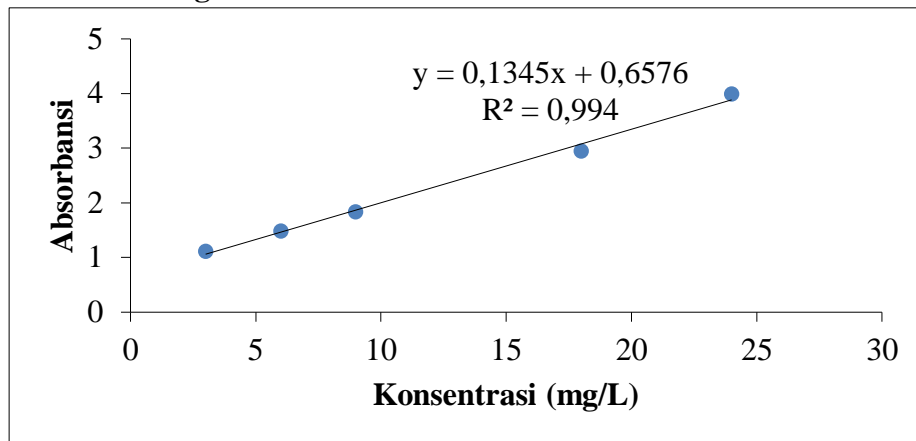
3. **Data absorbansi kemampuan adsorpsi MIP dan NIP**

No.	Sampel	Absorbansi	q_e (mg/g)	Δq_e (mg/g)
1	Adsorpsi DBP oleh MIP	1,608	0,4889	0,2032
2	Adsorpsi DBP oleh NIP	1,772	0,2857	

4. **Data absorbansi adsorpsi DBP oleh MIP terhadap pengaruh waktu**

No.	Sampel	Waktu (menit)	Absorbansi
1	DBP	10	1,786
2	DBP	30	1,731
3	DBP	90	1,637
4	DBP	150	1,627
5	DBP	180	1,696

5. Data penentuan kinetika adsorpsi orde satu semu dan orde dua semu

No.	Waktu	C_e (mgL^{-1})	q_t (mg/g)	q_e-q_t	Log (q_e-q_t)	t/q_t
1.	0	0	0	0,4654	-0,3321	0
2.	10	8,3896	0,2684	0,1970	-0,7055	37,2576
3.	30	7,9807	0,3366	0,1289	-0,8898	89,1384
4.	90	7,2818	0,4530	0,0124	-1,9069	198,6597
5.	150	7,2074	**0,4654**	0	0	322,2843
6.	180	7,7204	0,3799	0,0855	-1,0680	473,7769

Catatan:

q_t adalah q_e pada waktu t

q_e adalah q_t pada waktu optimum

6. Data absorbansi adsorpsi DBP oleh MIP terhadap pengaruh konsentrasi

No.	Sampel	Konsentrasi (mg/L)	Absorbansi
1	DBP	9	0,895
2	DBP	12	1,132
3	DBP	15	1,445
4	DBP	18	1,741
5	DBP	24	2,364

7. Data persamaan isotermal adsorpsi Langmuir dan Freundlich

No.	Sampel	Konsentrasi (mgL^{-1})	C_e (mgL^{-1})	q_e (mg/g)	Log C_e	Log q_e	$1/C_e$	$1/q_e$
1	MIP_DBP	9	1,7651	1,2058	0,2468	0,0813	0,5666	0,8293
2	MIP_DBP	12	3,5271	1,4121	0,5474	0,1499	0,2835	0,7081
3	MIP_DBP	15	5,8543	1,5243	0,7675	0,1831	0,1708	0,6560
4	MIP_DBP	18	8,0550	1,6575	0,9061	0,2195	0,1241	0,6033
5	MIP_DBP	24	12,6870	1,8855	1,1034	0,2754	0,0788	0,5304

Lampiran 4. Perhitungan

1. **Nilai konsentrasi adsorpsi DBP oleh MIP dan NIP**

   $y = 0,1345x + 0,6576$

   a. **Adsorpsi DBP oleh MIP**

   $y = 1,608$

   $y = 0,1345x + 0,6576$

   $1,608 = 0,1345x + 0,6576$

   $$x = \frac{1,608 - 0,6576}{0,1345}$$

   $x = 7,066 \text{ mg/L}$

   b. **Adsorpsi DBP oleh NIP**

   $y = 1,772$

   $y = 0,1345x + 0,6576$

   $1,772 = 0,1345x + 0,6576$

   $$x = \frac{1,772 - 0,6576}{0,1345}$$

   $x = 8,285 \text{ mg/L}$

2. **Nilai Kemampuan Adsorpsi DBP oleh MIP dan NIP**

   $$q_e = \frac{(C_o - C_e)\ V}{W}$$

   Diketahui: $C_o = 10 \text{ mg/L}$ $W = 0,03 \text{ g}$

   $V = 0,005 \text{ L}$ $C_e = $ Konsentrasi setelahadsorpsi

a. **Kemampuan Adsorpsi DBP oleh MIP**

$$q_e = \frac{(10 - 7{,}066)\,0{,}005}{0{,}03}$$

$$q_e = \frac{0{,}01467}{0{,}03}$$

$$q_e = 0{,}49 \text{ mg/g}$$

b. **Kemampuan Adsorpsi DBP oleh NIP**

$$q_e = \frac{(10 - 8{,}285)\,0{,}005}{0{,}03}$$

$$q_e = \frac{0{,}00857}{0{,}03}$$

$$q_e = 0{,}29 \text{ mg/g}$$

3. **Nilai konsentrasi adsorpsi dan kemampuan adsorpsi DBP oleh MIP terhadap pengaruh waktu**

Waktu (menit)	y (absorbansi)	x (Konsentrasi) (mg/L)	q_e (mg/g)
10	1,786	8,3896	0,2684
30	1,731	7,9807	0,3366
90	1,637	7,2818	0,4530
150	1,627	7,2074	0,4654
180	1,696	7,7204	0,3799

Contoh perhitungan konsentrasi adsorpsi dan kemampuan adsorpsi DBP oleh MIP terhadap pengaruh waktu:

a. Konsentrasi Adsorpsi DBP oleh MIP 30 menit

y $= 0{,}1345x + 0{,}6576$

y $= 1{,}731$

y $= 0{,}1345x + 0{,}6576$

$1{,}731 = 0{,}1345x + 0{,}6576$

x $= \dfrac{1{,}731 - 0{,}6576}{0{,}1345}$

x $= 7{,}98$ mg/L

b. Kemampuan Adsorpsi DBP oleh MIP 30 menit

$$q_e = \frac{(C_o - C_e)\,V}{W}$$

Diketahui: C_o $= 10$ mg/L W $= 0{,}03$ g

C_e $= $ Konsentrasi setelah adsorpsi V $= 0{,}005$ L

q_e $= \dfrac{(10 - 7{,}98)\,0{,}005}{0{,}03}$

q_e $= \dfrac{0{,}0101}{0{,}03}$

q_e $= 0{,}34$ mg/g

4. Nilai konsentrasi adsorpsi dan kemampuan adsorpsi DBP oleh MIP terhadap pengaruh konsentrasi

Konsenrasi awal (mg/L)	y (absorbansi)	x (konsentrasi) (mg/L)	q_e (mg/g)
9	0,895	1,7651	1,2058
12	1,132	3,5271	1,4121
15	1,445	5,8543	1,5243
18	1,741	8,0550	1,6575
24	2,364	12,6870	1,8855

Contoh perhitungan konsentrasi adsorpsi dan kemampuan adsorpsi DBP oleh MIP terhadap pengaruh konsentrasi:

a. Konsentrasi Adsorpsi DBP oleh MIP 9 mg/L

$$y = 0,1345x + 0,6576$$

$$y = 0,895$$

$$y = 0,1345x + 0,6576$$

$$0,895 = 0,1345x + 0,6576$$

$$x = \frac{0,895 - 0,6576}{0,1345}$$

$$x = 1,77 \text{ mg/L}$$

b. Kemampuan Adsorpsi DBP oleh MIP 9 mg/L

$$q_e = \frac{(C_o - C_e)\ V}{W}$$

Diketahui: C_o = konsentrasi awal   W = 0,03 g

           C_e = Konsentrasi setelah adsorpsi   V = 0,005 L

$$q_e = \frac{(9 - 1,77)\ 0,005}{0,03}$$

$$q_e = \frac{0{,}0361}{0{,}03}$$

$$q_e = 1{,}21 \text{ mg/g}$$

Lampiran 5. Foto Hasil Penelitian

Proses pencampuran bahan dan prapolimerisasi

Sonikasi

Pengaliran gas nitrogen untuk menghilangkan gas oksigen
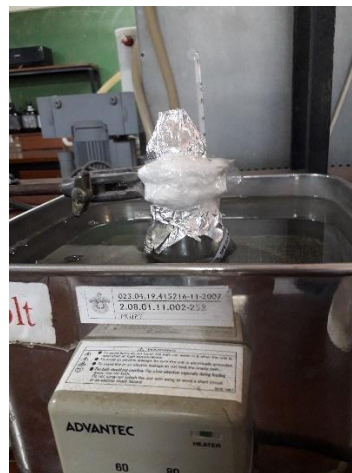
Polimerisasi dalam *waterbath*

Polimer terbentuk berwarna putih

Pengeringan polimer

Proses pencucian polimer dengan aseton, metanol, dan akuades agar bersih dari pengotor

Proses ekstraksi (sonikasi)

Pencucian polimer dengan akuades

Penentuan pH

Pembuatan deret standar DBP

Pengocokan dengan alat *shaker* untuk pengaruh waktu dan konsentrasi terhadap adsorpsi DBP

Polimer hasil sintesis MIP_DBP_MMA-co-TRIM dan NIP_MMA-co-TRIM disimpan

Lampiran 6. Karakterisasi EDS

1. NIP_MMA-co-TRIM
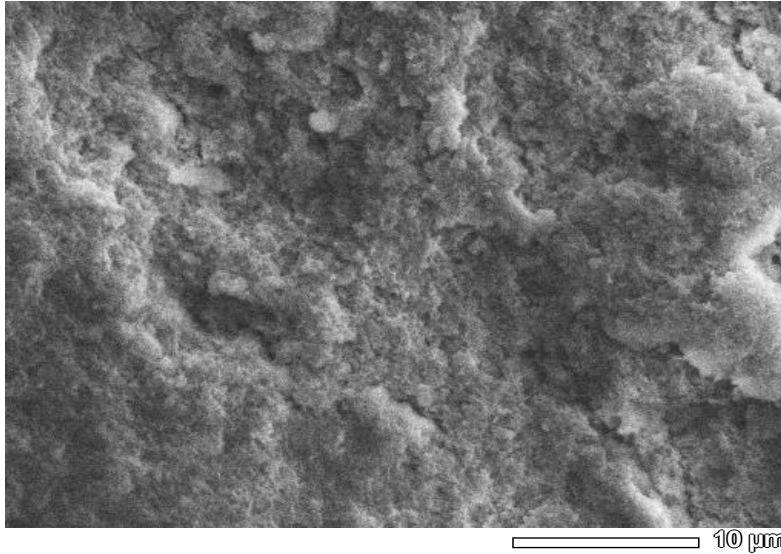

```
Title       : IMG1
-------------------------
Instrument  : 6510(LA)
Volt        : 10.00 kV
Mag.        : x 3,000
Date        : 2022/03/07
Pixel       : 512 x 384
```
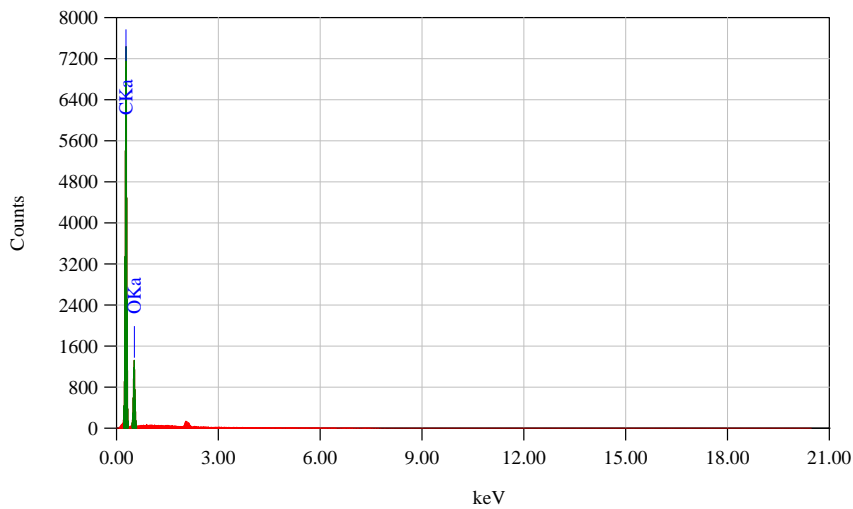


```
Acquisition Parameter
Instrument   : 6510(LA)
Acc. Voltage : 10.0 kV
Probe Current: 1.00000 nA
PHA mode     : T3
Real Time    : 50.52 sec
```

ZAF Method Standardless Quantitative Analysis
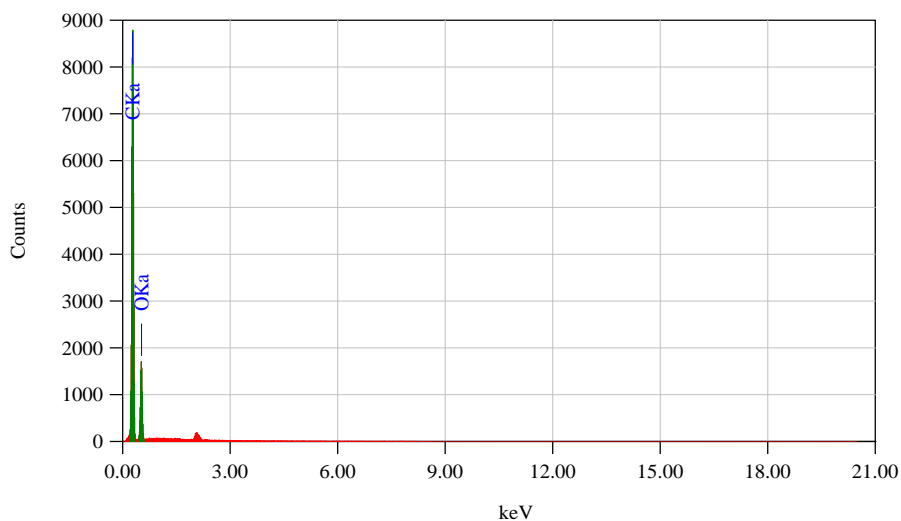
Fitting Coefficient : 0.0248

Element	(keV)	Mass%	Sigma	Atom%	Compound	Mass%	Cation	K
C K	0.277	77.85	0.23	82.40				84.4386
O K	0.525	22.15	0.28	17.60				15.5614
Total		100.00		100.00				

2. MIP_DBP_MMA-co-TRIM(BE)
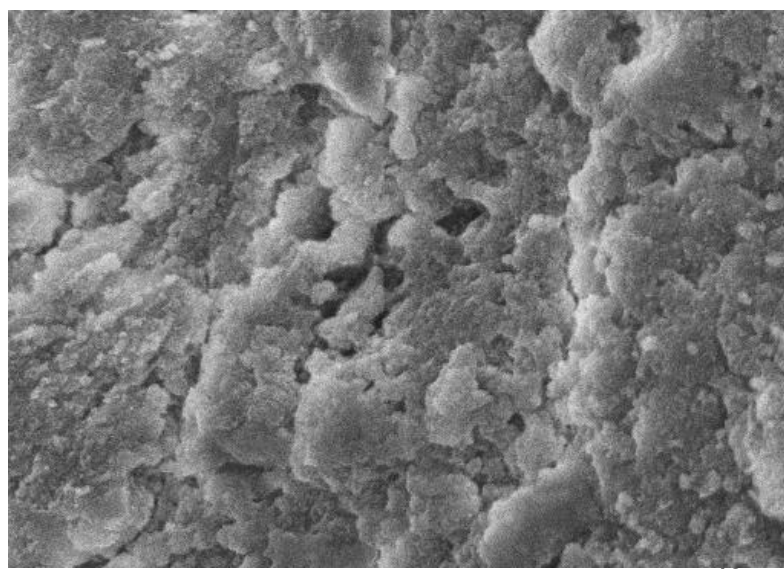

```
Title         : IMG1
--------------------------
-
Instrument    : 6510(LA)
Volt          : 10.00 kV
Mag.          : x 3,000
Date          : 2022/03/07
Pixel         : 512 x 384
```
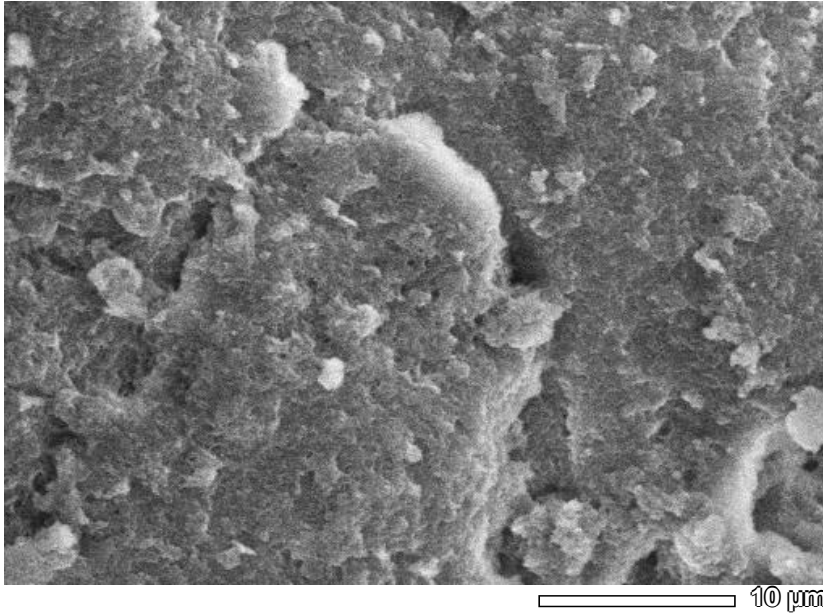


```
Acquisition Parameter
Instrument    : 6510(LA)
Acc. Voltage  : 10.0 kV
Probe Current: 1.00000 nA
PHA mode      : T3
Real Time     : 50.59 sec
```

ZAF Method Standardless Quantitative Analysis
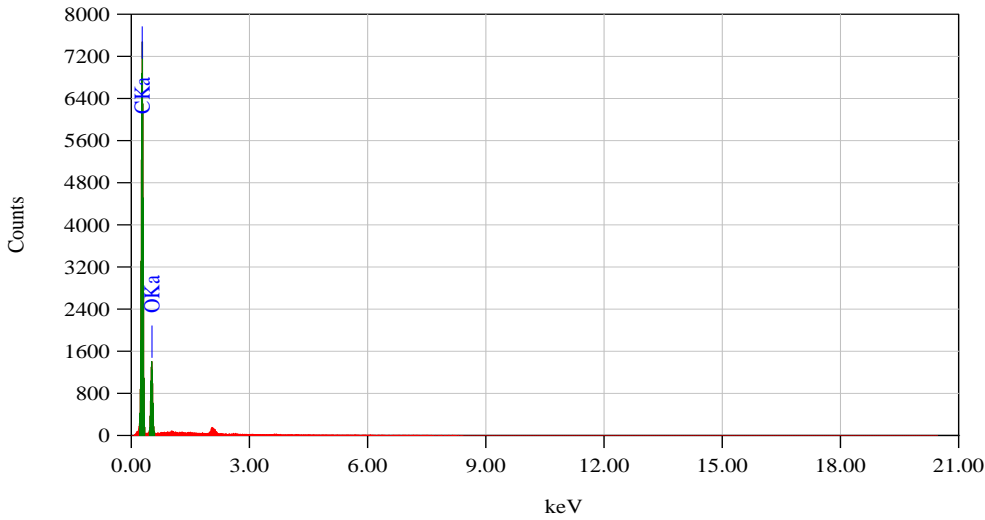
Fitting Coefficient : 0.0291

Element	(keV)	Mass%	Sigma	Atom%	Compound	Mass%	Cation	K
C K	0.277	76.32	0.21	81.11				82.9135
O K	0.525	23.68	0.26	18.89				17.0865
Total		100.00		100.00				

3. MIP_DBP_MMA-co-TRIM(TE)


```
Title       : IMG1
--------------------------
Instrument  : 6510(LA)
Volt        : 10.00 kV
Mag.        : x 3,000
Date        : 2022/03/07
Pixel       : 512 x 384
```



```
Acquisition Parameter
Instrument   : 6510(LA)
Acc. Voltage : 10.0 kV
Probe Current: 1.00000 nA
PHA mode     : T3
Real Time    : 50.51 sec
```
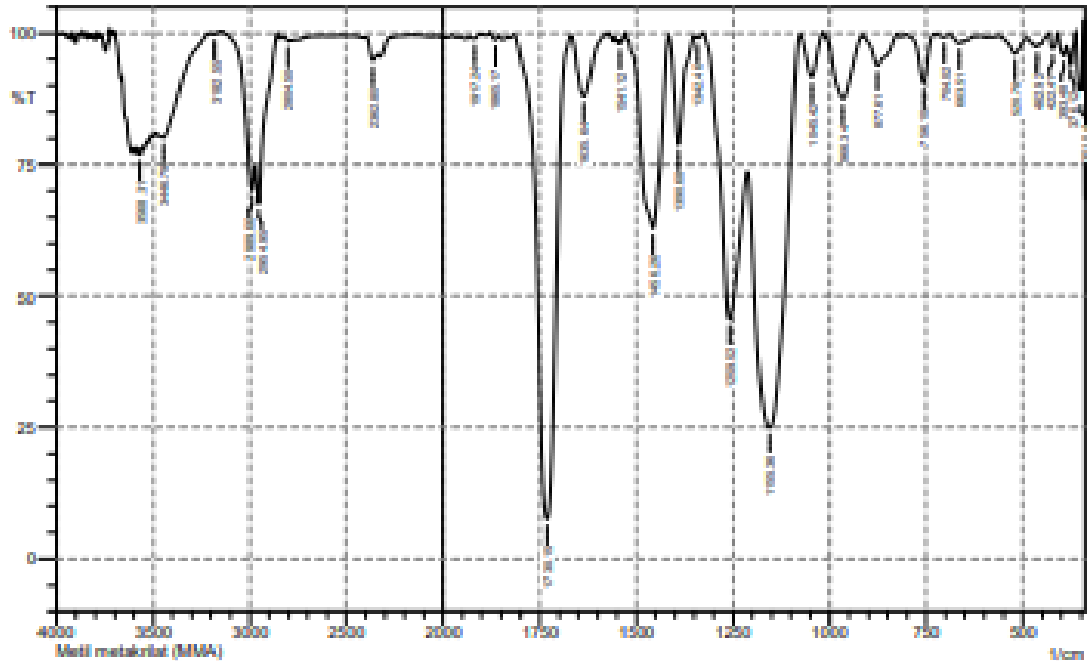
ZAF Method Standardless Quantitative Analysis

Fitting Coefficient : 0.0282

Element	(keV)	Mass%	Sigma	Atom%	Compound	Mass%	Cation	K
C K	0.277	76.11	0.23	80.93				82.6980
O K	0.525	23.89	0.29	19.07				17.3020
Total		100.00		100.00				

Lampiran 7. Karakterisasi FTIR

1. Spektrum Monomer MMA

Metil metakrilat (MMA)

No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	351.04	87.56	13.926	364.55	341.4	0.722	0.848
2	376.12	94.236	4.408	385.76	364.55	0.313	0.197
3	393.48	95.78	2.501	410.84	385.76	0.298	0.159
4	422.41	97.112	2.808	432.05	410.84	0.184	0.176
5	462.92	97.471	0.81	487.99	455.2	0.274	0.072
6	520.76	96.086	3.256	563.21	487.99	0.693	0.475
7	663.51	98.138	0.655	682.8	655.8	0.17	0.056
8	704.02	99.303	0.304	715.59	690.52	0.058	0.016
9	756.1	90.517	9.28	802.39	727.16	1.18	1.111
10	877.61	93.878	5.746	912.33	825.53	1.313	1.182
11	966.34	87.56	11.769	1006.84	914.26	2.999	2.751
12	1045.42	91.69	8.264	1076.28	1018.41	1.126	1.117
13	1155.36	24.936	59.596	1211.3	1076.21	45.218	36.375
14	1259.52	45.581	38.795	1327.03	1213.23	18.989	11.339
15	1342.46	99.092	0.555	1348.24	1327.03	0.051	0.03
16	1390.68	78.95	20.546	1415.75	1350.17	2.761	2.638
17	1456.26	62.906	36.253	1519.91	1417.68	10.702	10.268
18	1541.12	98.051	1.011	1546.91	1529.55	0.097	0.043
19	1635.64	88.049	11.528	1666.5	1581.63	2.275	2.134
20	1730.15	7.664	91.911	1815.02	1670.35	43.294	43.039
21	1865.17	98.8	0.976	1880.6	1857.45	0.074	0.062
22	1917.24	98.993	0.644	1933.74	1903.74	0.084	0.042
23	2362.8	94.789	2.675	2393.68	2335.8	0.989	0.355
24	2804.5	98.483	0.943	2827.64	2659.84	0.705	0.31
25	2954.95	87.616	10.245	2970.38	2856.58	8.43	1.328
26	2989.66	70.012	7.133	3145.9	2972.31	8.205	0.95
27	3182.55	99.826	0.296	3192.19	3147.83	-0.018	0.02
28	3446.79	90.207	1.226	3460.3	3194.12	10.241	0.301
29	3568.31	76.803	1.373	3577.95	3554.81	2.577	0.103

Comment;

Metil metakrilat (MMA)

Date/Time;   2/14/2022 3:11:17 PM

No. of Scans;

Resolution;

Apodization;

2. Spektrum NIP_MMA-co-TRIM
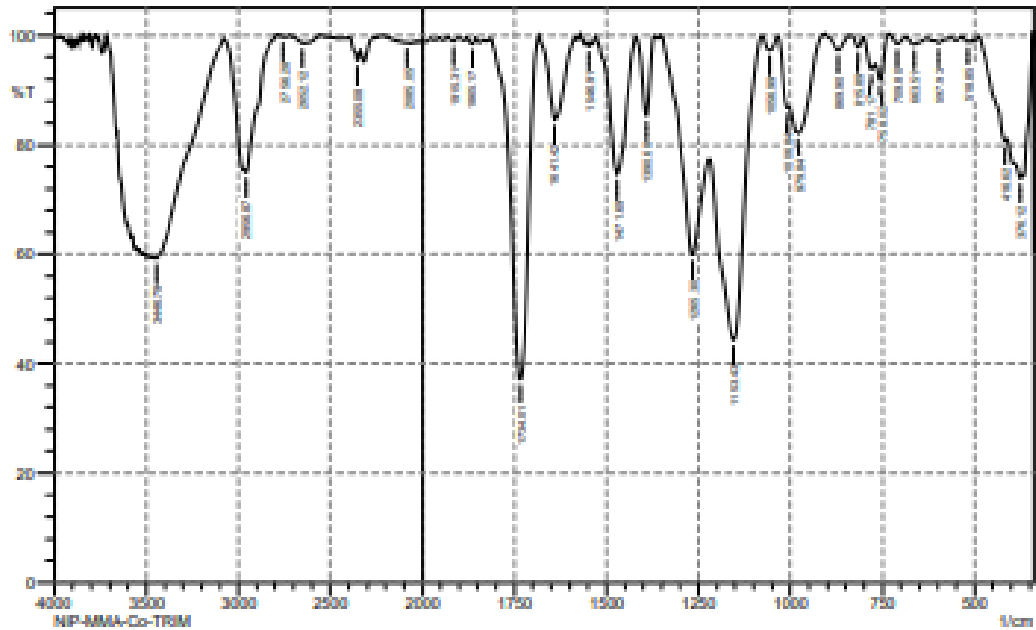
NIP-MMA-Co-TRIM

	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	376.12	73.987	0.982	387.69	372.26	1.947	0.047
2	416.62	80.672	1.848	487.99	410.84	3.708	0.176
3	518.85	98.917	0.284	532.35	514.99	0.061	0.016
4	597.93	98.705	0.449	605.65	578.64	0.12	0.038
5	663.51	98.41	0.654	682.8	653.87	0.15	0.05
6	709.8	98.57	1.375	732.95	690.52	0.131	0.125
7	758.02	91.906	4.787	771.53	732.95	0.794	0.369
8	781.17	93.811	2.476	802.39	771.53	0.654	0.172
9	815.89	97.928	1.9	837.11	802.39	0.15	0.129
10	869.9	97.409	2.759	906.54	837.11	0.342	0.395
11	979.84	82.147	7.956	1002.98	908.47	4.575	1.851
12	1006.84	96.785	0.841	1035.77	1004.91	1.056	0.095
13	1056.99	97.361	2.531	1078.21	1035.77	0.284	0.265
14	1153.43	44.414	43.624	1220.94	1078.21	26.401	18.536
15	1265.3	59.883	24.979	1350.17	1222.87	14.563	7.346
16	1390.68	85.368	14.485	1417.68	1371.39	1.477	1.445
17	1471.69	74.653	25.073	1527.62	1419.61	6.161	6.032
18	1546.91	98.168	0.594	1552.7	1544.98	0.054	0.012
19	1641.42	84.609	15.259	1681.93	1587.42	3.235	3.17
20	1734.01	37.22	62.455	1813.09	1683.86	20.253	20.054
21	1865.17	98.525	1.141	1880.6	1855.52	0.11	0.074
22	1915.31	99.011	0.597	1928.82	1901.81	0.081	0.046
23	2085.05	98.731	0.092	2102.41	2077.33	0.135	0.007
24	2355.08	95.409	2.572	2395.59	2337.72	0.686	0.314
25	2652.12	98.627	1.436	2721.56	2557.61	0.515	0.563
26	2756.28	99.823	0.022	2789.07	2754.35	0	-0.001
27	2958.87	75.012	24.455	3072.6	2802.57	14.747	14.121
28	3446.79	59.233	1.099	3456.44	3074.53	40.736	0.815

Comment;

NIP-MMA-Co-TRIM

Date/Time; 3/31/2022 10:32:24 AM

No. of Scans;

Resolution;

Apodization;

3. Spektrum MIP_DBP_MMA-co-TRIM(BE)

MIP-DBP-MMA-Co-TRIM (BE)
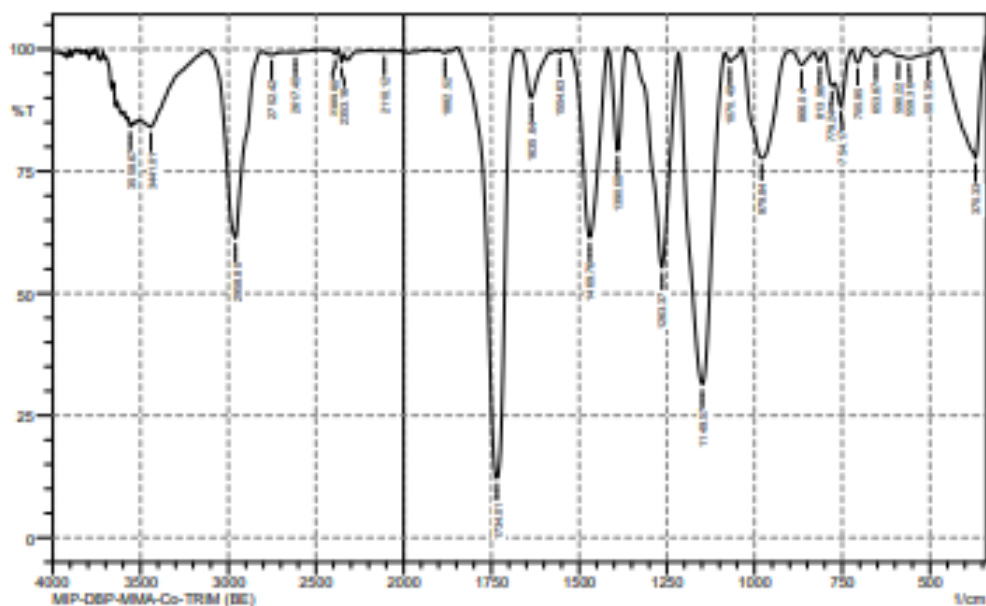
No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	370.33	77.8	24.24	474.49	339.47	7.16	7.97
2	505.35	98.85	0.28	513.07	474.49	0.11	0.02
3	559.36	98.13	0.52	584.43	513.07	0.49	0.08
4	590.22	98.49	0.17	628.79	584.43	0.18	0
5	653.87	98.41	1.44	684.73	628.79	0.2	0.17
6	705.95	97.2	2.74	723.31	684.73	0.22	0.22
7	754.17	88.36	6.8	769.6	723.31	1.33	0.6
8	779.24	92.46	2.24	800.46	771.53	0.65	0.16
9	813.96	97.48	1.98	831.32	800.46	0.2	0.13
10	866.04	96.8	2.78	898.83	831.32	0.51	0.38
11	979.84	77.71	22.19	1033.85	898.83	7.87	7.79
12	1070.49	97.43	2.04	1083.99	1035.77	0.32	0.26
13	1149.57	31.43	67.69	1215.15	1083.99	30.45	29.95
14	1263.37	55.37	43.97	1342.46	1217.08	12.84	12.5
15	1390.68	79.23	20.9	1415.75	1365.6	2.27	2.3
16	1469.76	61.46	38.51	1525.69	1417.68	10.06	10.04
17	1554.63	99.22	0.61	1566.2	1544.98	0.04	0.03
18	1635.64	90.07	9.43	1664.57	1585.49	1.68	1.49
19	1734.01	12.2	87.77	1847.81	1678.07	39.33	39.36
20	1882.52	99.25	0.43	1899.88	1870.95	0.07	0.03
21	2110.12	99.59	0.01	2117.84	2092.77	0.04	0
22	2353.16	97.31	2.07	2370.51	2339.65	0.22	0.14
23	2389.8	98.97	0.95	2411.02	2370.51	0.11	0.09
24	2617.4	99.37	0.03	2625.12	2480.46	0.24	0.01
25	2752.42	98.88	0.57	2808.36	2677.2	0.48	0.16
26	2958.8	61.38	38.2	3196.97	2808.36	23.34	22.78
27	3441.01	84.05	2.95	3487.3	3118.9	12.5	1
28	3558.67	84.2	1.03	3574.1	3547.09	1.93	0.07

Comment;
MIP-DBP-MMA-Co-TRIM (BE)

Date/Time;   4/5/2022 1:32:36 PM
No. of Scans;
Resolution;
Apodization;

4. Spektrum MIP_DBP_MMA-co-TRIM(TE)

MIP-DBP-MMA-Co-TRIM (TE)
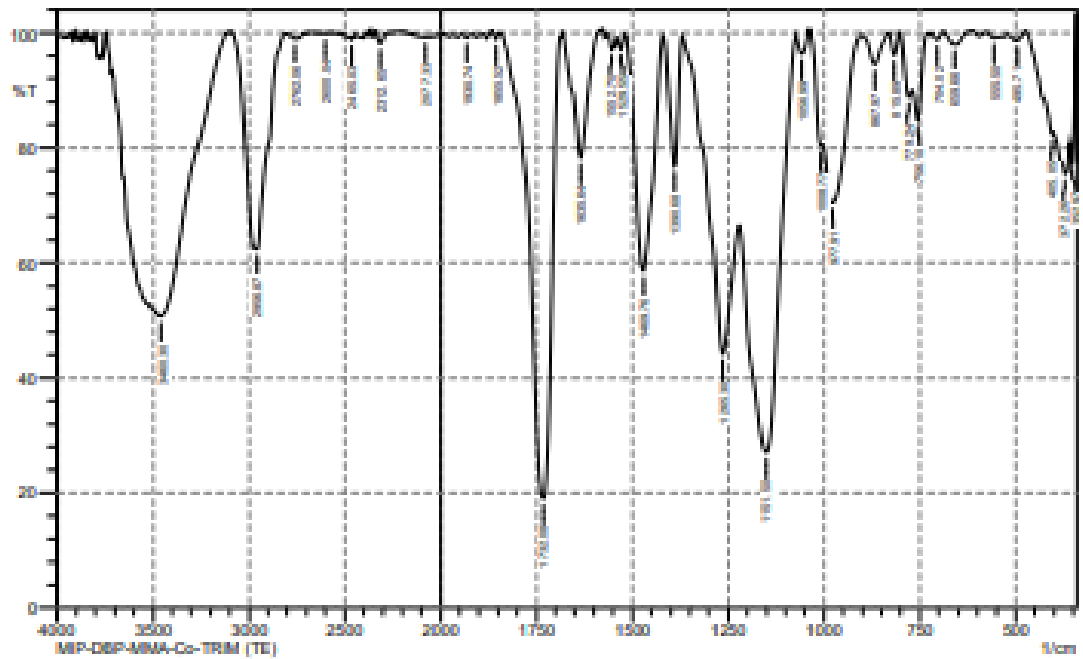
No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	352.97	77.254	7.732	356.83	343.33	1.041	0.388
2	372.26	75.458	1.124	403.12	368.4	3.606	0.081
3	435.05	82.442	3.652	474.49	403.12	2.698	-0.221
4	495.71	98.663	0.482	501.49	474.49	0.081	0.028
5	555.5	99.137	0.553	574.79	542	0.077	0.042
6	659.66	98.007	0.31	686.66	655.8	0.149	0.026
7	704.02	98.656	1.063	717.52	686.66	0.075	0.067
8	756.1	84.745	8.651	769.6	731.02	1.532	0.688
9	779.24	88.693	3.787	800.46	771.53	1.001	0.298
10	815.89	95.179	3.821	829.39	802.39	0.244	0.244
11	857.97	94.496	5.274	902.69	829.39	0.805	0.735
12	977.91	70.403	14.769	1002.98	902.69	8.709	4.061
13	1008.77	80.444	2.482	1037.7	1004.91	1.601	0.104
14	1056.99	96.383	1.669	1072.42	1037.7	0.321	0.337
15	1151.5	27.062	54.85	1220.94	1074.35	45.464	32.323
16	1265.3	44.184	31.696	1369.46	1222.87	24.14	10.777
17	1390.68	76.869	22.606	1417.68	1371.39	2.664	2.56
18	1469.76	58.626	40.812	1516.05	1419.61	11.43	11.195
19	1529.55	97.237	2.183	1539.2	1521.84	0.131	0.086
20	1552.7	97.183	3.999	1586.2	1548.84	0.109	0.015
21	1635.64	78.276	21.703	1678.07	1585.49	4.236	4.241
22	1732.08	19.076	80.34	1838.16	1687.71	36.467	36.131
23	1855.52	98.924	1.187	1867.09	1845.88	0.032	0.043
24	1930.74	99.169	0.548	1944.25	1915.31	0.061	0.025
25	2077.33	99.304	0.125	2204.64	2065.76	0.194	0.049
26	2312.65	98.199	1.966	2335.8	2270.22	0.223	0.251
27	2465.03	98.912	0.821	2569.18	2445.74	0.214	0.13
28	2600.04	99.904	0.017	2605.83	2569.18	0.008	0.001
29	2762.06	99.036	0.867	2804.5	2677.2	0.244	0.211
30	2956.87	62.392	2.435	2966.52	2804.5	12.924	0.252
31	3460.3	50.706	9.946	3527.8	3115.04	54.252	9.072

Date/Time; 2/18/2022 11:17:56 AM

No. of Scans;

Resolution;
Apodization;

Lampiran 8. Karakterisasi SAA

TriStar II 3020 2.00   TriStar II 3020 Version 2.00 Unit   Serial #: 1108   Page 1
1 Port 3

Sample: MIP_DBP_MMA-Co-TRIM (TE)
Operator: Sarah
Submitter: 31751
      File: C:\TriStar II 3020\data\SAMPEL...\MIP_DBP_MMA-Co-TRIM-TE.SMP

Started: 3/9/2022 7:18:50 AM   Analysis Adsorptive: N2
Completed: 3/9/2022 3:44:43 PM   Analysis Bath Temp.: -195.850 °C
Report Time: 3/10/2022 2:27:11 PM   Thermal Correction: No
Sample Mass: 0.2026 g   Warm Free Space: 11.3431 cm³ Measured
Cold Free Space: 32.8741 cm³   Equilibration Interval: 5 s
Low Pressure Dose: None   Sample Density: 1.000 g/cm³
Automatic Degas: No

Summary Report

Surface Area

Single point surface area at P/Po = 0.304769576: 458.6663 m²/g

BET Surface Area: 465.4849 m²/g

t-Plot Micropore Area: 77.1316 m²/g

t-Plot External Surface Area: 388.3533 m²/g

BJH Adsorption cumulative surface area of pores
between 1.7000 nm and 300.0000 nm diameter: 329.295 m²/g

BJH Desorption cumulative surface area of pores
between 1.7000 nm and 300.0000 nm diameter: 359.3916 m²/g

D-H Adsorption cumulative surface area of pores
between 1.7000 nm and 300.0000 nm diameter: 304.720 m²/g

D-H Desorption cumulative surface area of pores
between 1.7000 nm and 300.0000 nm diameter: 326.1318 m²/g

Pore Volume

Single point adsorption total pore volume of pores
less than 173.9738 nm diameter at P/Po = 0.988862530: 0.595801 cm³/g

t-Plot micropore volume: 0.041580 cm³/g

BJH Adsorption cumulative volume of pores
between 1.7000 nm and 300.0000 nm diameter: 0.506634 cm³/g

BJH Desorption cumulative volume of pores
between 1.7000 nm and 300.0000 nm diameter: 0.518920 cm³/g

Pore Size

Adsorption average pore width (4V/A by BET): 5.11983 nm

BJH Adsorption average pore diameter (4V/A): 6.1542 nm

BJH Desorption average pore diameter (4V/A): 5.7755 nm

D-H Adsorption average pore diameter (4V/A): 6.5003 nm

D-H Desorption average pore diameter (4V/A): 5.9925 nm

Sample: MIP_DBP_MMA-Co-TRIM (TE)
Operator: Sarah
Submitter: 31751
        File: C:\TriStar II 3020\data\SAMPEL...\MIP_DBP_MMA-Co-TRIM-TE.SMP

Started: 3/9/2022 7:18:50 AM	Analysis Adsorptive: N2
Completed: 3/9/2022 3:44:43 PM	Analysis Bath Temp.: -195.850 °C
Report Time: 3/10/2022 2:27:11 PM	Thermal Correction: No
Sample Mass: 0.2026 g	Warm Free Space: 11.3431 cm³ Measured
Cold Free Space: 32.8741 cm³	Equilibration Interval: 5 s
Low Pressure Dose: None	Sample Density: 1.000 g/cm³
Automatic Degas: No	

Isotherm Tabular Report

Relative Pressure (P/Po)	Absolute Pressure (mmHg)	Quantity Adsorbed (cm³/g STP)	Elapsed Time (h:min)	Saturation Pressure (mmHg)
				760.000000
0.009712559	7.381545	78.1929	01:10	
0.114014686	86.651161	122.1446	01:39	
0.202656856	154.019211	137.2590	01:53	
0.304769576	231.624878	151.5513	02:03	
0.414619968	315.111176	166.5968	02:15	
0.500769324	380.584686	179.1043	02:25	
0.597758805	454.296692	195.2863	02:34	
0.703498680	534.658997	218.8366	02:48	
0.797759046	606.296875	250.7292	03:03	
0.897860477	682.373962	319.1413	03:23	
0.988862530	751.535522	385.1832	03:33	
0.898862497	683.135498	364.7582	03:44	
0.802997388	610.278015	312.5013	04:08	
0.701298764	532.987061	246.5121	04:32	
0.570233355	433.377350	207.4870	04:48	
0.501431636	381.088043	194.2820	04:58	
0.410142356	311.708191	173.6311	05:10	
0.269506254	204.824753	154.9709	05:19	
0.205258841	155.996719	146.2115	05:27	
0.108867816	82.739540	130.3311	05:41	
0.010366427	7.878485	90.8154	06:25	

Sample: MIP_DBP_MMA-Co-TRIM (TE)
Operator: Sarah
Submitter: 31751
        File: C:\TriStar II 3020\data\SAMPEL...\MIP_DBP_MMA-Co-TRIM-TE.SMP

Started: 3/9/2022 7:18:50 AM   Analysis Adsorptive: N2
Completed: 3/9/2022 3:44:43 PM   Analysis Bath Temp.: -195.850 °C
Report Time: 3/10/2022 2:27:11 PM   Thermal Correction: No
Sample Mass: 0.2026 g   Warm Free Space: 11.3431 cm³ Measured
Cold Free Space: 32.8741 cm³   Equilibration Interval: 5 s
Low Pressure Dose: None   Sample Density: 1.000 g/cm³
Automatic Degas: No

Isotherm Linear Plot

Legend:
— MIP_DBP_MMA-Co-TRIM (TE) - Adsorption
—o— MIP_DBP_MMA-Co-TRIM (TE) - Desorption

X-axis: Relative Pressure (P/Po)
Y-axis: Quantity Adsorbed (cm³/g STP)

Sample: MIP_DBP_MMA-Co-TRIM (TE)
Operator: Sarah
Submitter: 31751
    File: C:\TriStar II 3020\data\SAMPEL...\MIP_DBP_MMA-Co-TRIM-TE.SMP

    Started: 3/9/2022 7:18:50 AM   Analysis Adsorptive: N2
  Completed: 3/9/2022 3:44:43 PM   Analysis Bath Temp.: -195.850 °C
Report Time: 3/10/2022 2:27:11 PM   Thermal Correction: No
Sample Mass: 0.2026 g   Warm Free Space: 11.3431 cm³ Measured
Cold Free Space: 32.8741 cm³   Equilibration Interval: 5 s
Low Pressure Dose: None   Sample Density: 1.000 g/cm³
Automatic Degas: No

BJH Adsorption Pore Distribution Report
Faas Correction
Harkins and Jura
$t = [13.99 / (0.034 - \log(P/Po))] ^ 0.5$

Diameter Range: 1.7000 nm to 300.0000 nm
Adsorbate Property Factor: 0.95300 nm
Density Conversion Factor: 0.0015468
Fraction of Pores Open at Both Ends: 0.00

Pore Diameter Range (nm)	Average Diameter (nm)	Incremental Pore Volume (cm³/g)	Cumulative Pore Volume (cm³/g)	Incremental Pore Area (m²/g)	Cumulative Pore Area (m²/g)
173.9 - 20.2	21.9	0.130785	0.130785	23.847	23.847
20.2 - 10.4	12.3	0.141619	0.272404	46.174	70.022
10.4 - 7.1	8.1	0.062156	0.334560	30.855	100.877
7.1 - 5.1	5.7	0.043896	0.378456	30.633	131.510
5.1 - 4.0	4.4	0.028318	0.406774	25.900	157.410
4.0 - 3.2	3.5	0.021386	0.428160	24.295	181.705
3.2 - 2.5	2.8	0.026053	0.454213	37.411	219.116
2.5 - 2.0	2.2	0.024663	0.478876	45.162	264.277
2.0 - 1.6	1.7	0.027757	0.506634	65.018	329.295

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Lampiran 9. Contoh Perhitungan Nilai K_1 dan K_2 berdasarkan Persamaan Orde Satu Semu dan Orde Dua Semu

1. **Penentuan K_1 dari persamaan orde satu semu**

   Persamaan orde satu semu:

   $$\log (q_e - q_t) = \log q_e - K_1 \, t/2{,}303$$

   - $\log q_e$ = Intercept
     q_e = Inv. log Intercept

     $\log q_e$ = -0,759
     q_e = 0,1741

   - $K_1/2{,}303$ = Slope
     K_1 = Slope x 2,303
     K_1 = -0,0008 x 2,303
     K_1 = -0,0018

2. **Penentuan K_2 dari persamaan orde dua semu**

   Persamaan orde dua semu:

   $$t/q_t = 1/K_2 \, q_e^2 + t/q_e$$

   - $1/q_e$ = Slope
     q_e = 1/Slope
     q_e = 1/2,3873
     q_e = 0,4189

   - $1/K_2 q_e^2$ = Intercept
     K_2 = 1/Intercept x q_e^2
     K_2 = 1/3,8233 x $(0{,}4189)^2$
     K_2 = 0,0459

Lampiran 10. Contoh Perhitungan Nilai Kapasitas Adsorpsi berdasarkan Model Persamaan Isotermal Adsorpsi Langmuir dan Isotermal Adsorpsi Freundlich

1.   **Isotermal Adsorpsi Langmuir**

Persamaan:

$$\frac{1}{q_e} = \frac{1}{q_m K_L} \text{ x } \frac{1}{C_e} + \frac{1}{q_m}$$

Keterangan:
C_e = Konsentrasi saat kesetimbangan (mg/L)
q_e = Jumlah zat teradsorpsi saat kesetimbangan (mg/g)
q_m = Kapasitas adsorpsi maksimum monolayer (mg/g)
K_L = Konstanta afinitas adsorpsi atau konstanta kesetimbangan (L/mg)

Berdasarkan model isotermal Langmuir diperoleh persamaan garis:

$$y = 0{,}5569x + 0{,}5291$$

$\dfrac{1}{q_m}$ $= 0{,}5291$ maka, q_m $= \dfrac{1}{0{,}5291} = 1{,}8900$

$\dfrac{1}{q_m K_L}$ $= 0{,}5569$ maka, K_L $= \dfrac{1}{0{,}5569 \text{ x } 1{,}8900} = 0{,}9500$

2.   **Isotermal Adsorpsi Freundlich**

Persamaan:

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

Keterangan:
C_e = Konsentrasi saat kesetimbangan (mg/L)
q_e = Jumlah zat teradsorpsi saat kesetimbangan (mg/g)
K_F = Kapasitas adsorpsi (mg/g)
$\dfrac{1}{n}$ = Konstanta Freundlich menyatakan faktor heterogenitas
n = Intensitas adsorpsi

Berdasarkan model isotermal Freundlich diperoleh persamaan garis:

$$y = 0{,}2196x + 0{,}025$$

$$\frac{1}{n} = 0,2196 \qquad \text{maka,} \qquad n = \frac{1}{0,2196} = 4,5537$$

$\log K_F = 0,025$
$K_F = \text{Inv. log } (0,025)$
$K_F = 1,0592$