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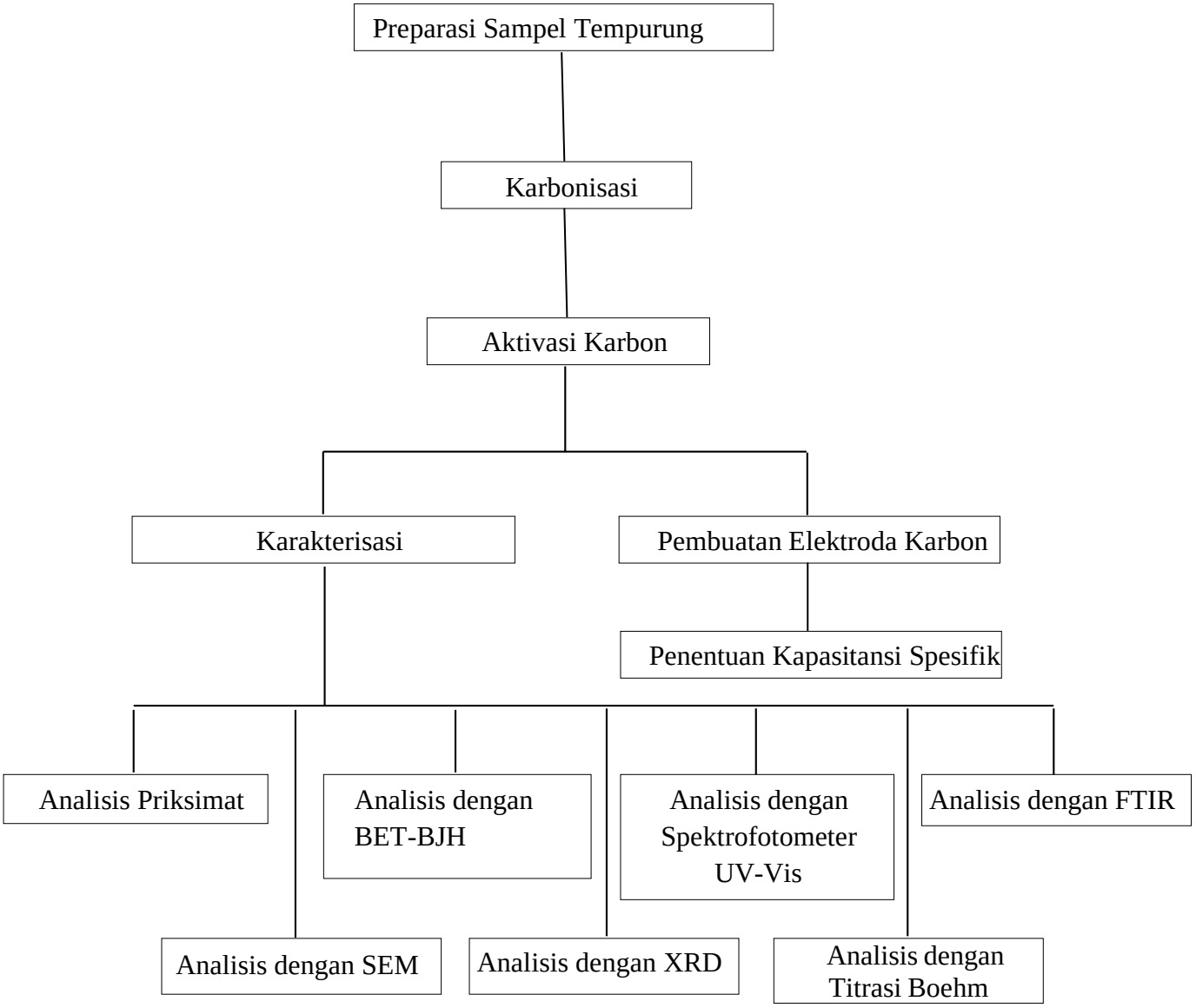
LAMPIRAN

Lampiran 1. Diagram Alir Penelitian



Lampiran 2. Bagan Kerja

1.1 Prosedur Umum

Tempurung Kemiri

- dibersihkan kotoran yang menempel pada tempurung dan dilanjutkan dengan pengeringan di bawah sinar matahari
- dikarbonisasi pada suhu 600 ^{o}C, 650 ^{o}C 700 ^{o}C, 750 ^{o}C 800^{o}C dan 900 ^{o}C selama 180 menit
- diayak dengan ukuran partikel 150 mesh.

Karbon Tempurung Kemiri

- diaktivasi dengan larutan H_3PO_4 10 % dengan perbandingan 5:1 (volume H_3PO_4 : massa karbon)
- dicuci dengan aquades hingga pH netral
- dipirolisis dalam tanur pada suhu 800 ^{o}C, 850 ^{o}C dan 900 ^{o}C selama 30 menit
- dibilas dengan aquades
- dikeringkan dalam oven pada suhu 170 ^{o}C selama 30 menit

Karbon Aktif Tempurung Kemiri

1.2 Analisis Kadar Air

Tempurung Kemiri

- ditimbang sebanyak 0.5 gram kedalam cawan porselin yang telah diketahui beratnya
- dikeringkan dalam oven pada suhu 105 ^{o}C selama 3 jam
- didinginkan dalam desikator, dan timbang bobotnya
- dimasukkan kembali ke dalam oven selama 15 menit dan dinginkan kembali dalam desikator hingga bobot konstan

Hasil

Catatan: diulangi prosedur yang sama dengan sampel lain seperti KTK dan KATK.

1.3 Analisis Kadar Abu

Tempurung Kemiri

- ditimbang sebanyak 0.5 gram kedalam cawan porselin yang telah diketahui beratnya
- dikeringkan dalam oven pada suhu 600 ^{o}C selama 6 jam
- didinginkan dalam desikator, dan timbang bobotnya
- dimasukkan kembali ke dalam oven selama 30 menit dan dinginkan kembali dalam desikator hingga bobot konstan

Hasil

Catatan: diulangi prosedur yang sama dengan sampel lain seperti KTK dan KATK.

1.4 Analisis Kadar Senyawa Volatil

Tempurung Kemiri

- ditimbang sebanyak 0.5 gram kedalam cawan porselin yang telah diketahui beratnya
- dikeringkan dalam oven pada suhu 800 ^{o}C selama 7 menit
- didinginkan dalam desikator, dan timbang bobotnya
- dimasukkan kembali ke dalam oven selama 5 menit dan dinginkan kembali dalam desikator hingga bobot konstan

Hasil

Catatan: diulangi prosedur yang sama dengan sampel lain seperti KTK dan KATK.

1.5 Analisis Luas Permukaan

Tempurung Kemiri

- dianalisis dengan instrument *Surface Area Analyzer* dengan metode Brunauer-Emmett-Teller isotherm (BET) dan Barret-Joyner-Halenda (BJH)

Hasil

Catatan: diulangi prosedur yang sama dengan sampel KTK dan KATK

1.6 Analisis Gugus Fungsi dengan FTIR

Tempurung Kemiri

- ditimbang sebanyak 1-10 mg sampel dan dihaluskan
- dicampur dengan 100 mg KBr dan dicetak menjadi cakram tipis atau pelet lalu dianalisis.

Hasil

Catatan: diulangi prosedur yang sama dengan sampel KTK dan KATK.

1.7 Analisis Gugus Fungsi dengan Titrasi Boehm

Karbon Tempurung Kemiri

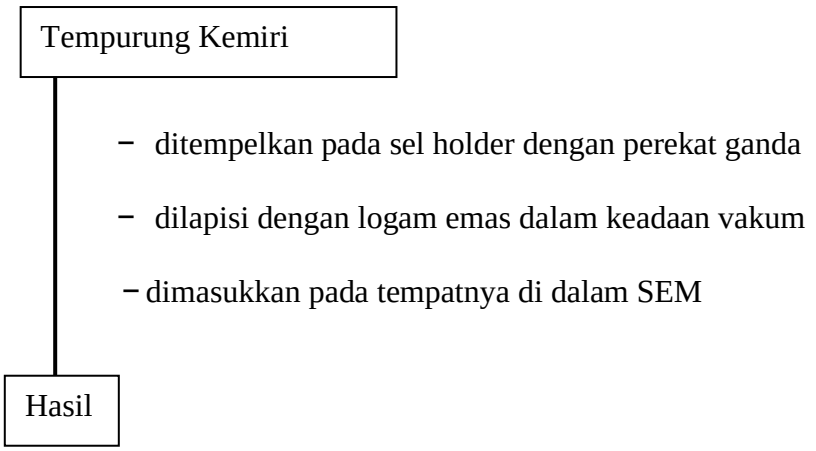
- ditimbang sebanyak 0,1 gram dimasukkan ke dalam 4 buah gelas kimia yang berisi larutan Na_2CO_3 0,05 N, $NaHCO_3$ 0,05 N, NaOH 0,05 N dan HCl 0,05 N masing-masing sebanyak 25 mL
- didiamkan selama 24 jam dan disaring

Filtrat | Endapan

- dipipet sebanyak 5 mL dari larutan Na_2CO_3, $NaHCO_3$ dan NaOH, kemudian ditambahkan HCl 0.05 N berlebih, lalu ditirasi balik dengan menggunakan larutan NaOH 0,05 N.
- dipipet sebanyak 5 mL dari larutan HCl dan ditambahkan NaOH 0.05 N berlebih, kemudian dititrasi balik dengan menggunakan HCl 0,05 N.

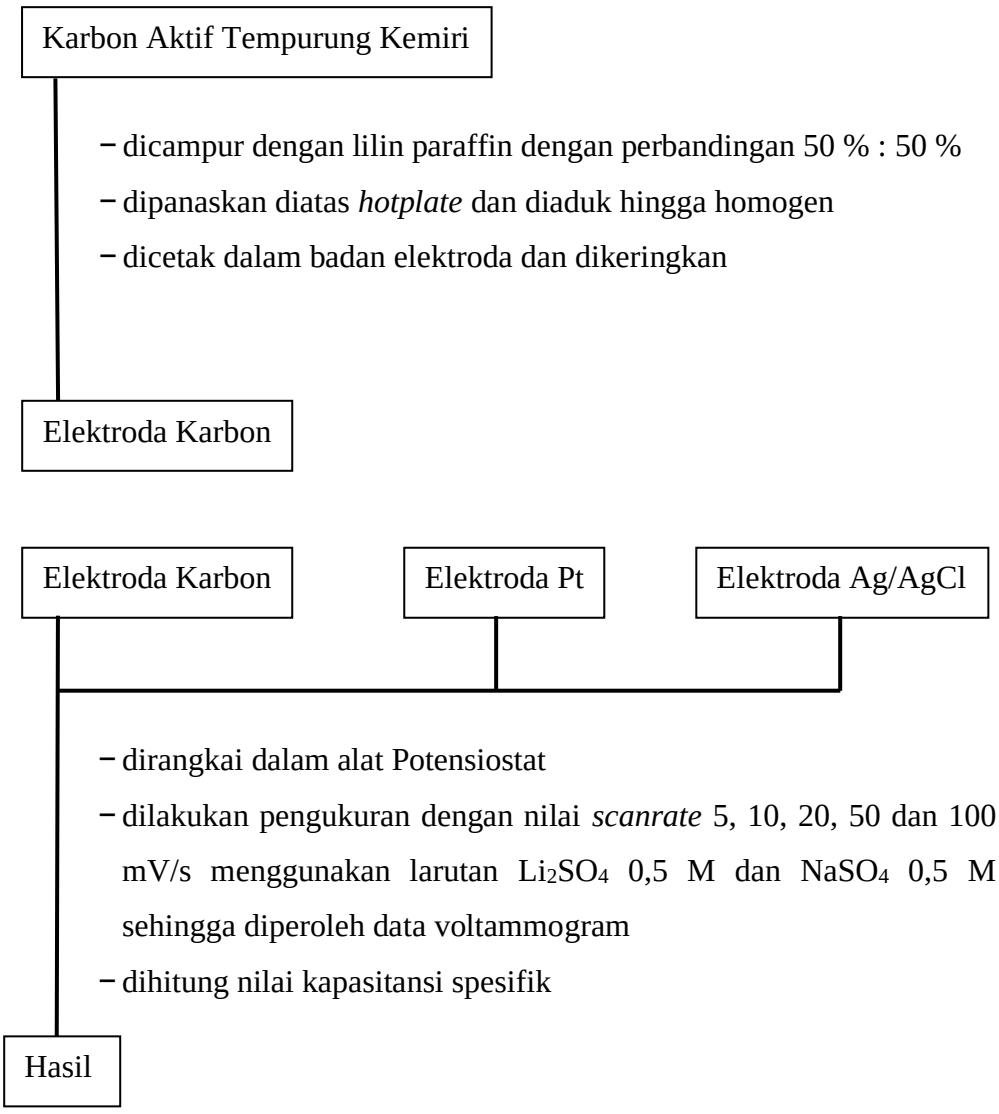
Hasil

1.8 Analisis Morologi dengan SEM



Catatan: diulangi prosedur yang sama dengan sampel KTK dan KATK.

1.9 Analisis Kapasitansi Spesifik



Lampiran 3. Perhitungan Pembuatan Larutan Pereaksi

2.1 Pembuatan Larutan H_3PO_4 10% dari H_3PO_4 85%

$V_1 \times M_1 = V_2 \times M_2$

$V_1 \times 85\% = 500\ mL \times 10\%$

$V_1 = 58{,}82\ mL$

2.2 Pembuatan Larutan Na_2CO_3 0,05 N

gram = L × N × BE

gram = 0,25 L × 0,05 N × 53 g/eq = 0,6625 gram

2.3 Pembuatan Larutan $NaHCO_3$ 0,05 N

gram = L × N × BE

gram = 0,25 L × 0,05 N × 8 g/eq = 1,0500 gram

2.4 Pembuatan Larutan NaOH 0,05 N

gram = L × N × BE

gram = 0,25 L × 0,05 N × 40 g/eq = 0,5000 gram

2.5 Pembuatan Larutan HCl 0,05 N

$$N = \frac{\% \times bj \times 10}{BE}$$

$$N = \frac{37 \times 1{,}19\ g/mL \times 10}{36{,}5\ g/eq}$$

$N = 12{,}06\ N$

$V_1 \times N_1 = V_2 \times N_2$

V_1 × 12,06 N = 250 mL × 0,05 N

V_1 = 1,03 mL

2.6 Pembuatan Larutan $Na_2B_4O_7$ 0,05 N

gram = L × N × BE

gram = 0,1 L × 0,05 N × 99 g/eq = 0,4950 gram

2.7 Pembuatan Larutan $H_2C_2O_4$ 0,05 N

gram = L × N × BE

gram = 0,1 L × 0,05 N × 63 g/eq = 0,3150 gram

2.8 Pembuatan Larutan Li_2SO_4 1 M

gram = L × M × BM

gram = 0.05 L × 1 M × 109.94 g/mol

gram = 5.4970 gram

2.9 Pembuatan Larutan Na_2SO_4 1 M

gram = L × M × BM

gram = 0.05 L × 1 M × 142.04 g/mol

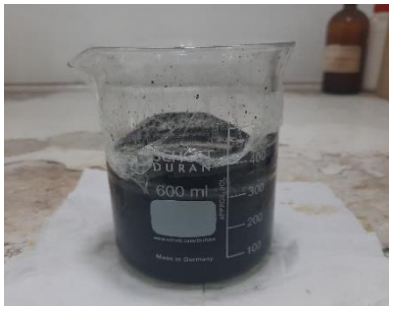
gram = 7.1020 gram

Lampiran 4. Dokumentasi Penelitian

Tempurung Kemiri

Karbon Tempurung Kemiri

Karbon Tempurung Kemiri ukuran 200 mesh



Aktivasi Karbon Tempurung Kemiri dengan H_3PO_4

Penyaringan Karbon Tempurung Kemiri teraktivasi H_3PO_4

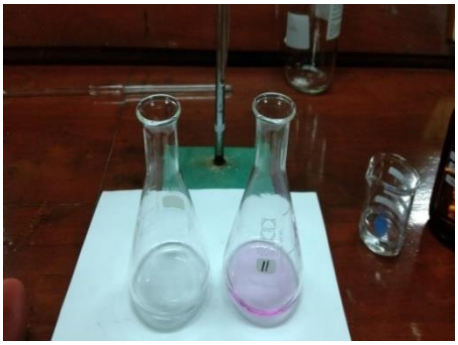
Karbon Aktif Setelah Pengeringan pada suhu 105^oC selama 2 jam

Analisis Kadar Air

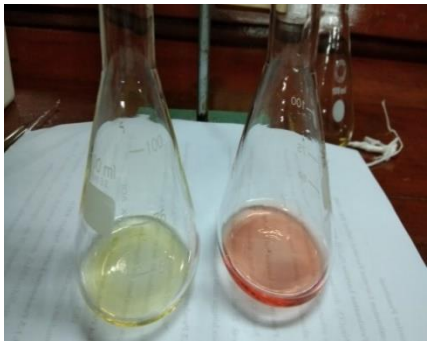
Karbon Aktif Tempurung Kemiri

Analisis Kadar Abu

Analisis Kadar Senyawa Volatil



Standarisasi NaOH dengan $H_2C_2O_4$



Standarisasi HCl dengan $Na_2B_4O_7$

Perendaman sampel pada Titrasi Boehm

Hasil Titrasi Boehm

Elektroda karbon

Penentuan kapasitansi spesifik

Lampiran 5. Hasil Karakterisasi XRD

1. Karbon Tempurung Kemiri dengan Suhu Karbonisasi 600ºC

*** Basic Data Process ***

Group : Standard
Data : Carbon#600C#6jam

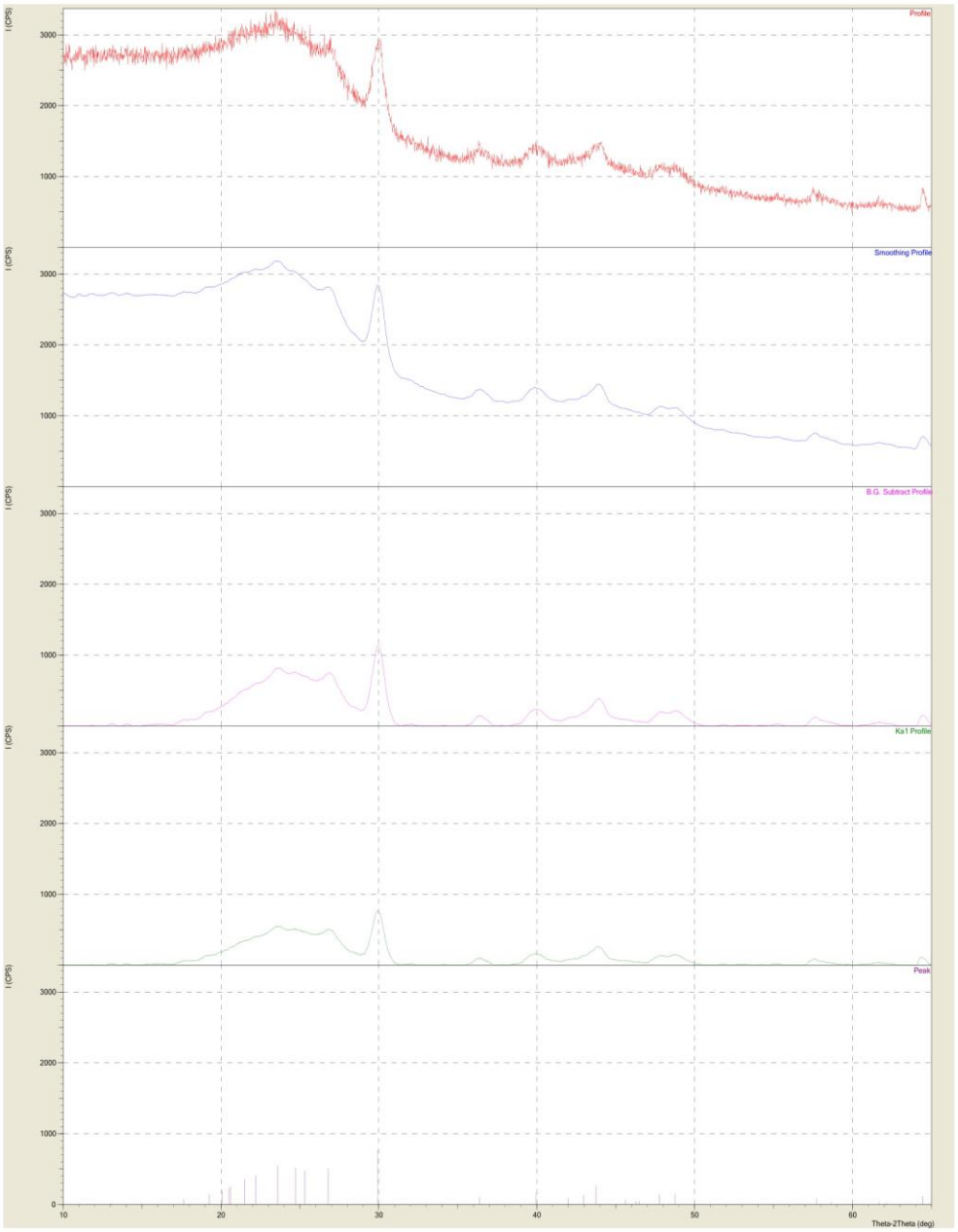
Strongest 3 peaks

no. peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1 13	29.9271	2.98329	100	0.95020	460	24322
2 9	23.6000	3.76682	72	0.00000	331	0
3 10	24.7200	3.59863	67	0.00000	310	0

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	13.0900	6.75799	3	0.40000	14	374
2	17.6200	5.02944	9	0.66000	40	1968
3	19.2600	4.60472	18	1.38000	83	7056
4	20.0800	4.41849	25	0.00000	115	0
5	20.5000	4.32890	30	0.00000	136	0
6	20.6000	4.30811	32	0.00000	148	0
7	21.4800	4.13356	46	0.00000	210	0
8	22.2000	4.00110	53	0.00000	246	0
9	23.6000	3.76682	72	0.00000	331	0
10	24.7200	3.59863	67	0.00000	310	0
11	25.3000	3.51744	62	0.00000	286	0
12	26.8000	3.32387	67	2.05000	306	38881
13	29.9271	2.98329	100	0.95020	460	24322
14	36.3817	2.46746	13	0.83000	61	2751
15	39.9433	2.25527	21	1.35330	98	7312
16	42.0000	2.14947	11	0.84000	51	4245
17	42.9800	2.10270	17	0.00000	76	0
18	43.7620	2.06692	35	1.36400	159	11407
19	45.6200	1.98697	8	0.00000	39	0
20	46.2800	1.96015	6	0.00000	27	0
21	46.4800	1.95219	6	0.00000	29	0
22	47.7800	1.90206	18	1.00000	82	4142
23	48.7600	1.86610	19	1.38660	89	5867
24	57.7241	1.59581	12	1.01830	54	2273
25	58.6400	1.57305	3	0.80000	15	853
26	61.6700	1.50283	5	0.86000	23	934
27	62.1600	1.49215	3	0.80000	14	463
28	64.4433	1.44468	14	0.52670	66	1691

< Group: Standard Data: Carbon#600C#6jam >



2. Karbon Tempurung Kemiri dengan Suhu Karbonisasi 650^{o}C

*** Basic Data Process ***

Group : Standard
Data : AC#650#2020

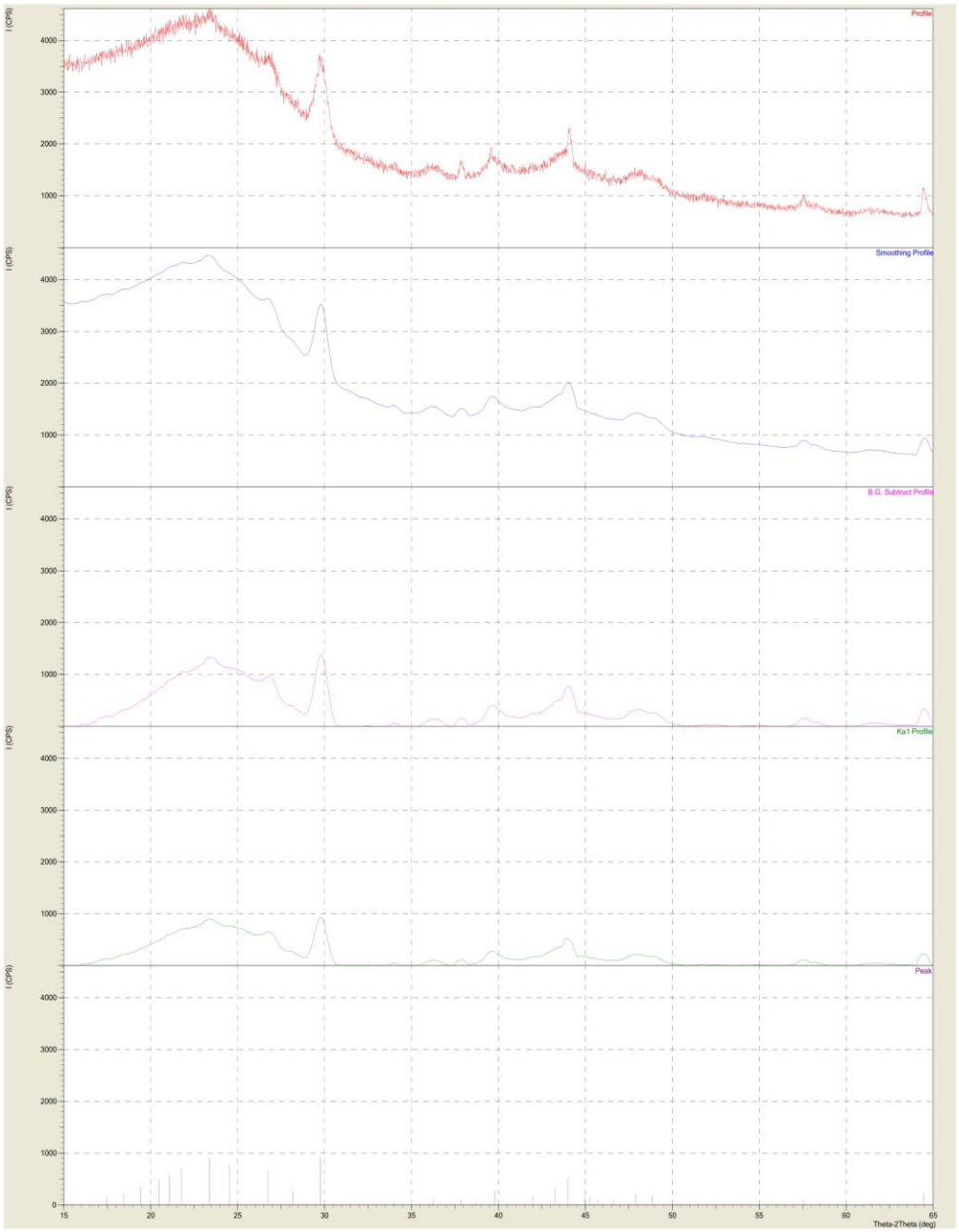
Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	11	29.7597	2.99969	100	0.86950	556	29945
2	7	23.3800	3.80177	97	0.00000	541	0
3	8	24.5400	3.62462	82	0.00000	458	0

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	17.4600	5.07516	14	1.20000	80	7485
2	18.4400	4.80759	24	0.00000	134	0
3	19.4200	4.56714	36	0.00000	198	0
4	20.4800	4.33308	53	0.00000	297	0
5	21.0800	4.21109	64	0.00000	358	0
6	21.7800	4.07730	76	0.00000	420	0
7	23.3800	3.80177	97	0.00000	541	0
8	24.5400	3.62462	82	0.00000	458	0
9	26.7400	3.33119	71	1.64580	396	62059
10	28.1800	3.16415	28	0.00000	155	0
11	29.7597	2.99969	100	0.86950	556	29945
12	33.9900	2.63541	5	0.42000	27	553
13	36.2508	2.47607	11	0.98830	61	2942
14	37.8610	2.37438	12	0.57800	64	1771
15	38.7400	2.32251	4	0.65340	24	1155
16	39.8100	2.26252	30	1.26000	165	14283
17	41.9800	2.15044	19	0.00000	103	0
18	43.2600	2.08973	35	0.00000	194	0
19	44.0000	2.05629	56	0.85140	313	17459
20	44.9600	2.01459	19	0.00000	105	0
21	45.2800	2.00109	15	0.00000	86	0
22	45.7400	1.98203	13	0.00000	71	0
23	46.6200	1.94665	11	0.00000	62	0
24	47.9000	1.89757	24	1.52000	133	8706
25	48.8400	1.86323	19	1.32000	108	6715
26	57.5783	1.59950	12	0.73670	65	2717
27	58.4800	1.57697	5	0.26000	26	638
28	61.4000	1.50879	5	0.96000	27	924
29	61.9200	1.49736	5	1.05000	28	1316
30	64.4585	1.44438	25	0.60700	138	4255

< Group: Standard Data: AC#650#2020 >



3. Karbon Tempurung Kemiri dengan Suhu Karbonisasi 700^{o}C

*** Basic Data Process ***

Group : Standard
Data : Carbon#700#3

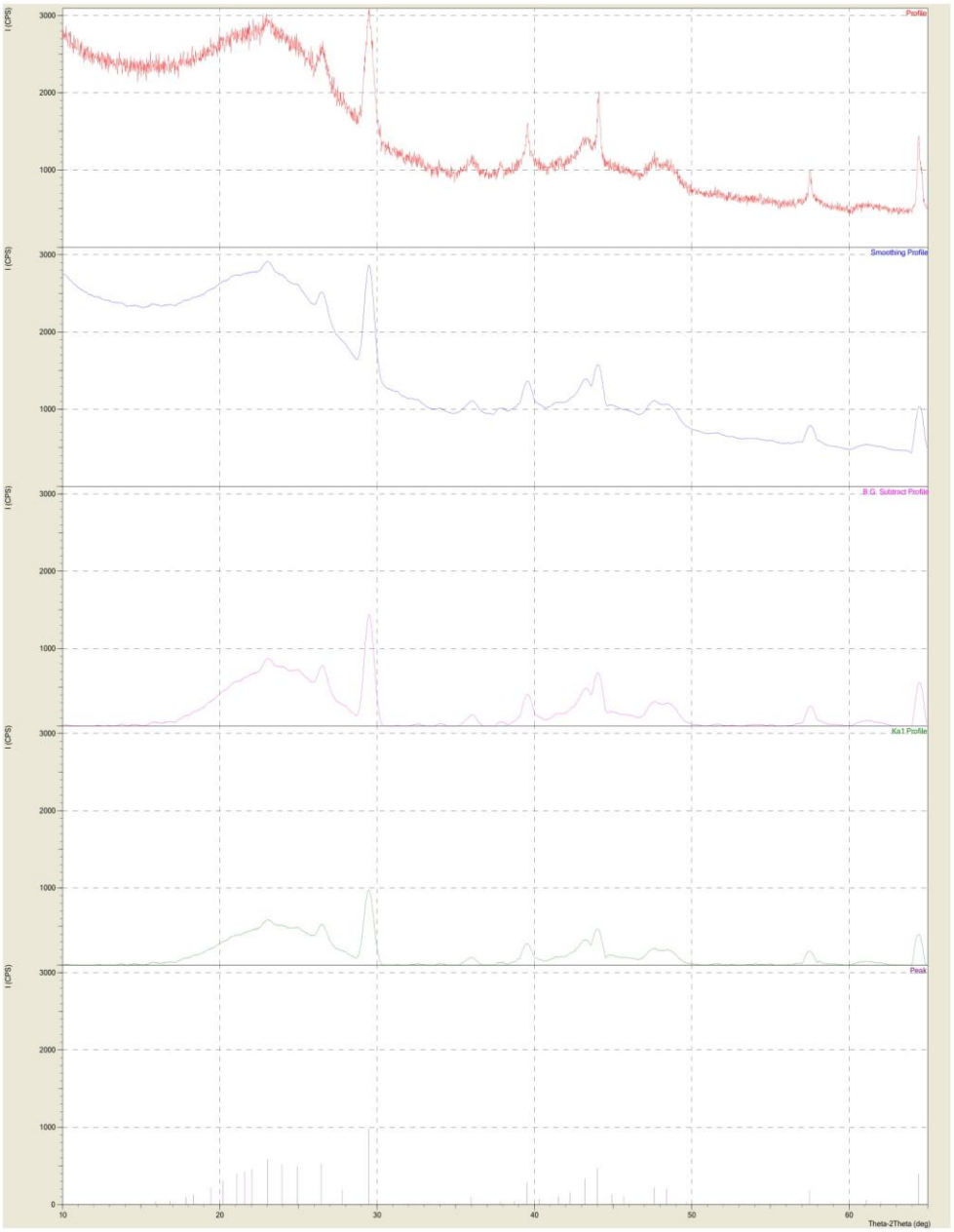
Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	15	29.4716	3.02836	100	0.73370	584	21527
2	10	23.0400	3.85709	60	0.00000	353	0
3	13	26.4600	3.36580	54	1.38660	318	27786

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	15.9050	5.56768	4	0.65000	23	937
2	16.8600	5.25440	5	1.02000	27	1121
3	17.8600	4.96239	9	1.08000	55	2647
4	18.3400	4.83358	13	0.00000	75	0
5	19.4400	4.56248	22	0.00000	130	0
6	20.2000	4.39251	32	0.00000	185	0
7	21.0800	4.21109	41	0.00000	237	0
8	21.5800	4.11463	43	0.00000	252	0
9	22.0600	4.02618	47	0.00000	275	0
10	23.0400	3.85709	60	0.00000	353	0
11	23.9600	3.71103	54	0.00000	313	0
12	24.9200	3.57020	51	0.00000	295	0
13	26.4600	3.36580	54	1.38660	318	27786
14	27.7800	3.20880	20	1.61340	114	9642
15	29.4716	3.02836	100	0.73370	584	21527
16	35.9733	2.49453	10	0.78670	60	2451
17	37.8466	2.37525	4	0.54670	22	595
18	38.7400	2.32251	5	0.52000	29	949
19	39.5310	2.27784	29	0.75400	168	6620
20	40.3200	2.23507	8	0.00000	44	0
21	41.5200	2.17320	11	1.38660	65	5351
22	42.2600	2.13684	16	0.00000	92	0
23	43.2000	2.09250	34	1.46660	199	10888
24	43.9800	2.05718	48	0.80580	280	10375
25	44.9200	2.01629	13	0.00000	77	0
26	45.6800	1.98450	10	0.00000	61	0
27	47.6000	1.90883	22	1.25000	131	8878
28	48.4000	1.87913	21	1.45340	121	6604
29	49.6600	1.83436	3	0.48000	20	812
30	57.4991	1.60152	19	0.65170	109	4453
31	61.0900	1.51570	5	1.22000	32	1973
32	62.0200	1.49518	3	0.36000	19	460
33	64.4268	1.44501	41	0.55890	238	6428

< Group: Standard Data: Carbon#700#3 >



4. Karbon Tempurung Kemiri de ngan Suhu Karbonisasi 800^{o}C

*** Basic Data Process ***

Group : Standard
Data : Carbon#800#3

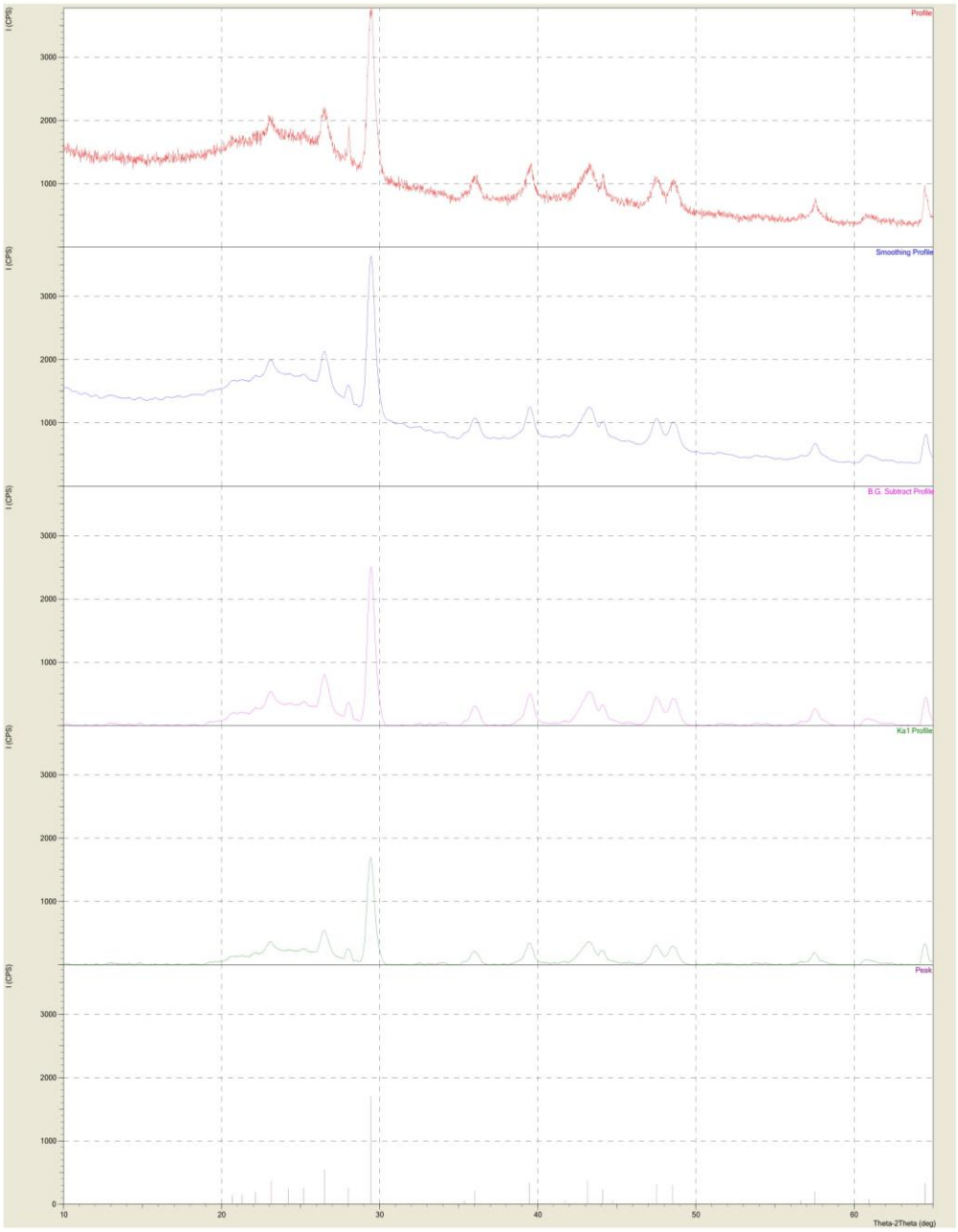
Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	9	29.4431	3.03122	100	0.55380	1020	31363
2	7	26.5133	3.35916	32	0.77780	326	18730
3	4	23.1400	3.84065	21	1.25600	219	15709

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	20.6800	4.29163	8	0.75420	85	5614
2	21.3000	4.16809	9	0.00000	88	0
3	22.1400	4.01181	11	0.00000	116	0
4	23.1400	3.84065	21	1.25600	219	15709
5	24.2200	3.67178	14	0.00000	145	0
6	25.2000	3.53117	15	0.00000	154	0
7	26.5133	3.35916	32	0.77780	326	18730
8	28.0189	3.18198	15	0.47490	152	4695
9	29.4431	3.03122	100	0.55380	1020	31363
10	35.3600	2.53638	3	0.32000	33	634
11	36.0160	2.49167	13	0.63200	128	4084
12	39.4642	2.28154	20	0.62570	203	7879
13	41.7400	2.16225	3	0.76800	33	2106
14	43.1500	2.09481	21	1.11000	218	11071
15	44.1000	2.05186	13	0.49720	137	3220
16	44.7400	2.02398	4	0.59000	39	1903
17	47.5089	1.91228	18	0.78220	186	7659
18	48.5275	1.87449	17	0.76500	175	6856
19	56.6600	1.62322	3	0.42000	32	940
20	57.5164	1.60108	11	0.53290	113	3889
21	60.9500	1.51884	5	0.90000	47	2727
22	64.4885	1.44378	19	0.39800	196	4193

< Group: Standard Data: Carbon#800#3 >



5. Karbon Tempurung Kemiri dengan Suhu Karbonisasi $^{900°C}$

*** Basic Data Process ***

Group : Standard
Data : Carbon#900#3jam

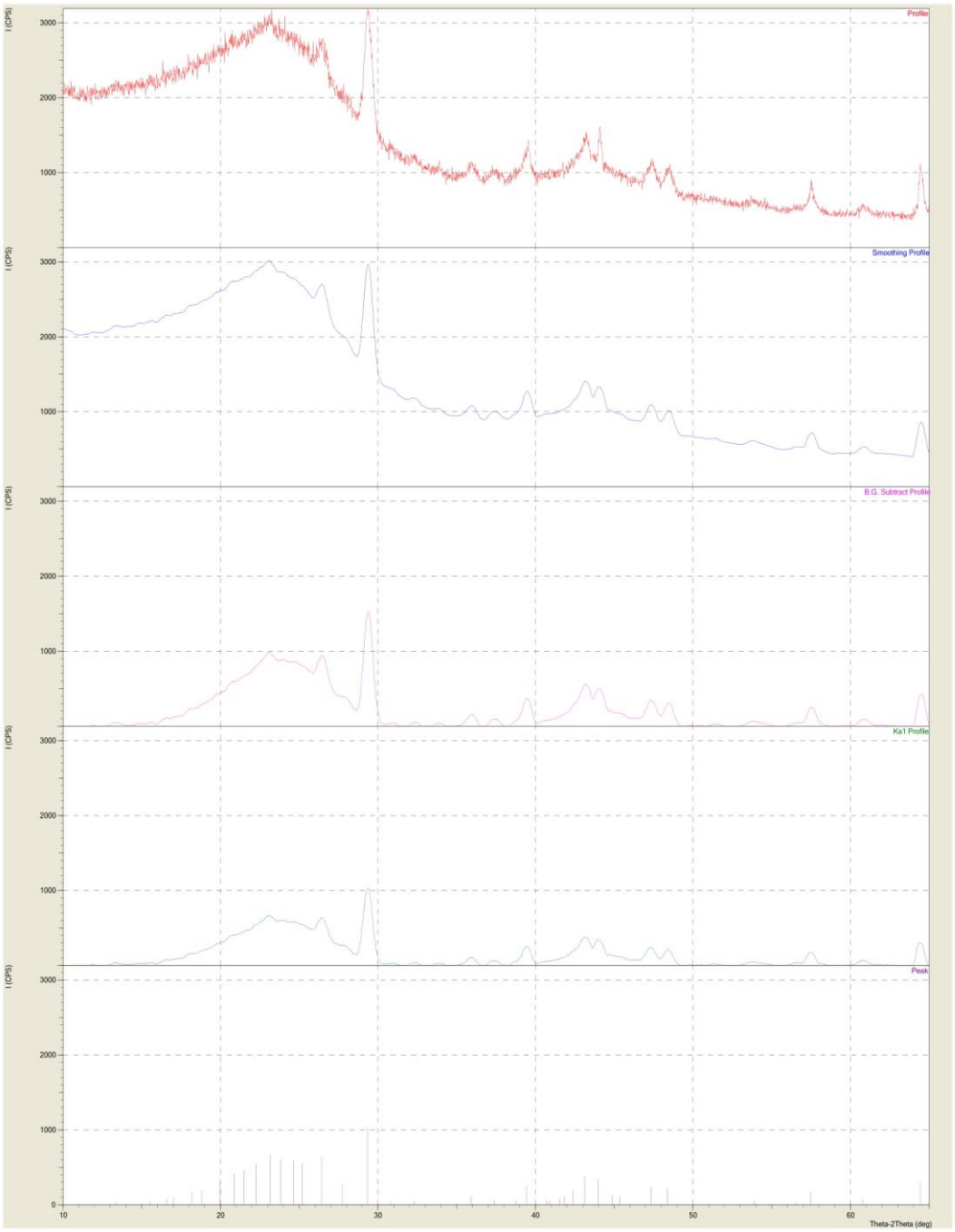
Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	17	29.3508	3.04055	100	0.71010	620	22190
2	11	23.1600	3.83738	65	0.00000	400	0
3	15	26.4200	3.37081	62	1.38500	383	28644

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	13.3800	6.61217	4	0.60000	22	827
2	15.5260	5.70273	4	0.61200	23	1066
3	16.6000	5.33611	8	0.86000	47	1900
4	17.0200	5.20536	9	0.00000	54	0
5	18.2000	4.87044	16	2.08000	97	7199
6	18.8200	4.71137	19	0.00000	117	0
7	19.9600	4.44478	29	0.00000	181	0
8	20.8600	4.25500	40	0.00000	245	0
9	21.5000	4.12976	44	0.00000	273	0
10	22.2800	3.98692	52	0.00000	325	0
11	23.1600	3.83738	65	0.00000	400	0
12	23.8400	3.72944	58	0.00000	361	0
13	24.6400	3.61014	57	0.00000	351	0
14	25.2000	3.53117	53	0.00000	329	0
15	26.4200	3.37081	62	1.38500	383	28644
16	27.7400	3.21334	27	1.69340	165	13365
17	29.3508	3.04055	100	0.71010	620	22190
18	30.8166	2.89918	3	0.64670	20	802
19	32.3000	2.76934	4	0.52000	24	571
20	35.9133	2.49856	10	0.66670	64	2210
21	37.3875	2.40336	6	0.65500	38	1280
22	38.7600	2.32136	5	0.54000	31	1022
23	39.4376	2.28302	24	0.65810	151	4706
24	40.7200	2.21403	5	1.16000	33	1260
25	40.9000	2.20470	5	0.00000	34	0
26	41.5400	2.17220	8	0.00000	52	0
27	41.8400	2.15732	10	0.00000	65	0
28	42.3800	2.13107	18	0.00000	110	0
29	43.1200	2.09619	36	1.44000	226	11042
30	43.9800	2.05718	33	0.94400	204	8945
31	44.8800	2.01799	12	0.00000	74	0
32	45.3400	1.99858	12	0.00000	72	0
33	47.3265	1.91922	23	0.83700	143	9220
34	48.3967	1.87925	21	0.74000	128	4699
35	53.8900	1.69993	5	1.02000	30	1762
36	56.5200	1.62691	3	0.48000	21	635
37	57.4819	1.60195	17	0.64960	106	3710
38	60.7950	1.52234	6	0.71000	40	1698
39	64.4365	1.44482	29	0.57060	180	5037

< Group: Standard Data: Carbon#900#3jam >



6. Karbon Aktif Tempurung Kemiri 850^{o}C

*** Basic Data Process ***

Group : Standard
Data : H3PO#850C

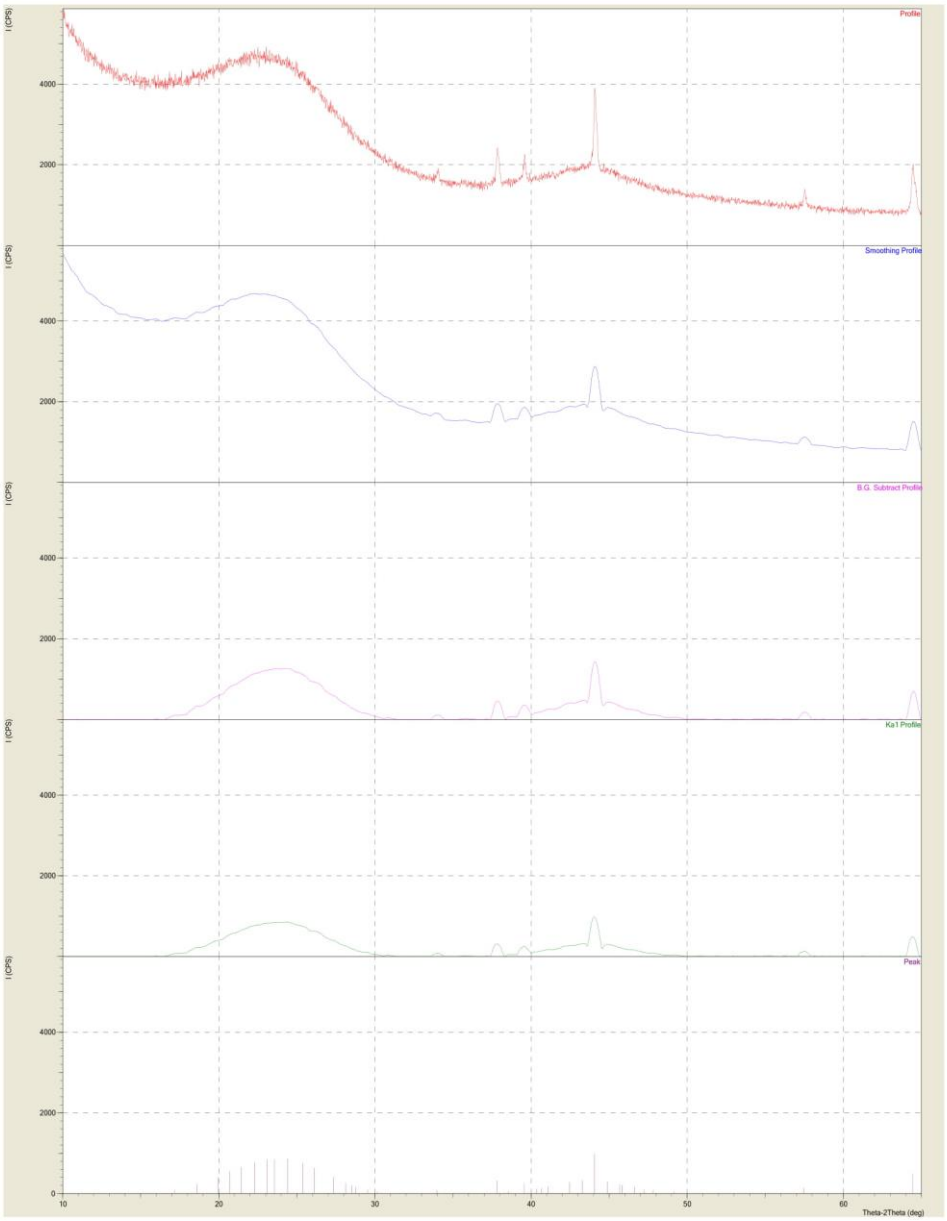
Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	27	44.0620	2.05354	100	0.68010	586	24885
2	9	24.4000	3.64510	88	0.00000	517	0
3	8	23.5800	3.76997	87	0.00000	509	0

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	17.1800	5.15724	8	0.65340	47	1963
2	18.6000	4.76660	23	1.13340	137	15996
3	19.9600	4.44478	41	0.00000	241	0
4	20.7000	4.28753	56	0.00000	326	0
5	21.4600	4.13737	67	0.00000	392	0
6	22.3200	3.97986	80	0.00000	466	0
7	23.0800	3.85050	85	0.00000	498	0
8	23.5800	3.76997	87	0.00000	509	0
9	24.4000	3.64510	88	0.00000	517	0
10	25.3800	3.50653	77	0.00000	451	0
11	26.1200	3.40884	65	0.00000	380	0
12	27.3400	3.25943	41	0.00000	242	0
13	28.1400	3.16856	26	0.00000	155	0
14	28.5000	3.12935	20	0.00000	115	0
15	28.7800	3.09954	16	0.00000	94	0
16	29.5400	3.02150	10	0.89340	59	3550
17	30.1400	2.96270	5	0.54000	27	1197
18	33.9691	2.63699	8	0.59170	46	1353
19	37.8300	2.37626	32	0.58290	188	5317
20	38.5600	2.33294	5	0.25600	32	553
21	39.5577	2.27636	25	0.70050	147	6243
22	40.3600	2.23294	11	0.00000	65	0
23	40.6800	2.21611	14	0.00000	81	0
24	41.1000	2.19443	18	0.00000	107	0
25	42.4600	2.12724	29	0.00000	169	0
26	43.2800	2.08882	33	0.00000	193	0
27	44.0620	2.05354	100	0.68010	586	24885
28	44.8800	2.01799	31	0.00000	181	0
29	45.6800	1.98450	23	0.00000	134	0
30	45.8200	1.97876	21	0.00000	121	0
31	46.6400	1.94586	16	0.00000	94	0
32	47.2400	1.92254	11	0.00000	62	0
33	47.8200	1.90056	9	1.11000	51	2833
34	49.1800	1.85114	4	0.78000	25	1302
35	57.4775	1.60207	14	0.58500	80	2487
36	64.4377	1.44480	50	0.54780	293	7800

< Group: Standard Data: H3PO#850C >



7. Karbon Aktif Tempurung Kemiri 900°C

*** Basic Data Process ***

Group : Standard
Data : H3PO#900C

Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	35	44.0743	2.05300	100	0.18770	1242	13793
2	40	64.4450	1.44465	59	0.20280	729	7770
3	28	37.8282	2.37637	51	0.19160	634	6953

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	17.6407	5.02358	3	0.11850	37	370
2	19.6781	4.50781	3	0.44630	38	1583
3	20.6870	4.29019	4	0.21400	47	712
4	21.1800	4.19143	3	0.24000	42	542
5	21.3960	4.14960	5	0.26580	57	651
6	21.7016	4.09185	5	0.20330	56	532
7	21.9712	4.04225	5	0.27750	66	987
8	22.2600	3.99045	4	0.00000	47	0
9	22.4600	3.95537	4	0.00000	54	0
10	22.6600	3.92091	4	0.00000	55	0
11	22.8600	3.88706	5	0.32000	57	877
12	23.1400	3.84065	5	0.19720	65	499
13	23.3800	3.80177	6	0.29340	78	934
14	23.5200	3.77945	5	0.00000	61	0
15	23.8000	3.73562	6	0.00000	70	0
16	23.9200	3.71715	6	0.00000	75	0
17	24.1200	3.68678	5	0.32660	66	1084
18	24.4280	3.64099	7	0.18220	88	1086
19	24.6800	3.60438	5	0.00000	59	0
20	24.8658	3.57786	7	0.19900	86	967
21	25.1187	3.54241	5	0.26080	68	826
22	25.4200	3.50110	5	0.09860	68	335
23	25.6800	3.46624	4	0.28660	45	822
24	26.0423	3.41883	5	0.26870	67	806
25	26.4200	3.37081	4	0.29600	51	739
26	26.8581	3.31681	3	0.25170	41	855
27	33.9759	2.63647	14	0.16960	173	1855
28	37.8282	2.37637	51	0.19160	634	6953
29	39.5470	2.27695	31	0.14780	387	3274
30	39.7988	2.26313	4	0.07930	50	195
31	42.0926	2.14495	6	0.13690	69	731
32	42.7062	2.11554	4	0.19250	49	755
33	42.9975	2.10188	4	0.15500	46	364
34	43.2000	2.09250	3	0.08880	42	486
35	44.0743	2.05300	100	0.18770	1242	13793
36	44.5515	2.03211	4	0.16090	50	815
37	57.5174	1.60105	18	0.16740	228	2174
38	57.8505	1.59262	3	0.10300	41	240
39	64.1400	1.45078	5	0.11000	58	622
40	64.4450	1.44465	59	0.20280	729	7770
41	64.6800	1.43997	5	0.08000	64	489

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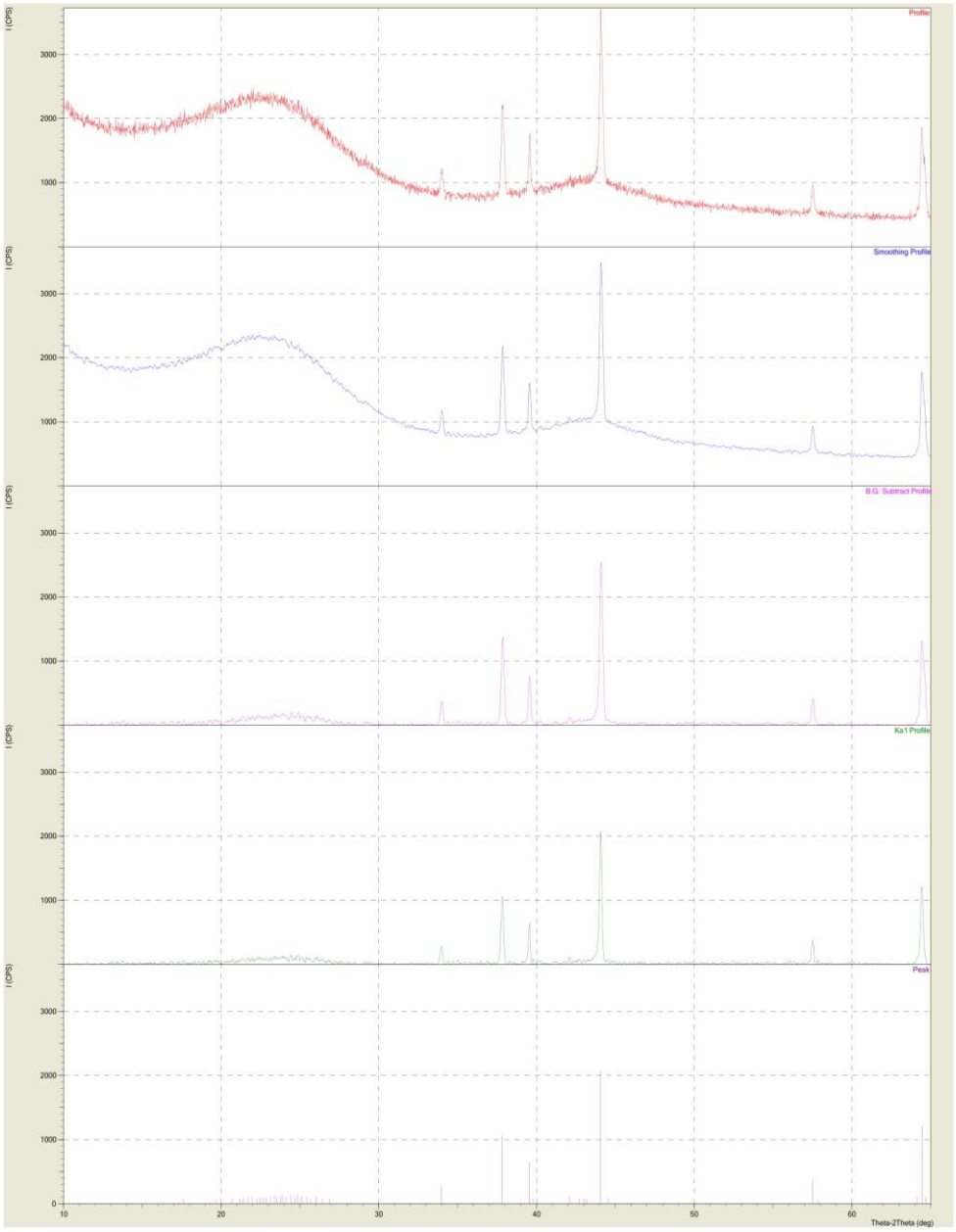
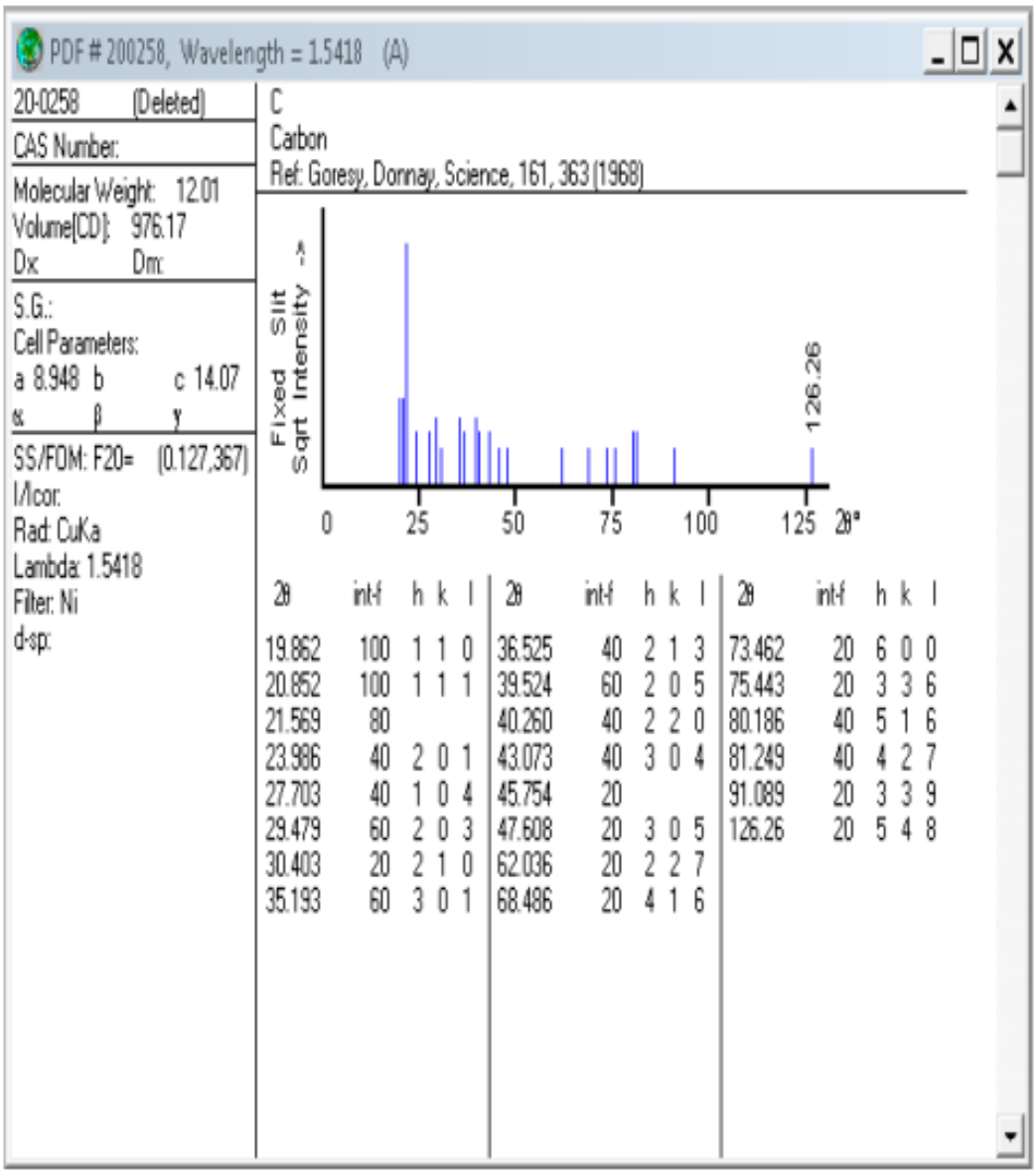
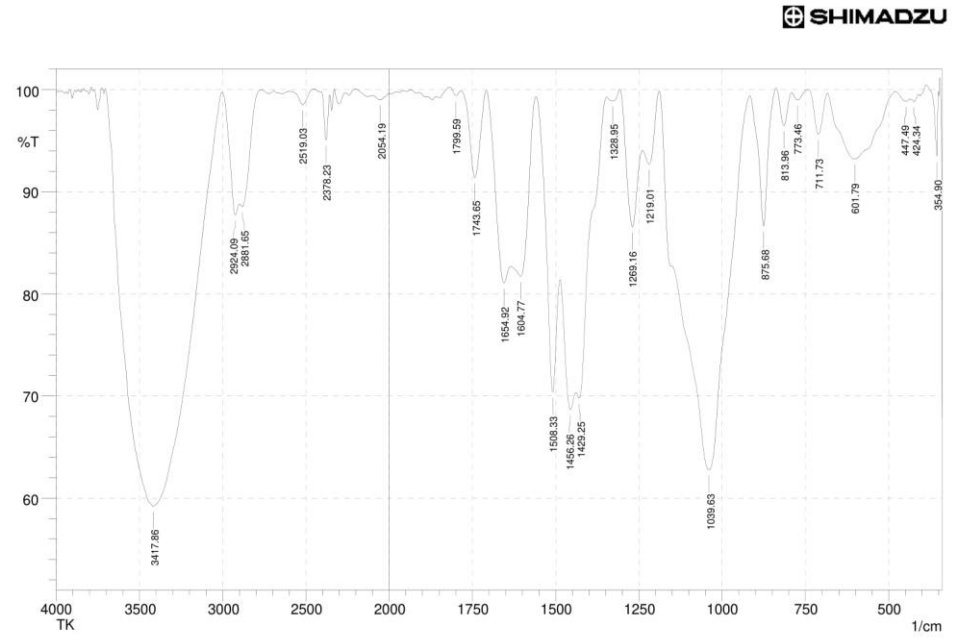


Lampiran 6. *Database* JCPDS Karbon



Lampiran 7. Hasil Karakterisasi FTIR

1. Tempurung Kemiri

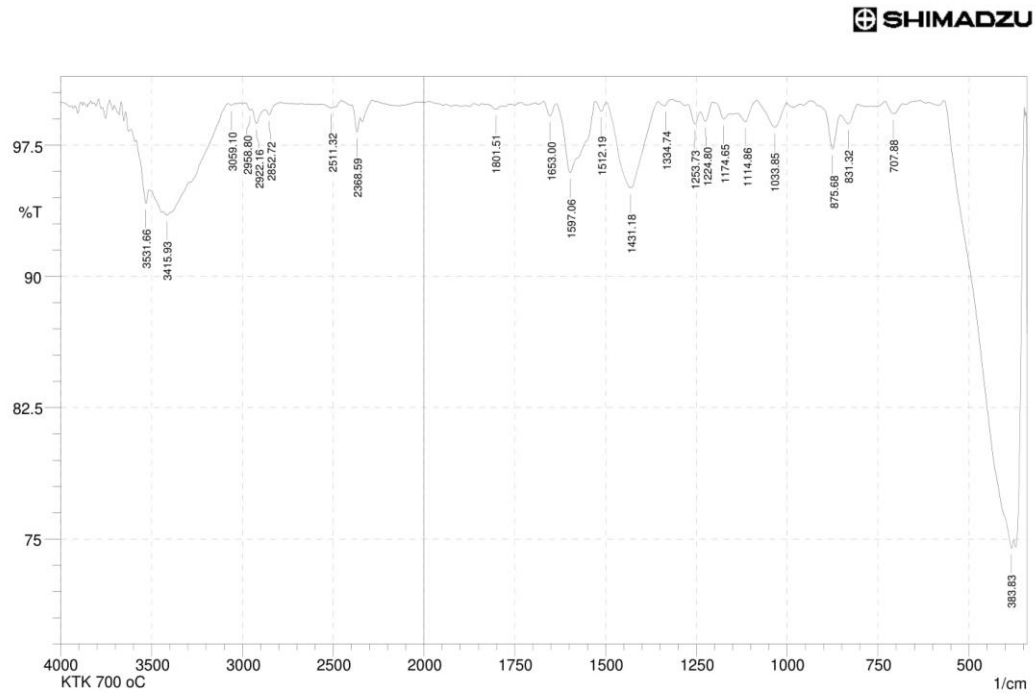


	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	354.9	93.466	6.443	387.69	351.04	0.242	0.267
2	424.34	98.832	0.432	435.91	408.91	0.108	0.025
3	447.49	98.858	0.398	480.28	435.91	0.152	0.042
4	601.79	93.206	6.493	682.8	482.2	3.755	3.507
5	711.73	95.628	4.179	742.59	684.73	0.544	0.499
6	773.46	98.988	0.82	790.81	742.59	0.114	0.083
7	813.96	96.473	3.446	839.03	790.81	0.361	0.346
8	875.68	86.657	13.135	916.19	839.03	1.91	1.838
9	1039.63	62.782	36.81	1188.15	918.12	28.488	28.035
10	1219.01	92.693	3.684	1238.3	1190.08	1.081	0.451
11	1269.16	86.549	10.117	1305.81	1240.23	2.473	1.571
12	1328.95	98.898	0.716	1346.31	1307.74	0.14	0.081
13	1429.25	69.779	3.632	1438.9	1348.24	6.69	0.408
14	1456.26	68.669	5.439	1485.19	1440.83	6.294	0.837
15	1508.33	70.404	16.445	1556.55	1487.12	5.734	2.45
16	1604.77	81.706	7.098	1631.78	1558.48	4.369	1.344
17	1654.92	81.058	6.628	1707	1633.71	4.292	1.196
18	1743.65	91.39	8.51	1782.23	1708.93	1.337	1.305
19	1799.59	99.401	0.655	1816.94	1784.15	0.037	0.047
20	2054.19	99.008	0.494	2102.41	2004.04	0.325	0.112
21	2378.23	95.078	4.536	2405.23	2357.01	0.541	0.464
22	2519.03	98.52	1.461	2600.04	2453.45	0.39	0.372
23	2881.65	88.532	1.601	2897.08	2767.85	3.227	0.376
24	2924.09	87.73	3.705	3003.17	2899.01	3.443	0.728
25	3417.86	59.196	40.763	3705.26	3005.1	92.869	92.641

Comment;
TK

Date/Time; 11/16/2020 9:17:13 AM
No. of Scans;
Resolution;
Apodization;

2. Karbon Tempurung Kemiri dengan Suhu Karbonisasi 700^{o}C



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	383.83	74.476	1.228	567.07	378.05	12.478	0.644
2	707.88	99.286	0.641	731.02	680.87	0.091	0.074
3	831.32	98.713	0.787	852.54	806.25	0.178	0.082
4	875.68	97.276	2.135	916.19	852.54	0.339	0.197
5	1033.85	98.522	1.457	1083.99	1002.98	0.269	0.269
6	1114.86	98.837	0.812	1139.93	1083.99	0.161	0.085
7	1174.65	98.988	0.574	1195.87	1157.29	0.112	0.043
8	1224.8	98.847	0.789	1240.23	1205.51	0.108	0.058
9	1253.73	98.71	0.842	1274.95	1240.23	0.122	0.062
10	1334.74	99.747	0.076	1338.6	1317.38	0.004	-0.002
11	1431.18	95.061	4.902	1496.76	1355.96	1.63	1.609
12	1512.19	99.435	0.534	1527.62	1496.76	0.039	0.035
13	1597.06	95.916	3.976	1633.71	1529.55	1.073	1.034
14	1653	99.164	0.764	1670.35	1635.64	0.066	0.055
15	1801.51	99.535	0.223	1824.66	1788.01	0.053	0.017
16	2368.59	98.249	1.083	2395.59	2351.23	0.208	0.094
17	2511.32	99.633	0.295	2555.68	2457.31	0.107	0.081
18	2852.72	99.227	0.406	2875.86	2789.07	0.143	0.041
19	2922.16	98.736	0.797	2949.16	2875.86	0.257	0.107
20	2958.8	99.508	0.13	2985.81	2949.16	0.05	0.006
21	3059.1	99.772	0.102	3078.39	3039.81	0.029	0.008
22	3415.93	93.509	0.555	3437.15	3080.32	6.046	0.938
23	3531.66	94.177	1.467	3583.74	3514.3	1.348	0.211

Comment;
KTK 700 oC

Date/Time; 11/10/2020 12:05:48 PM
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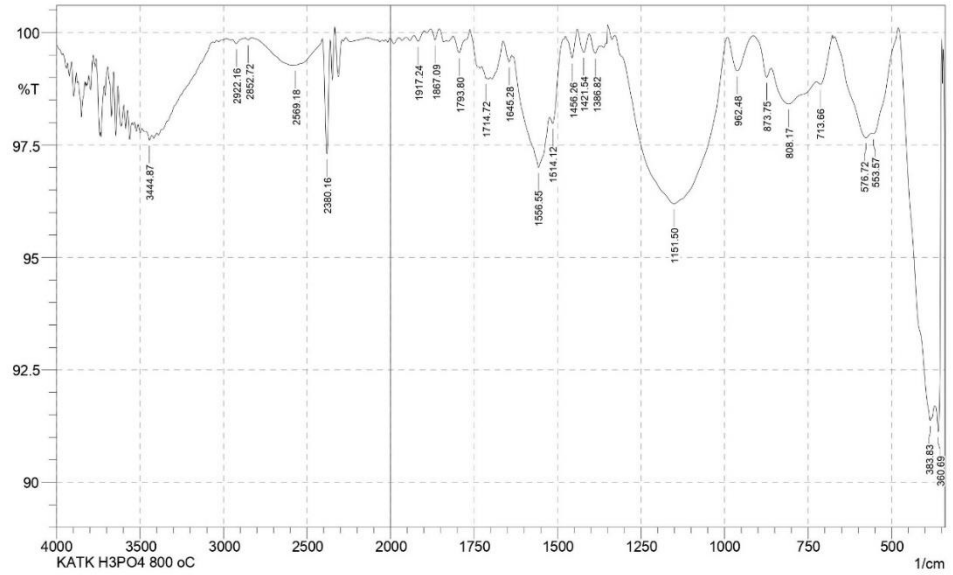
Resolution;
Apodization;

3. Karbon Aktif Tempurung Kemiri 800^{o}C

SHIMADZU



	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	360.69	91.126	4.276	370.33	349.12	0.659	0.253
2	383.83	91.375	1.232	478.35	372.26	2.534	0.523
3	553.57	97.752	0.179	559.36	480.28	0.431	0.059
4	576.72	97.658	0.434	671.23	559.36	0.71	0.135
5	713.66	98.844	0.308	725.23	677.01	0.169	0.047
6	808.17	98.41	0.679	860.25	725.23	0.794	0.237
7	873.75	99.006	0.379	914.26	860.25	0.124	0.022
8	962.48	99.145	0.761	991.41	914.26	0.156	0.126
9	1151.5	96.193	3.717	1327.03	991.41	3.702	3.572
10	1386.82	99.535	0.272	1404.18	1375.25	0.04	0.019
11	1421.54	99.562	0.456	1440.83	1404.18	0.035	0.039
12	1456.26	99.431	0.572	1475.54	1440.83	0.042	0.041
13	1514.12	97.983	0.494	1523.76	1475.54	0.222	0.014
14	1556.55	97.001	1.477	1637.56	1525.69	1.02	0.423
15	1645.28	99.345	0.241	1662.64	1637.56	0.051	0.013
16	1714.72	98.98	0.036	1728.22	1712.79	0.059	0
17	1793.8	99.552	0.329	1813.09	1774.51	0.045	0.025
18	1867.09	99.831	0.246	1880.6	1853.59	0.003	0.012
19	1917.24	99.805	0.164	1928.82	1897.95	0.013	0.01
20	2380.16	97.305	2.533	2409.09	2360.87	0.289	0.256
21	2569.18	99.275	0.028	2576.9	2409.09	0.389	0.072
22	2852.72	99.834	0.049	2870.08	2831.5	0.024	0.004
23	2922.16	99.752	0.101	2947.23	2870.08	0.06	0.012
24	3444.87	97.611	0.143	3464.15	3429.43	0.35	0.009

Comment;
KATK H3PO4 800 oC

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Resolution;
Apodization;

4. Karbon Aktif Tempurung Kemiri 850^{o}C

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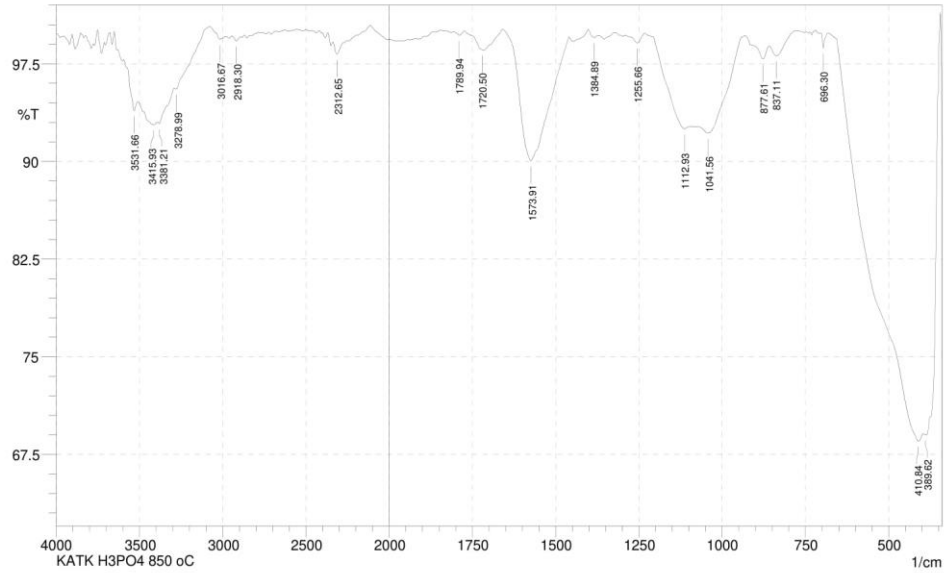

No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	389.62	69.007	0.473	395.41	376.12	3.06	0.049
2	410.84	68.514	2.022	682.8	397.34	25.641	2.867
3	696.3	98.707	1.134	702.09	682.8	0.048	0.035
4	837.11	98.121	1.042	858.32	773.46	0.359	0.158
5	877.61	97.865	1.031	914.26	858.32	0.363	0.097
6	1041.56	92.17	2.112	1074.35	931.62	3.197	0.789
7	1112.93	92.511	1.009	1230.58	1097.5	2.468	0.313
8	1255.66	99.097	0.675	1292.31	1232.51	0.139	0.075
9	1384.89	99.519	0.341	1402.25	1373.32	0.04	0.028
10	1573.91	90.062	9.829	1656.85	1460.11	4.4	4.265
11	1720.5	98.571	0.071	1751.36	1718.58	0.134	0.008
12	1789.94	99.696	0.29	1805.37	1774.51	0.022	0.02
13	2312.65	98.241	0.963	2337.72	2250.93	0.445	0.154
14	2918.3	99.266	0.335	2943.37	2893.22	0.124	0.036
15	3016.67	99.36	0.222	3078.39	3007.02	0.045	0.021
16	3278.99	95.564	0.34	3290.56	3095.75	1.882	0.137
17	3381.21	92.9	0.415	3392.79	3292.49	2.643	0.103
18	3415.93	92.82	0.229	3446.79	3394.72	1.662	0.034
19	3531.66	93.899	1.554	3574.1	3510.45	1.412	0.239

Comment;
KATK H3PO4 850 oC

Date/Time; 11/10/2020 12:32:18 PM
No. of Scans;
Resolution;
Apodization;

5. Karbon Aktif Tempurung Kemiri 900^{o}C

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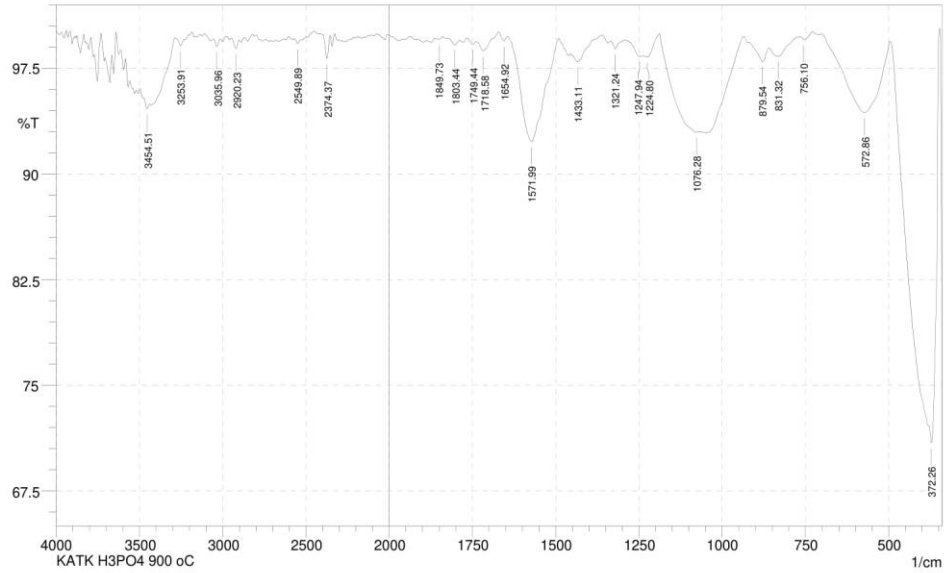

No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	372.26	70.9174	6.4713	378.05	347.19	2.939	0.9505
2	572.86	94.3714	5.2569	702.09	497.63	2.9514	2.6809
3	756.1	99.5598	0.314	767.67	729.09	0.0408	0.0324
4	831.32	98.3745	0.8311	860.25	767.67	0.4112	0.1512
5	879.54	97.9983	1.1658	935.48	860.25	0.3821	0.1733
6	1076.28	92.9865	0.584	1188.15	1066.64	2.6948	0.75
7	1224.8	98.3183	0.5057	1238.3	1188.15	0.2348	0.0569
8	1247.94	98.3435	0.2638	1290.38	1238.3	0.2479	0.0121
9	1321.24	98.9018	0.5727	1336.67	1290.38	0.1413	0.0382
10	1433.11	97.9929	0.0651	1435.04	1382.96	0.2682	-0.0084
11	1571.99	92.3131	7.3861	1643.35	1492.9	2.7357	2.5346
12	1654.92	99.4656	0.4593	1670.35	1643.35	0.0341	0.0278
13	1718.58	98.7434	0.7602	1737.86	1687.71	0.1844	0.0813
14	1749.44	99.2119	0.3093	1766.8	1737.86	0.0763	0.0191
15	1803.44	99.1781	0.3912	1822.73	1789.94	0.0875	0.028
16	1849.73	99.579	0.1433	1861.31	1840.09	0.0341	0.008
17	2374.37	98.2218	1.6665	2414.88	2355.08	0.1748	0.1513
18	2549.89	99.2753	0.2994	2573.04	2532.54	0.0969	0.0228
19	2920.23	98.9326	0.6518	2949.16	2902.87	0.1445	0.0643
20	3035.96	99.0553	0.5456	3055.24	3014.74	0.115	0.0447
21	3253.91	99.113	0.4899	3288.63	3232.7	0.1397	0.0465
22	3454.51	94.6395	0.5515	3475.73	3437.15	0.8674	0.0455

Comment;
KATK H3PO4 900 oC

Date/Time; 11/10/2020 12:14:19 PM
No. of Scans;
Resolution;
Apodization;

Lampiran 8. Hasil Karakterisasi BET

1. Tempurung Kemiri

Quantachrome® ASiQwin™- Automated Gas Sorption Data Acquisition and Reduction
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Analysis			Report			
Operator:	UNDIP	**Date:**2021/01/04	**Operator:**	UNDIP	**Date:**2021/01/06	
Sample ID:	01158	**Filename:**	20210104 TK.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.0559 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	1:43 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	2.05531 cc	**Warm Zone V:**	17.5265 cc	

Multi-Point BET

Data Reduction Parameters Data

Adsorbate					
	Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm	
	Nitrogen	**Temperature**	77.350K		
	Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc

Multi-Point BET Data

Relative Pressure [P/Po]	Volume @ STP [cc/g]	1 / [W((Po/P) - 1)]	Relative Pressure [P/Po]	Volume @ STP [cc/g]	1 / [W((Po/P) - 1)]
1.00357e-01	1.0203	8.7476e+01	2.50485e-01	2.6583	1.0059e+02
1.50418e-01	1.5992	8.8581e+01	3.00495e-01	3.1251	1.0999e+02
2.00418e-01	2.1461	9.3449e+01			

BET summary

Slope =	113.987
Intercept =	7.317e+01
Correlation coefficient, r =	0.962724
C constant=	2.558
Surface Area =	18.608 m²/g

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Analysis			**Report**			
Operator:	UNDIP	**Date:**2021/01/04	**Operator:**	UNDIP	**Date:**2021/01/22	
Sample ID:	01158	**Filename:**	20210104 TK.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.0559 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	1:43 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	2.05531 cc	**Warm Zone V:**	17.5265 cc	

Average Pore Size

Data Reduction Parameters Data

Adsorbate					
	Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm	
	Nitrogen	**Temperature**	77.350K		
	Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc

Average Pore Size summary

Average pore Radius = 1.60416e+01 Å

Analysis			Report			
Operator:	UNDIP	**Date:**2021/01/04	**Operator:**	UNDIP	**Date:**2021/01/22	
Sample ID:	01158	**Filename:**	20210104 TK.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.0559 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	1:43 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	2.05531 cc	**Warm Zone V:**	17.5265 cc	

Total Pore Volume

Data Reduction Parameters Data

Adsorbate					
	Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm	
	Nitrogen	**Temperature**	77.350K		
	Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc

Total Pore Volume summary
Total Pore Volume

Total pore volume = 1.492e-02 cc/g for
pores smaller than 1792.7 Å (Radius)
at P/Po = 0.99463

2. Karbon Tempurung Kemiri

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Analysis			Report			
Operator:	UNDIP	**Date:** 2020/12/30	**Operator:**	UNDIP	**Date:** 2021/01/06	
Sample ID:	01157	**Filename:**	20201230 KATK.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.1267 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	8:37 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	0 cc	**Warm Zone V:**	0 cc	

Total Pore Volume

Data Reduction Parameters Data

Adsorbate	**Thermal Transpiration:** on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm	
	Nitrogen	**Temperature**	77.350K		
	Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc

Total Pore Volume summary
Total Pore Volume

Total pore volume = 2.685e-01 cc/g for
pores smaller than 1843.7 Å (Radius)
at P/Po = 0.99478

Quantachrome® ASiQwin™- Automated Gas Sorption Data Acquisition and Reduction
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version 3.01

Analysis			**Report**			
Operator:	UNDIP	**Date:**2020/12/30	**Operator:**	UNDIP	**Date:**2021/01/06	
Sample ID:	01157	**Filename:**	20201230 KATK.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.1267 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	8:37 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	0 cc	**Warm Zone V:**	0 cc	

Multi-Point BET

Data Reduction Parameters Data

Adsorbate	**Thermal Transpiration:** on	**Eff. mol. diameter (D):** 3.54 Å	**Eff. cell stem diam. (d):** 4.0000 mm
	Nitrogen	**Temperature** 77.350K	
	Molec. Wt.: 28.013	**Cross Section:** 16.200 Å²	**Liquid Density:** 0.808 g/cc

Multi-Point BET Data

Relative Pressure [P/Po]	Volume @ STP [cc/g]	1 / [W((Po/P) - 1)]	Relative Pressure [P/Po]	Volume @ STP [cc/g]	1 / [W((Po/P) - 1)]
1.03875e-01	130.3953	7.1127e-01	2.50367e-01	137.5935	1.9422e+00
1.49815e-01	132.9931	1.0602e+00	3.00305e-01	139.8401	2.4557e+00
2.00085e-01	135.3542	1.4786e+00			

BET summary

Slope =	8.865
Intercept =	-2.513e-01
Correlation coefficient, r =	0.998273
C constant=	-34.271
Surface Area =	404.297 m²/g

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Analysis				**Report**			
Operator:	UNDIP	**Date:**	2020/12/30	**Operator:**	UNDIP	**Date:**	2021/01/06
Sample ID:	01157	**Filename:**		20201230 KATK.qps			
Sample Desc:		**Comment:**					
Sample Weight:	0.1267 g	**Instrument:**		Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**		300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**		6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	8:37 hr:min	**Bath temp.:**		77.35 K			
Analysis Mode:	Standard				**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**		0 cc	**Warm Zone V:**	0 cc	

Average Pore Size

Data Reduction Parameters Data

Adsorbate	**Thermal Transpiration:** on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm	
	Nitrogen	**Temperature**	77.350K		
	Molec. Wt.: 28.013	**Cross Section:**	16.200 $Å^2$	**Liquid Density:**	0.808 g/cc

Average Pore Size summary

Average pore Radius = 1.32803e+01 Å

3. Karbon Aktif Tempurung Kemiri 850^{o}C

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Analysis				**Report**			
Operator:	UNDIP	**Date:**	2021/01/11	**Operator:**	UNDIP	**Date:**	2021/01/12
Sample ID:	01163	**Filename:**		20210111 KATK H3PO4 900C.qps			
Sample Desc:		**Comment:**					
Sample Weight:	0.1508 g	**Instrument:**		Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**		300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**		6.58e-05 1/Torr	**CellType:**		9mm w/o rod
Analysis Time:	3:26 hr:min	**Bath temp.:**		77.35 K			
Analysis Mode:	Standard				**VoidVol Remeasure:**		off
VoidVol. Mode:	He Measure	**Cold Zone V:**		1.49275 cc	**Warm Zone V:**		18.1828 cc

Multi-Point BET

Data Reduction Parameters Data

Adsorbate						
	Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm		
	Nitrogen	**Temperature**	77.350K			
	Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc	

Multi-Point BET Data

Relative Pressure [P/Po]	**Volume @ STP [cc/g]**	**1 / [W((Po/P) - 1)]**	**Relative Pressure [P/Po]**	**Volume @ STP [cc/g]**	**1 / [W((Po/P) - 1)]**
1.01323e-01	163.0603	5.5324e-01	2.49165e-01	172.2619	1.5414e+00
1.49880e-01	166.6512	8.4647e-01	2.99225e-01	174.7541	1.9550e+00
2.00360e-01	169.7143	1.1813e+00			

BET summary

Slope =	7.067
Intercept =	-1.979e-01
Correlation coefficient, r =	0.998072
C constant=	-34.710
Surface Area =	506.973 m²/g

Analysis			Report			
Operator:	UNDIP	**Date:**2021/01/11	**Operator:**	UNDIP	**Date:**2021/01/22	
Sample ID:	01163	**Filename:**	20210111 KATK H3PO4 900C.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.1508 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	3:26 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	1.49275 cc	**Warm Zone V:**	18.1828 cc	

Total Pore Volume

Data Reduction Parameters Data

Adsorbate					
Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm		
Nitrogen	**Temperature**	77.350K			
Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc	

Total Pore Volume summary
Total Pore Volume

Total pore volume = 3.150e-01 cc/g for
pores smaller than 2082.5 Å (Radius)
at P/Po = 0.99539

Analysis				Report			
Operator:	UNDIP	**Date:**	2021/01/11	**Operator:**	UNDIP	**Date:**	2021/01/22
Sample ID:	01163	**Filename:**		20210111 KATK H3PO4 900C.qps			
Sample Desc:		**Comment:**					
Sample Weight:	0.1508 g	**Instrument:**		Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**		300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**		6.58e-05 1/Torr	**CellType:**		9mm w/o rod
Analysis Time:	3:26 hr:min	**Bath temp.:**		77.35 K			
Analysis Mode:	Standard				**VoidVol Remeasure:**		off
VoidVol. Mode:	He Measure	**Cold Zone V:**		1.49275 cc	**Warm Zone V:**		18.1828 cc

Average Pore Size

Data Reduction Parameters Data

Adsorbate						
Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm			
Nitrogen	**Temperature**	77.350K				
Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc		

Average Pore Size summary

Average pore Radius = 1.24267e+01 Å

4. Karbon Aktif Tempurung Kemiri 900°C

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Analysis				Report			
Operator:	UNDIP	**Date:**	2020/11/26	**Operator:**	UNDIP	**Date:**	2020/12/03
Sample ID:	01128	**Filename:**		20201126 KATK H3PO4 900C.qps			
Sample Desc:		**Comment:**					
Sample Weight:	0.1406 g	**Instrument:**		Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**		300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**		6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	5:34 hr:min	**Bath temp.:**		77.35 K			
Analysis Mode:	Standard				**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**		1.21592 cc	**Warm Zone V:**	18.415 cc	

Multi-Point BET

Data Reduction Parameters Data

Adsorbate							
	Thermal Transpiration: on		**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm		
	Nitrogen		**Temperature**	77.350K			
	Molec. Wt.:	28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc	

Multi-Point BET Data

Relative Pressure [P/Po]	Volume @ STP [cc/g]	1 / [W((Po/P) - 1)]	Relative Pressure [P/Po]	Volume @ STP [cc/g]	1 / [W((Po/P) - 1)]
1.00837e-01	162.7014	5.5150e-01	2.49323e-01	171.2571	1.5517e+00
1.49716e-01	166.0156	8.4862e-01	2.99500e-01	173.5651	1.9710e+00
1.99125e-01	168.7607	1.1788e+00			

BET summary

Slope =	7.130
Intercept =	-2.036e-01
Correlation coefficient, r =	0.998029
C constant=	-34.019
Surface Area =	502.767 m²/g

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Analysis			**Report**			
Operator:	UNDIP	**Date:** 2020/11/26	**Operator:**	UNDIP	**Date:**	2021/01/12
Sample ID:	01128	**Filename:**	20201126 KATK H3PO4 900C.qps			
Sample Desc:		**Comment:**				
Sample Weight:	0.1406 g	**Instrument:**	Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**	300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**	6.58e-05 1/Torr	**CellType:**	9mm w/o rod	
Analysis Time:	5:34 hr:min	**Bath temp.:**	77.35 K			
Analysis Mode:	Standard			**VoidVol Remeasure:**	off	
VoidVol. Mode:	He Measure	**Cold Zone V:**	1.21592 cc	**Warm Zone V:**	18.415 cc	

Total Pore Volume

Data Reduction Parameters Data

Adsorbate					
	Thermal Transpiration: on	**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm	
	Nitrogen	**Temperature**	77.350K		
	Molec. Wt.: 28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**	0.808 g/cc

Total Pore Volume summary
Total Pore Volume

Total pore volume = 3.148e-01 cc/g for
pores smaller than 1722.4 Å (Radius)
at P/Po = 0.99441

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Analysis				Report			
Operator:	UNDIP	**Date:**	2020/11/26	**Operator:**	UNDIP	**Date:**	2021/01/12
Sample ID:	01128	**Filename:**		20201126 KATK H3PO4 900C.qps			
Sample Desc:		**Comment:**					
Sample Weight:	0.1406 g	**Instrument:**		Autosorb iQ Station 1			
Outgas Time:	3.0 hrs	**Outgas Temp.:**		300 °C			
Analysis gas:	Nitrogen	**Non-ideality:**		6.58e-05 1/Torr	**CellType:**		9mm w/o rod
Analysis Time:	5:34 hr:min	**Bath temp.:**		77.35 K			
Analysis Mode:	Standard				**VoidVol Remeasure:**		off
VoidVol. Mode:	He Measure	**Cold Zone V:**		1.21592 cc	**Warm Zone V:**		18.415 cc

Average Pore Size

Data Reduction Parameters Data

Adsorbate							
	Thermal Transpiration: on		**Eff. mol. diameter (D):** 3.54 Å		**Eff. cell stem diam. (d):** 4.0000 mm		
	Nitrogen		**Temperature**	77.350K			
	Molec. Wt.:	28.013	**Cross Section:**	16.200 Å²	**Liquid Density:**		0.808 g/cc

Average Pore Size summary

Average pore Radius = 1.25231e+01 Å

Lampiran 9. Hasil Karakterisasi SEM

KEMENTERIAN RISET TEKNOLOGI DAN PENDIDIKAN TINGGI
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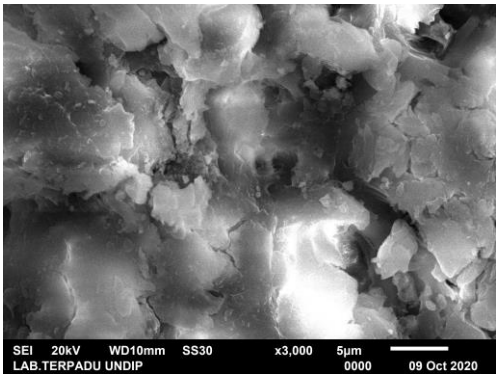
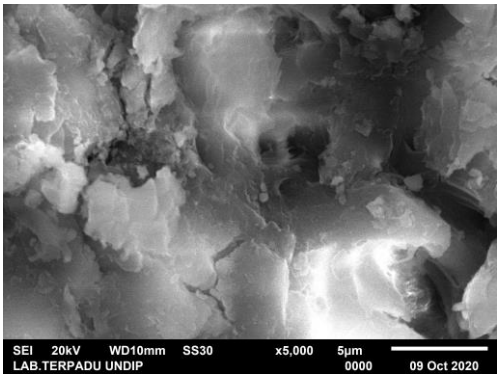
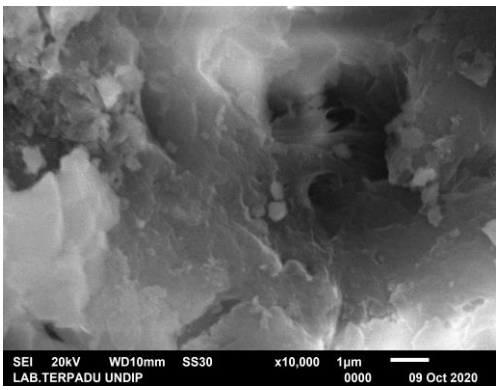
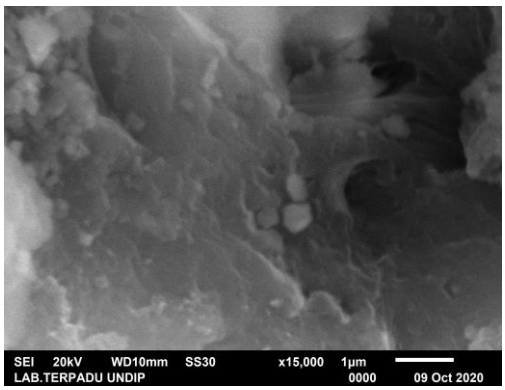
UPT LABORATORIUM TERPADU
Jalan Prof. Soedarto, SH Tembalang Semarang Kotak Pos 1269
Telepon (024) 76918147- Faksimile (024) 76918148, Website : http://labterpadu.undip.ac.id;
E-mail : labterpadu@live.undip.ac.id

Hasil Uji SEM :
TK









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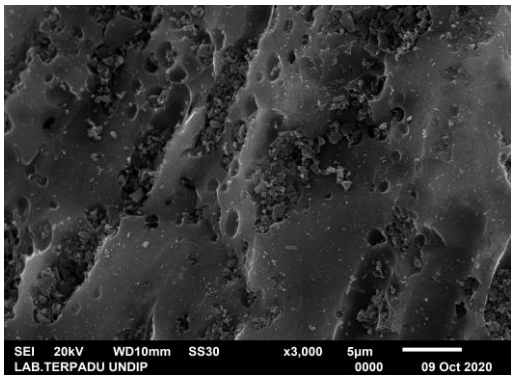
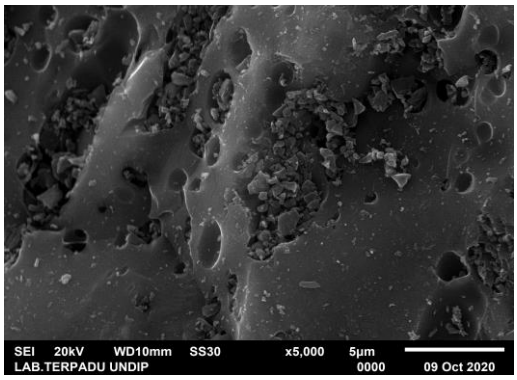
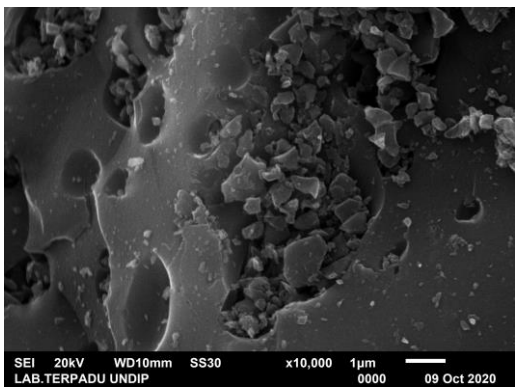
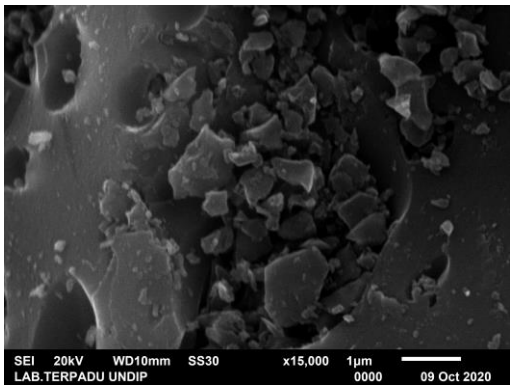
Telepon (024) 76918147- Faksimile (024) 76918148, Website : http://labterpadu.undip.ac.id;
E-mail : labterpadu@live.undip.ac.id

Hasil Uji SEM :
KTK 700









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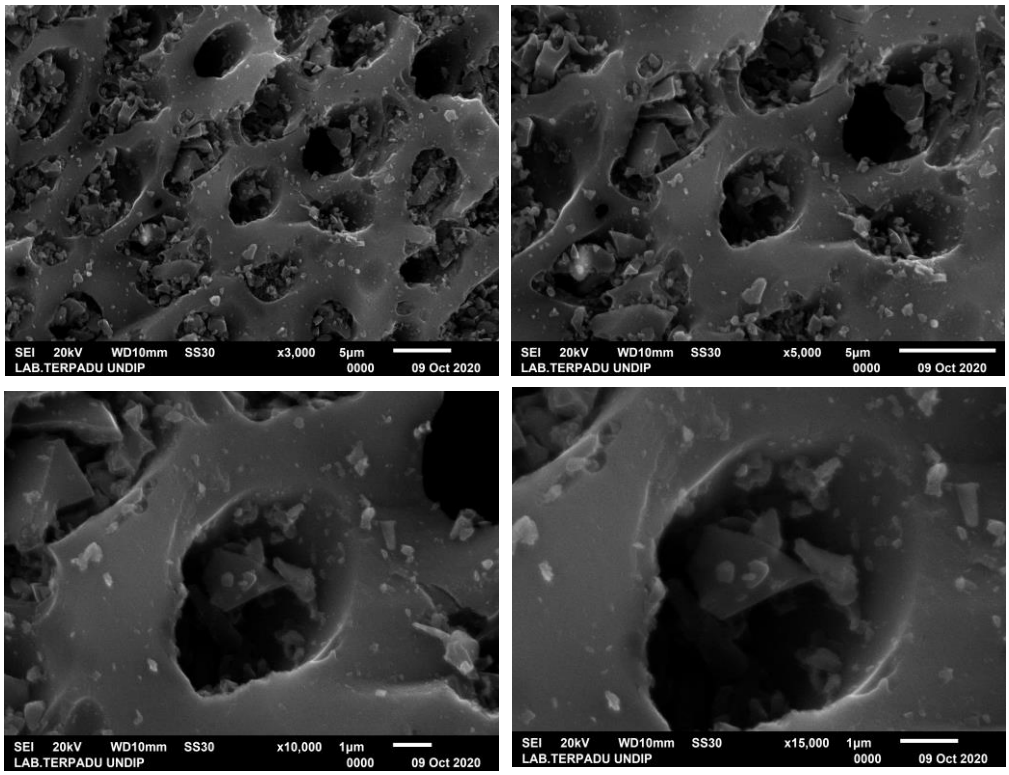
E-mail : labterpadu@live.undip.ac.id

Hasil Uji SEM :
KATK 850



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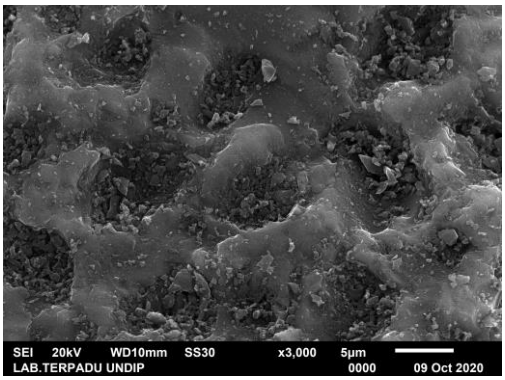
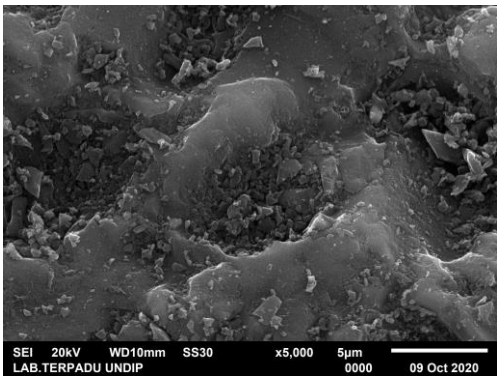
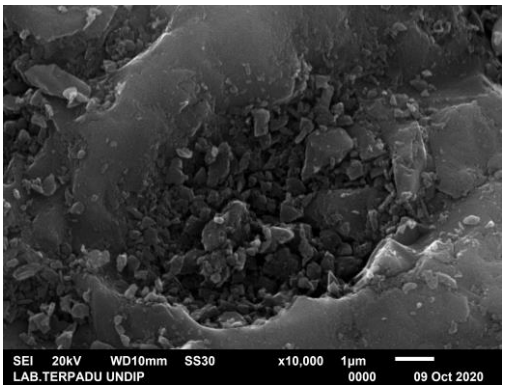
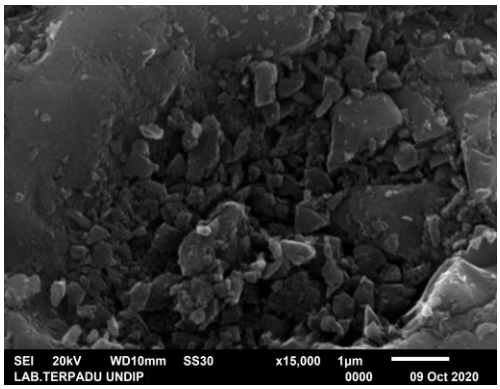
Telepon (024) 76918147- Faksimile (024) 76918148, Website : http://labterpadu.undip.ac.id;
E-mail : labterpadu@live.undip.ac.id

Hasil Uji SEM :
KATK 900









Lampiran 10. Perhitungan Analisis Proksimat

1. Perhitungan Kadar Air

$$\text{Kadar air (\%)} = \frac{\text{Berat Uap Air}}{\text{berat awal sampel}} \times 100\ \% = \frac{0.0293\ \text{gram}}{0.5002\ \text{gram}} \times 100\ \% = 5{,}86\ \%$$

a. Tempurung Kemiri

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	39.8126	40.3128	40.2835	0.0293	0.5002	5.86
2	45.5554	46.0562	46.0281	0.0281	0.5008	5.61
3	48.0456	48.5465	48.5179	0.0286	0.5009	5.71
Rata-rata						5.73

b. Karbon dengan suhu karbonisasi 600^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	48.8334	49.3339	49.3051	0.0288	0.5005	5.75
2	48.8396	49.3396	49.3079	0.0317	0.5000	6.34
3	39.8395	40.3442	40.3159	0.0283	0.5047	5.61
Rata-rata						5.90

c. Karbon dengan suhu karbonisasi 650 ^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	48.0455	48.5480	48.5343	0.0137	0.5025	2.73
2	39.8130	40.3138	40.2999	0.0139	0.5008	2.78
3	45.5560	46.0571	46.0460	0.0111	0.5011	2.21
Rata-rata						2.58

d. Karbon dengan suhu karbonisasi 700 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	36.2956	36.7983	36.7752	0.0231	0.5027	4.60
2	45.5804	46.0823	46.0596	0.0227	0.5019	4.52
3	48.0624	48.5664	48.5521	0.0143	0.5040	2.84
Rata-rata						3.99

e. Karbon dengan suhu karbonisasi 750 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	48.0454	48.5465	48.5320	0.0145	0.5011	2.89
2	45.5555	46.0555	46.0418	0.0137	0.5000	2.74
3	39.8128	40.3149	40.3026	0.0123	0.5021	2.45
Rata-rata						2.69

f. Karbon dengan suhu karbonisasi 800 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	48.0586	48.5597	48.5085	0.0512	0.5011	10.22
2	39.8295	40.3298	40.2764	0.0534	0.5003	10.67
3	48.0456	48.5478	48.4952	0.0526	0.5022	10.47
Rata-rata						10.45

g. Karbon dengan suhu karbonisasi 900 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	45.5687	46.0689	46.0128	0.0561	0.5002	11.22
2	36.3137	36.8141	36.7569	0.0572	0.5004	11.43
3	39.8127	40.3137	40.2542	0.0595	0.5010	11.88
Rata-rata						11.51

h. Karbon Aktif dengan Perendaman

	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	39.8115	40.3118	40.3084	0.0034	0.5003	0.69
2	36.2966	36.7969	36.7940	0.0029	0.5003	0.58
3	36.2962	36.7972	36.7941	0.0031	0.5010	0.63
Rata-rata						0.63

i. Karbon Aktif 800^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	40.6397	41.1407	41.1374	0.0033	0.5010	0.67
2	46.0305	46.5310	46.5285	0.0025	0.5005	0.50
3	35.6070	36.1079	36.1041	0.0038	0.5009	0.77
Rata-rata						0.64

j. Karbon Aktif 850^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	48.8123	49.3128	49.3106	0.0022	0.5005	0.45
2	40.6156	41.1166	41.1145	0.0021	0.5010	0.42
3	45.2148	45.7198	45.7160	0.0038	0.5050	0.76
Rata-rata						0.54

k. Karbon Aktif 900^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Berat Uap Air (B-C)	Bobot awal (B-A)	Kadar Air (%)
1	39.5442	40.0445	40.0423	0.0022	0.5003	0.43
2	38.6413	39.1419	39.1382	0.0037	0.5006	0.73
3	36.2981	36.7987	36.7956	0.0031	0.5006	0.61
Rata-rata						0.59

2. Perhitungan Kadar Abu

$$\text{Kadar abu (\%)} = \frac{\text{berat abu}}{\text{berat awal sampel}} \text{ x } 100\ \%$$

$$= \frac{0.0106 \text{ gram}}{0.5006 \text{ gram}} \text{ x } 100\ \% = 2.43\ \%$$

a. Tempurung Kemiri

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	50.4229	50.9235	50.4335	0.0106	0.5006	2.12
2	43.5748	44.0756	43.5859	0.0111	0.5008	2.22
3	45.8492	46.3490	45.8640	0.0148	0.4998	2.95
Rata-rata						2.43

b. Karbon dengan suhu karbonisasi 600 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	49.0786	49.5788	49.1141	0.0355	0.5002	7.10
2	54.8987	55.3988	54.9399	0.0412	0.5001	8.24
3	45.3809	45.8860	45.4164	0.0355	0.5051	7.03
Rata-rata						7.45

c. Karbon dengan suhu karbonisasi 650 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	31.5137	32.0140	31.5409	0.0272	0.5003	5.44
2	29.5475	30.0478	29.5751	0.0276	0.5003	5.51
3	32.3045	32.8048	32.3252	0.0207	0.5003	4.13
Rata-rata						5.03

d. karbon dengan suhu karbonisasi 700 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	32.2977	32.7989	32.3204	0.0227	0.5012	4.54
2	31.4968	31.9978	31.5179	0.0211	0.5010	4.20
3	29.5328	30.0332	29.5525	0.0197	0.5004	3.94
Rata-rata						4.23

e. karbon dengan suhu karbonisasi 750 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	31.5012	32.0014	31.5403	0.0391	0.5002	7.82
2	29.5413	30.0420	29.5817	0.0404	0.5007	8.08
3	32.2992	32.7999	32.3506	0.0514	0.5007	10.26
Rata-rata						8.72

f. karbon dengan suhu karbonisasi 800 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	54.8704	55.3713	54.8873	0.0169	0.5009	3.38
2	45.3848	45.8852	45.4022	0.0174	0.5004	3.48
3	32.3472	32.8478	32.3642	0.0170	0.5006	3.40
Rata-rata						3.42

g. Karbon dengan suhu karbonisasi 900 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	29.5358	30.0358	29.5662	0.0304	0.5000	6.07
2	31.5495	32.0520	31.5796	0.0301	0.5025	5.99
3	32.3448	32.8449	32.3739	0.0291	0.5001	5.81
Rata-rata						5.96

h. Karbon Aktif dengan Perendaman

	Bobot Kosong Cawan (A)	Bobot Cawan + Sampel (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	32.2598	32.7601	32.2662	0.0064	0.5003	1.29
2	32.2608	32.7610	32.2665	0.0057	0.5002	1.14
3	32.2592	32.7606	32.2643	0.0051	0.5014	1.02
Rata-rata						1.15

i. Karbon Aktif 800 ^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	32.2586	32.7597	32.2654	0.0068	0.5011	1.35
2	50.4359	50.9369	50.4429	0.0070	0.5010	1.40
3	31.4968	31.9973	31.5048	0.0080	0.5005	1.61
Rata-rata						1.45

j. Karbon Aktif 850 ^{o}C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	26.8265	27.3265	26.8342	0.0077	0.5000	1.55
2	29.5330	30.0332	29.5408	0.0078	0.5002	1.57
3	31.4968	31.9973	31.5048	0.0080	0.5005	1.61
Rata-rata						1.57

k. Karbon Aktif 900°C

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Abu (C-A)	Bobot Awal Sampel (B-A)	Kadar Abu (%)
1	45.8607	46.3615	45.8660	0.0053	0.5008	1.06
2	29.5173	30.0177	29.5235	0.0062	0.5004	1.24
3	32.2657	32.7660	32.2717	0.0060	0.5003	1.19
Rata-rata						1.16

3. Perhitungan Kadar Senyawa Volatil

$$\text{Kadar Senyawa Volatil (\%)} = \left(\frac{\text{bobot senyawa volatil}}{\text{bobot awal sampel}} \text{ x } 100\ \% \right)$$

$$\text{Kadar Senyawa Volatil (\%)} = \left(\frac{0.4248 \text{ gram}}{0.5000 \text{ gram}} \text{ x } 100\ \% \right)$$

Kadar Senyawa Volatil (%) = 84.96 %

a. Tempurung Kemiri

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	21.1457	21.6457	21.2209	0.4248	0.5000	84.96
1	26.7595	27.2598	26.8415	0.4183	0.5003	83.61
3	22.3651	22.8656	22.4459	0.4197	0.5005	83.86
Rata-rata						84.14

b. karbon dengan suhu karbonisasi 600 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	22.3614	22.8614	22.5416	0.3198	0.5000	63.96
2	21.5416	22.0418	21.7216	0.3202	0.5002	64.01
3	26.7595	27.2596	26.9389	0.3207	0.5001	64.13
Rata-rata						64.03

c. karbon dengan suhu karbonisasi 650 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	29.5465	30.0481	29.7443	0.3038	0.5016	60.57
2	31.5298	32.0308	31.7255	0.3053	0.5010	60.94
3	32.3056	32.8060	32.5006	0.3054	0.5004	61.03
Rata-rata						60.85

d. karbon dengan suhu karbonisasi 700 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	31.5460	32.0462	31.7853	0.2609	0.5002	52.16
2	45.8480	46.3484	46.0825	0.2659	0.5004	53.14
3	32.3086	32.8094	32.5570	0.2524	0.5008	50.40
Rata-rata						51.90

e. karbon dengan suhu karbonisasi 750ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	31.5306	32.0132	31.7324	0.2808	0.4826	58.18
2	32.3050	32.8053	32.5018	0.3035	0.5003	60.66
3	29.5462	30.0484	29.7577	0.2907	0.5022	57.89
Rata-rata						58.91

f. karbon dengan suhu karbonisasi 800 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	29.5421	30.0428	29.7378	0.3050	0.5007	60.91
2	29.5432	30.0442	29.7528	0.2914	0.5010	58.16
3	29.5451	30.0455	29.7679	0.2776	0.5004	55.48
Rata-rata						58.18

g. Karbon dengan suhu karbonisasi 900 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Tetap Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	32.3024	32.8030	32.5441	0.2589	0.5006	51.72
2	31.5003	32.0065	31.7509	0.2556	0.5062	50.49
3	29.5434	30.0440	29.7781	0.2659	0.5006	53.12
Rata-rata						51.78

h. Karbon Aktif Tempurung Kemiri

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	22.3062	22.8062	22.6678	0.1384	0.5000	27.68
2	22.3660	22.8665	22.7168	0.1497	0.5005	29.91
3	45.8494	46.3495	46.2284	0.1211	0.5001	24.22
Rata-rata						27.27

i. Karbon Aktif 800ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	24.9644	25.9652	25.7338	0.2314	1.0008	23.12
2	26.9544	27.9548	27.7225	0.2323	1.0004	23.22
3	24.9656	25.9665	25.7156	0.2509	1.0009	25.07
Rata-rata						23.80

j. Karbon Aktif 850 ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	16.8957	17.8957	17.7046	0.1911	1.0000	19.11
2	26.8277	27.8284	27.6400	0.1884	1.0007	18.83
3	26.8290	27.8292	27.6222	0.2070	1.0002	20.70
Rata-rata						19.54

k. Karbon Aktif 900ºC

No.	Bobot Kosong Cawan (A)	Bobot Cawan + Sampe (B)	Bobot Penimbangan (C)	Bobot Senyawa Volatil (B-C)	Bobot Awal Sampel (B-A)	Kadar Senyawa Volatil (%)
1	26.9511	27.9515	27.7375	0.2140	1.0004	21.39
2	24.9633	25.9638	25.7377	0.2261	1.0005	22.60
4	26.9547	27.9555	27.7056	0.2499	1.0008	24.97
Rata-rata						22.99

4. Perhitungan Kadar Karbon Tetap

Karbon tetap (%) = 100 % - (kadar air + kadar abu + kadar senyawa volatil) %

Karbon tetap (%) = 100 % - (5.73 + 2.43 + 84.14) %

Karbon tetap (%) = 7.70 %

Sampel	Kadar Air (%)	Kadar Abu (%)	Kadar Senyawa Volatil (%)	Kadar Karbon Tetap (%)
TK	5.73	2.43	84.14	7.70
KTK 600	5.90	7.45	64.03	22.61
KTK 650	2.57	5.03	60.85	31.54
KTK 700	3.99	4.23	53.18	38..60
KTK 750	2.69	8.72	58.91	29.68
KTK 800	10.46	3.42	58.18	27.94
KTK 900	11.51	5.96	51.78	30.76
KATK	0.63	1.15	27.27	70.95
KATK 800	0.64	1.45	23.80	74.10
KATK 850	0.54	1.57	19.54	78.34
KATK 900	0.59	1.16	22.99	75.26

Lampiran 11. Perhitungan Kadar Gugus Fungsi dengan Titrasi Boehm

a. Tempurung Kemiri

Penentunan Kadar Karboksilat

No	V. Sampel (Vs) (mL)	V. Titran $NaHCO_3$ (Vp) (mL)	N. $NaHCO_3$	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Carboxyl (meq/g)
1	25	5	0.0500	0.0466	10	0.0573	8	0.1008	12.0238
2	25	5	0.0500	0.0466	10	0.0573	8.2	0.1008	12.5923
3	25	5	0.0500	0.0466	10	0.0573	8	0.1008	12.0238
Rata - rata									**12.2133**

$$n_{carboxylic} = \frac{\left[V_{NaHCO_3} N_{NaHCO_3} - (N_{HCl} V_{HCl} - N_{NaOH} V_{NaOH})\right] \frac{V_p}{V_s}}{w}$$

$$n_{carboxylic} = \frac{[5\ mL \times 0.0515\ N - (0.0460\ N \times 10\ mL - 0.04466\ N \times 8.5\ mL)] \frac{25\ mL}{5\ mL}}{0.1008\ gram}$$

$$n_{carboxylic} = \frac{[0.2500\ meq - (0.4660\ meq - 0.4584\ meq)] \frac{25\ mL}{5\ mL}}{0.1008\ gram}$$

$$n_{carboxylic} = \frac{[0.2575\ meq - 0.0076 meq] \frac{25\ mL}{5\ mL}}{0.1008\ gram} = 12.0238\ \frac{meq}{gram}$$

Penentuan Kadar Lakton

No	V. Sampel (Vs) (mL)	V. Titran Na_2CO_3 (Vp) (mL)	N. Na_2CO_3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Lactone (meq/g)
1	25	5	0.0501	0.0466	10	0.0573	4.8	0.1024	-6.2094
2	25	5	0.0501	0.0466	10	0.0573	4.8	0.1024	-6.7778
3	25	5	0.0501	0.0466	10	0.0573	4.8	0.1024	-6.2094
Rata – rata									**-6.3988**

$$n_{lactonic} = \frac{\left[V_{Na_2CO_3} N_{Na_2CO_3} - (N_{HCl} V_{HCl} - N_{NaOH} V_{NaOH})\right] \frac{V_p}{V_s}}{w} - n_{carboxylic}$$

$$n_{lactonic} = \frac{[5\ mL \times 0.0501\ N - (0.0466\ N \times 10\ mL - 0.0573\ N \times 4.8\ mL)] \frac{25\ mL}{5\ mL}}{0.1024} - 12.0238\ \frac{meq}{gram}$$

$$n_{lactonic} = \frac{[0.2505\ meq - (0.4660\ meq - 0.2750\ meq)] \frac{25\ mL}{5\ mL}}{0.3178\ gram} - 12.0238 \frac{meq}{gram}$$

$$n_{lactonic} = 5.8145\ \frac{meq}{gram} - 12.0238\ \frac{meq}{gram} = -6.3988 \frac{meq}{gram}$$

Penentuan Kadar Fenol

No	V. Sampel (Vs) (mL)	V. Titran NaOH (Vp) (mL)	N. NaOH	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Phenolic (meq/g)
1	25	5	0.0573	0.0466	10	0.0573	4.1	0.1011	-0.3318
2	25	5	0.0573	0.0466	10	0.0573	4.2	0.1011	0.2350
3	25	5	0.0573	0.0466	10	0.0573	4.4	0.1011	1.3685
Rata – rata									**0.4239**

$$n_{phenolic} = \frac{[V_{NaOH}N_{NaOH} - (N_{HCl}V_{HCl} - N_{NaOH}V_{NaOH})]\frac{V_p}{V_s}}{w} - n_{carboxylic} - n_{lactonic}$$

$$n_{phenolic} = \frac{[5\ mL \times 0.0573\ N - (0.0466\ N \times 10\ mL - 0.0573\ N \times 4.1\ mL)]\frac{25\ mL}{5\ mL}}{0.1011\ gram} - 12.0238\ \frac{meq}{gram} - (-6.3988\ \frac{meq}{gram})$$

$$n_{phenolic} = \frac{[0.2865\ meq - (0.4660\ meq - 0.2349\ meq)]\frac{25\ mL}{5\ mL}}{0.1011\ gram} - 12.0238\ \frac{meq}{gram} - (-6.3988\ \frac{meq}{gram})$$

$$n_{phenolic} = 5.4827\frac{meq}{gram} - 12.0238\ \frac{meq}{gram} - (-6.3988\ \frac{meq}{gram}) = -0.3318\ \frac{meq}{gram}$$

Penentuan Kadar Basa Total

No	V. Sampel (Vs) (mL)	V. Titran HCl (Vp) (mL)	N. HCl	N. NaOH	V. NaOH (mL)	N. HCl	V. HCl (mL)	Massa Karbon (g)	n total base (meq/g)
1	25	5	0.0466	0.0573	7.5	0.0466	4.3	0.1055	0.3441
2	25	5	0.0466	0.0573	7.5	0.0466	4.2	0.1055	-0.0976
3	25	5	0.0466	0.0573	7.5	0.0466	4.2	0.1055	-0.0976
Rata - rata									**0.0496**

$$n_{total\ base} = \frac{[V_{HCl}N_{HCl} - (N_{NaOH}V_{NaOH} - N_{HCl}V_{HCl})]\ \frac{V_p}{V_s}}{w}$$

$$n_{total\ base} = \frac{[5\ mL \times 0.0466\ N - (0.0573\ N \times 7.5\ mL - 0.0466\ N \times 4.3\ mL)]\ \frac{25\ mL}{5\ mL}}{0.1055\ gram}$$

$$n_{total\ base} = \frac{[0.2330\ meq - (0.4298\ meq - 0.2003\ meq)]\ \frac{25\ mL}{5\ mL}}{0.1055\ gram}$$

$$n_{total\ base} = \frac{[0.2330\ meq - 0.2294\ meq]\ \frac{25\ mL}{5\ mL}}{0.1055\ gram} = 0.3441\ \frac{meq}{gram}$$

b. Karbon Tempurung Kemiri

Penentuan Kadar Karboksilat

No	V. Sampel (Vs) (mL)	V. Titran NaHCO3 (Vp) (mL)	N. NaHCO3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Carboxyl (meq/g)
1	25	5	0.0501	0.0442	10	0.0452	8.2	0.1001	8.8146
2	25	5	0.0501	0.0442	10	0.0452	8.4	0.1001	9.2619
3	25	5	0.0501	0.0442	10	0.0452	9.8	0.1001	12.3932
Rata – rata									**10.1566**

Penentuan Kadar Lakton

No	V. Sampel (Vs) (mL)	V. Titran Na2CO3 (Vp) (mL)	N. Na2CO3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Lactone (meq/g)
1	25	5	0.05	0.0442	10	0.0452	8.6	0.1003	0.9599
2	25	5	0.05	0.0442	10	0.0452	8.4	0.1003	-3.0692
3	25	5	0.05	0.0442	10	0.0452	8.2	0.1003	-0.3883
Rata – rata									**-0.8325**

Penentuan Kadar Fenol

No	V. Sampel (Vs) (mL)	V. Titran NaOH (Vp) (mL)	N. NaOH	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Phenolic (meq/g)
1	25	5	0.0452	0.0442	10	0.0452	7.8	0.1005	-3.0165
2	25	5	0.0452	0.0442	10	0.0452	7.8	0.1005	-2.5661
3	25	5	0.0452	0.0442	10.2	0.0452	7.3	0.1005	-3.6798
Rata - rata									**-3.0875**

Penentuan Kadar Basa Total

No	V. Sampel (Vs) (mL)	V. Titran HCl (Vp) (mL)	N. HCl	N. NaOH	V. NaOH (mL)	N. HCl	V. HCl (mL)	Massa Karbon (g)	n total base (meq/g)
1	25	5	0.0442	0.0452	7.5	0.0442	2	0.1	-1.4560
2	25	5	0.0442	0.0452	7.5	0.0442	2.7	0.1	0.0926
3	25	5	0.0442	0.0452	7.5	0.0442	2	0.1	-1.4560
Rata - rata									**-0.9398**

c. Karbon Aktif Tempurung Kemiri 850^{O}C

Penentuan Kadar Karboksilat

No	V. Sampel (Vs) (mL)	V. Titran NaHCO3 (Vp) (mL)	N. NaHCO3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Carboxyl (meq/g)
1	50	5	0.05	0.0442	10	0.0452	6.9	0.1000	5.9635
2	50	5	0.05	0.0442	10	0.0452	6.8	0.1000	5.7376
3	50	5	0.05	0.0442	10	0.0452	6.7	0.1000	5.5116
Rata - rata									**5.7376**

Penentuan Kadar Lakton

No	V. Sampel (Vs) (mL)	V. Titran Na2CO3 (Vp) (mL)	N. Na2CO3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Lactone (meq/g)
1	50	5	0.05	0.0442	10	0.0452	7.5	0.1002	1.3408
2	50	5	0.05	0.0442	10	0.0452	7.4	0.1002	1.3413
3	50	5	0.05	0.0442	10	0.0452	7.7	0.1002	2.2435
Rata - rata									**1.6419**

Penentuan Kadar Fenol

No	V. Sampel (Vs) (mL)	V. Titran NaOH (Vp) (mL)	N. NaOH	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Phenolic (meq/g)
1	50	5	0.0452	0.0442	10	0.0452	8.8	0.1010	1.6569
2	50	5	0.0452	0.0442	10	0.0452	8.8	0.1010	1.8824
3	50	5	0.0452	0.0442	10	0.0452	9	0.1010	1.6534
Rata - rata									**1.7309**

Penentuan Kadar Basa Total

No	V. Sampel (Vs) (mL)	V. Titran HCl (Vp) (mL)	N. HCl	N. NaOH	V. NaOH (mL)	N. HCl	V. HCl (mL)	Massa Karbon (g)	n total base (meq/g)
1	25	1	0.0442	0.0452	7.5	0.0442	3.1	0.1002	0.9756
2	25	1	0.0442	0.0452	7.5	0.0442	3.0	0.1002	0.7548
3	25	1	0.0442	0.0452	7.5	0.0442	3.2	0.1005	1.1929
Rata - rata									**0.9744**

d. Karbon Aktif Tempurung Kemiri 900^{O}C

Penentuan Kadar Karboksilat

No	V. Sampel (Vs) (mL)	V. Titran NaHCO3 (Vp) (mL)	N. NaHCO3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Carboxyl (meq/g)
1	50	5	0.05	0.0442	10	0.0452	6.4	0.1005	4.8099
2	50	5	0.05	0.0442	10	0.0452	6.3	0.1005	4.5851
3	50	5	0.05	0.0442	10	0.0452	6.2	0.1005	4.3603
Rata - rata									**4.5851**

Penentuan Kadar Lakton

No	V. Sampel (Vs) (mL)	V. Titran Na2CO3 (Vp) (mL)	N. Na2CO3	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Lactone (meq/g)
1	50	5	0.05	0.0442	10	0.0452	7.2	0.1004	1.8048
2	50	5	0.05	0.0442	10	0.0452	7.1	0.1004	1.8046
3	50	5	0.05	0.0442	10	0.0452	6.9	0.1004	1.5794
Rata - rata									**1.7296**

Penentuan Kadar Fenol

No	V. Sampel (Vs) (mL)	V. Titran NaOH (Vp) (mL)	N. NaOH	N. HCl	V. HCl (mL)	N. NaOH	V. NaOH (mL)	Massa Karbon (g)	n Phenolic (meq/g)
1	50	1	0.0452	0.0442	10	0.0452	8.4	0.1005	1.4919
2	50	1	0.0452	0.0442	10	0.0452	8.2	0.1005	1.2674
3	50	1	0.0452	0.0442	10	0.0452	8.3	0.1005	1.9422
Rata - rata									**1.5672**

Penentuan Kadar Basa Total

No	V. Sampel (Vs) (mL)	V. Titran HCl (Vp) (mL)	N. HCl	N. NaOH	V. NaOH (mL)	N. HCl	V. HCl (mL)	Massa Karbon (g)	n total base (meq/g)
1	50	5	0.0442	0.0452	7.5	0.0442	3.3	0.1002	1.4172
2	50	5	0.0442	0.0452	7.5	0.0442	3.3	0.1002	1.4172
3	50	5	0.0442	0.0452	7.5	0.0442	3.2	0.1005	1.1929
Rata - rata									**1.3424**

Lampiran 12. Perhitungan Kapasitansi Spesifik

a. Elektolit Li_2SO_4

Sampel	Scanrate (V/s)	Ic (A)	Id (A)	Massa karbon (gram)	Kapasitansi Spesifik (mF/g)
TK	0.1	3.90×10^{-7}	3.85×10^{-7}	0.1011	$4{,}95 \times 10^{-4}$
	0.05	3.91×10^{-7}	3.84×10^{-7}	0.1011	1.37×10^{-3}
	0.02	3.94×10^{-7}	3.86×10^{-7}	0.1011	4.36×10^{-3}
	0.01	3.91×10^{-7}	3.80×10^{-7}	0.1011	1.08×10^{-2}
KTK 700	0.1	2.20×10^{-6}	-1.40×10^{-6}	0.1020	0,35
	0.05	2.78×10^{-6}	-1.94×10^{-6}	0.1020	0,93
	0.02	3.21×10^{-6}	-2.28×10^{-6}	0.1020	2,69
	0.01	3.54×10^{-6}	-2.52×10^{-6}	0.1020	5,94
KATK 850	0.1	4.13×10^{-5}	-5.15×10^{-5}	0.1006	9,22
	0.05	4.20×10^{-5}	-6.30×10^{-5}	0.1006	20,90
	0.02	4.77×10^{-5}	-8.55×10^{-5}	0.1006	66,20
	0.01	4.94×10^{-5}	-9.15×10^{-5}	0.1006	140,00

1. Penentuan Kapasitansi TK

1.1 Scan rate 100 mV/s

$$C_s = \frac{(3.90 \times 10^{-7} - (3.85 \times 10^{-7})\ A}{0.1\ {}^{V}/_{s} \times 0.1011\ gram} = 4.95 \times 10^{-7}\ {}^{F}/_{g} = 4{,}95 \times 10^{-4}\ mF/g$$

1.2 Scan rate 50 mV/s

$$C_s = \frac{(3.91 \times 10^{-7} - (3.84 \times 10^{-7})\ A}{0.05\ {}^{V}/_{s} \times 0.1011\ gram} = 1.37 \times 10^{-6}\ {}^{F}/_{g} = 1.37 \times 10^{-3}\ mF/g$$

1.3 Scan rate 20 mV/s

$$C_s = \frac{(3.94 \times 10^{-7} - (3.94 \times 10^{-7})\ A}{0.02\ {}^{V}/_{s} \times 0.1011\ gram} = 4.36 \times 10^{-6}\ {}^{F}/_{g} = 4.36 \times 10^{-3}\ mF/g$$

1.4 Scan rate 10 mV/s

$$C_s = \frac{(3.90 \times 10^{-7} - (3.85 \times 10^{-7})\ A}{0.01\ V/s \times 0.1011\ gram} = 1.08 \times 10^{-5}\ F/g = 1.08 \times 10^{-2}\ mF/g$$

2. Penentuan Kapasitansi KTK 700

2.1 Scan rate 100 mV/s

$$C_s = \frac{(2.20 \times 10^{-6} - (-1.40 \times 10^{-6})\ A}{0.1\ V/s \times 0.1020\ gram} = 3.50 \times 10^{-4}\ F/g = 0{,}35\ mF/g$$

2.2 Scan rate 50 mV/s

$$C_s = \frac{(2.78 \times 10^{-6} - (-1.94 \times 10^{-6})\ A}{0.05\ V/s \times 0.1020\ gram} = 9.30 \times 10^{-4}\ F/g = 0{,}93\ mF/g$$

2.3 Scan rate 20 mV/s

$$C_s = \frac{(3.21 \times 10^{-6} - (-2.28 \times 10^{-6})\ A}{0.02\ V/s \times 0.1020\ gram} = 2.69 \times 10^{-3}\ F/g = 2{,}69\ mF/g$$

2.4 Scan rate 10 mV/s

$$C_s = \frac{(3.54 \times 10^{-6} - (-2.52 \times 10^{-6})\ A}{0.01\ V/s \times 0.1020\ gram} = 5.94 \times 10^{-3}\ F/g = 5{,}94\ mF/g$$

3. Penentuan Kapasitansi Spesifik KATK 850

3.1 Scan rate 100 mV/s

$$C_s = \frac{(4.13 \times 10^{-5} - (-5.15 \times 10^{-5})\ A}{0.1\ V/s \times 0.1006\ gram} = 9.22 \times 10^{-3}\ F/g = 9{,}22\ mF/g$$

3.2 Scan rate 50 mV/s

$$C_s = \frac{(4.20 \times 10^{-5} - (-6.30 \times 10^{-5})\ A}{0.05\ V/s \times 0.1006\ gram} = 2.09 \times 10^{-2}\ F/g = 20{,}90\ mF/g$$

3.3 Scan rate 20 mV/s

$$C_s = \frac{(4.77 \times 10^{-5} - (-8.55 \times 10^{-5})\ A}{0.02\ V/s \times 0.1006\ gram} = 6.62 \times 10^{-2}\ F/g = 66{,}20\ mF/g$$

3.4 Scan rate 10 mV/s

$$C_s = \frac{(4.94 \times 10^{-5} - (-9.15 \times 10^{-5})\ A}{0.01\ V/s \times 0.1006\ gram} = 1.40 \times 10^{-1}\ F/g = 140{,}00\ mF/g$$

b. Elektolit Na_2SO_4

Sampel	Scanrate (V/s)	Ic (A)	Id (A)	Massa karbon (gram)	Kapasitansi Spesifik (mF/g)
TK	0.1	3.96E-07	3.86E-07	0.1011	1.03×10^{-3}
	0.05	3.96E-07	3.83E-07	0.1011	2.50×10^{-3}
	0.02	4.04E-07	3.89E-07	0.1011	7.54×10^{-3}
	0.01	3.95E-07	3.84E-07	0.1011	1.14×10^{-2}
KTK 700	0.1	2.79×10^{-6}	-1.84×10^{-6}	0.1020	0,45
	0.05	2.33×10^{-6}	-1.44×10^{-6}	0.1020	0,74
	0.02	2.78×10^{-6}	-2.30×10^{-7}	0.1020	2,36
	0.01	2.77×10^{-6}	-2.02×10^{-6}	0.1020	4,69
KATK 850	0.1	3.02×10^{-5}	-6.90×10^{-5}	0.1005	9,87
	0.05	3.11×10^{-5}	-6.40×10^{-5}	0.1005	18,90
	0.02	2.81×10^{-5}	-6.25×10^{-5}	0.1005	45,10
	0.01	2.51×10^{-5}	-6.55×10^{-5}	0.1005	90,10

1. Penentuan Kapasitansi TK

1.1 Scan rate 100 mV/s

$$C_s = \frac{(3.96x\ 10^{-7} - (3.86 \times 10^{-7})\ A}{0.1\ V/s \times 0.1011\ gram} = 1.30 \times 10^{-6}\ F/g = 1.03 \times 10^{-3}\ mF/g$$

1.2 Scan rate 50 mV/s

$$C_s = \frac{(3.96 \times 10^{-7} - (3.83 \times 10^{-7})\ A}{0.05\ V/s \times 0.1011\ gram} = 2.50 \times 10^{-6}\ F/g = 2.50 \times 10^{-3}\ mF/g$$

1.3 Scan rate 20 mV/s

$$C_s = \frac{(4.04 \times 10^{-7} - (3.89 \times 10^{-7})\ A}{0.02\ V/s \times 0.1011\ gram} = 7.54 \times 10^{-6}\ F/g = 7.54 \times 10^{-3}\ mF/g$$

1.4 Scan rate 10 mV/s

$$C_s = \frac{(3.95 \times 10^{-7} - (3.84 \times 10^{-7})\ A}{0.01\ V/s \times 0.1011\ gram} = 1.14 \times 10^{-5}\ F/g = 1.14 \times 10^{-2}\ mF/g$$

2. Penentuan Kapasitansi KTK 700

2.1 Scan rate 100 mV/s

$$C_s = \frac{(2.79 \times 10^{-6} - (-1.84 \times 10^{-6})\ A}{0.1\ V/s \times 0.1020\ gram} = 4.50 \times 10^{-4}\ F/g = 0{,}45\ mF/g$$

2.2 Scan rate 50 mV/s

$$C_s = \frac{(2.33 \times 10^{-6} - (-1.44 \times 10^{-6})\ A}{0.05\ V/s \times 0.1020\ gram} = 7.40 \times 10^{-4}\ F/g = 0{,}74\ mF/g$$

2.3 Scan rate 20 mV/s

$$C_s = \frac{(2.78 \times 10^{-6} - (-2.30 \times 10^{-7})\ A}{0.02\ V/s \times 0.1020\ gram} = 2.36 \times 10^{-3}\ F/g = 2{,}36\ mF/g$$

2.4 Scan rate 10 mV/s

$$C_s = \frac{(2.77 \times 10^{-6} - (-2.02 \times 10^{-6})\ A}{0.01\ V/s \times 0.1020\ gram} = 4.69 \times 10^{-3}\ F/g = 4{,}69\ mF/g$$

3. Penentuan Kapasitansi Spesifik KATK 850

3.1 Scan rate 100 mV/s

$$C_s = \frac{(3.02 \times 10^{-5} - (-6.90 \times 10^{-5})\ A}{0.1\ V/s \times 0.1005\ gram} = 9.87 \times 10^{-3}\ F/g = 9{,}87\ mF/g$$

3.2 Scan rate 50 mV/s

$$C_s = \frac{\left(3.11 \times 10^{-5} - (-6.40 \times 10^{-5})\right) A}{0.05\ {}^{V}/_{s} \times 0.1005\ \text{gram}} = 1.89 \times 10^{-2}\ {}^{F}/_{g} = 18{,}90\ \text{mF/g}$$

3.3 Scan rate 20 mV/s

$$C_s = \frac{\left(2.81 \times 10^{-5} - (-6.25 \times 10^{-5})\right) A}{0.02\ {}^{V}/_{s} \times 0.1005\ \text{gram}} = 4.51 \times 10^{-2}\ {}^{F}/_{g} = 45{,}10\ \text{mF/g}$$

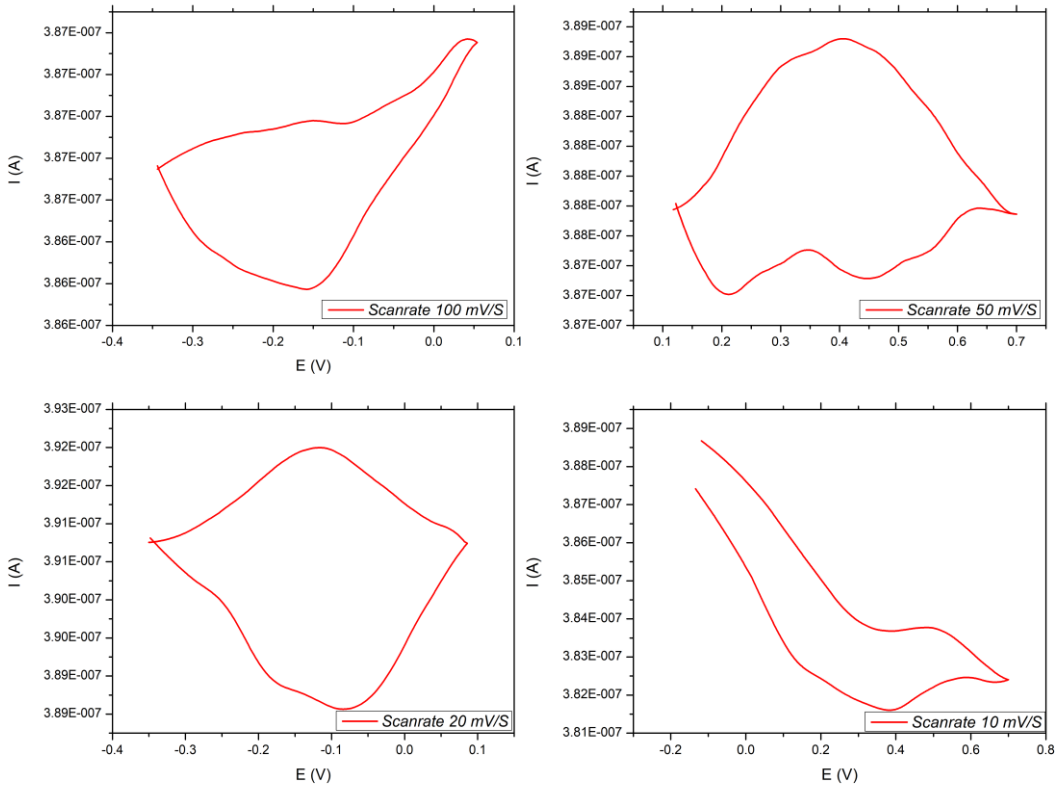
3.4 Scan rate 10 mV/s

$$C_s = \frac{\left(2.51 \times 10^{-5} - (-6.55 \times 10^{-5})\right) A}{0.01\ {}^{V}/_{s} \times 0.1005\ \text{gram}} = 9.01 \times 10^{2}\ {}^{F}/_{g} = 90{,}10\ \text{mF/g}$$

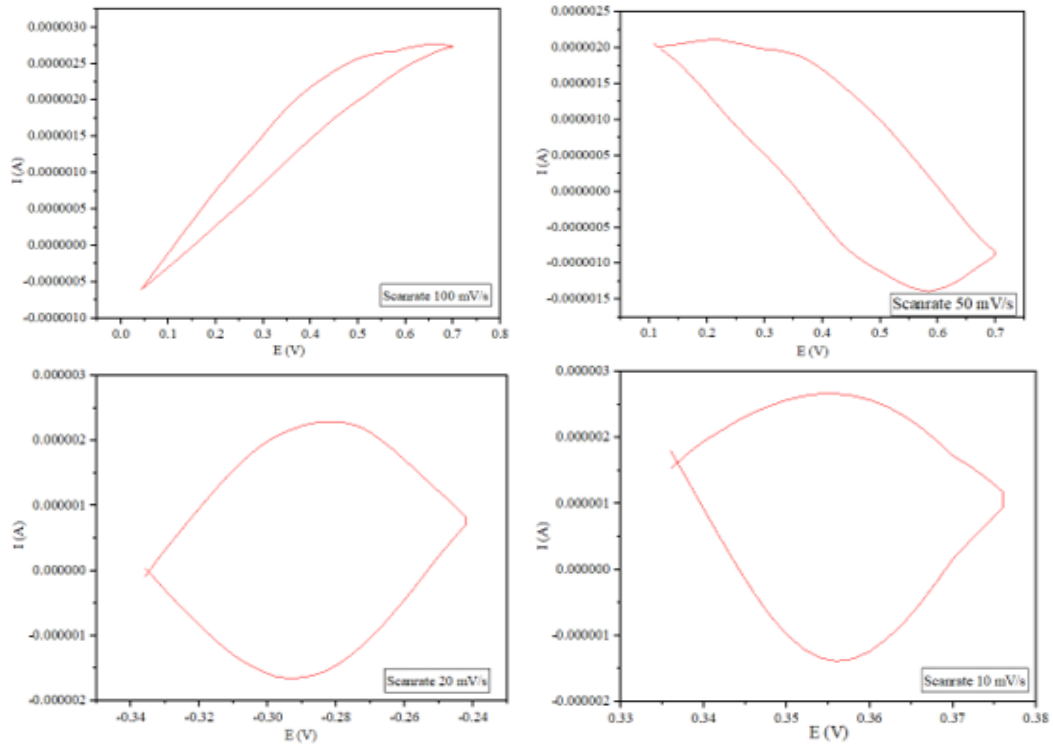
Lampiran 13. Grafik Kapasitansi Spesifik TK, KTK 700 dan KATK 850

1. Grafik kapasitansi spesifik dalam elektrolit Li_2SO_4 1 M

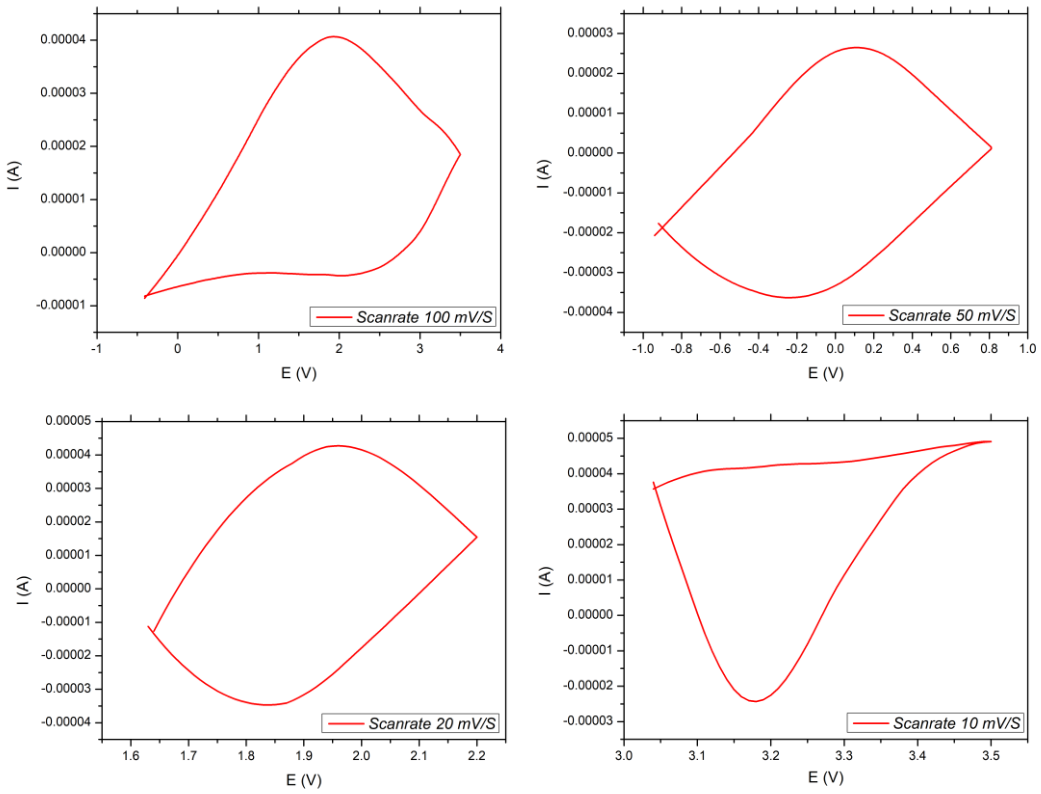
   a. TK



   b. KTK 700

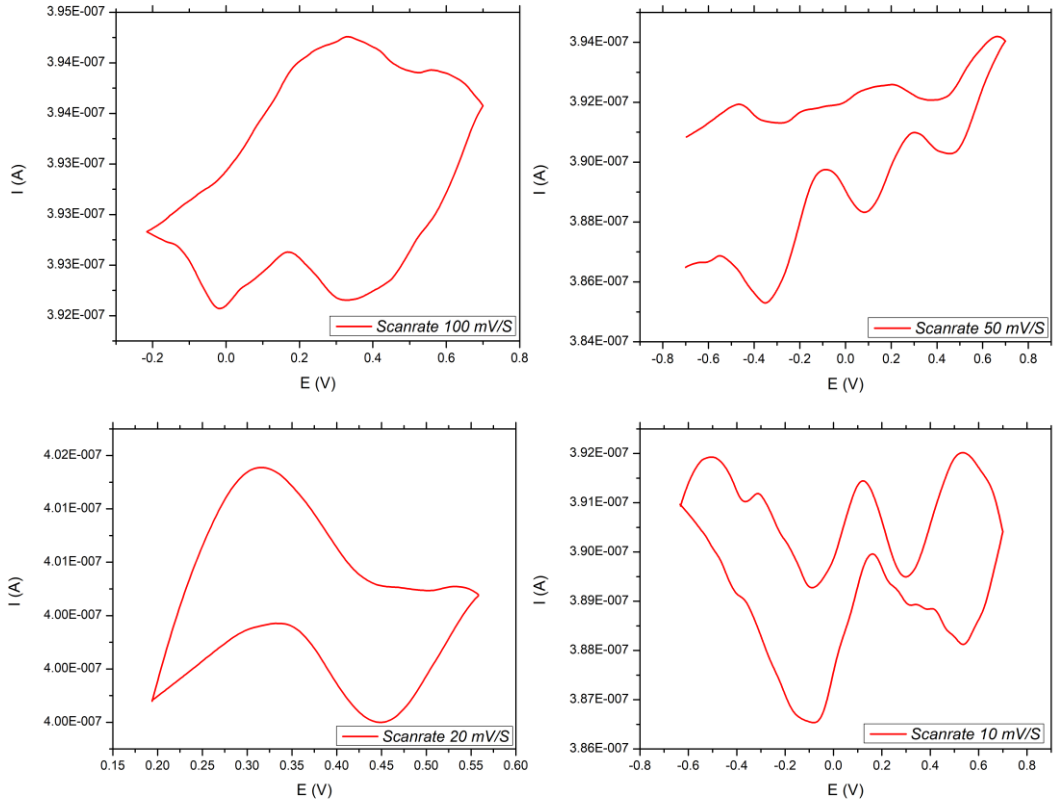


c. KATK 850

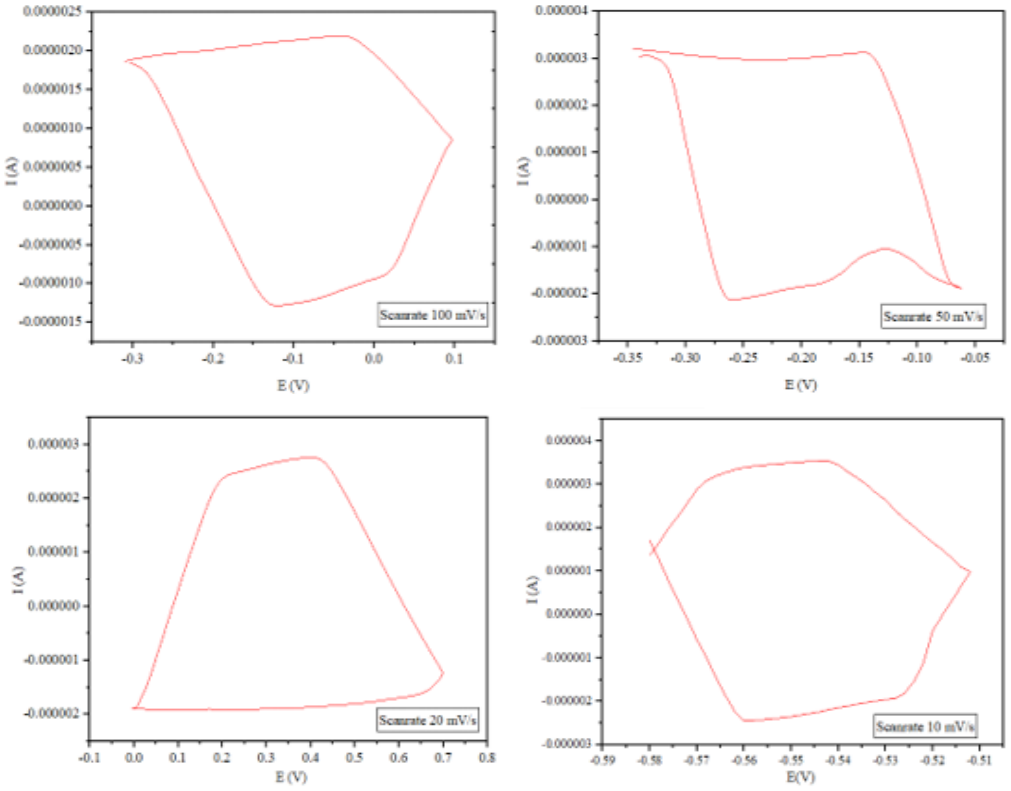


2. Grafik kapasitansi spesifik dalam elektrolit Na_2SO_4 1 M

a. TK



b. KTK 700



c. KATK 850