REFERENCES

Aladin, A. (2009). Penentuan Rasio Optimum Campuran CPO: Batubara dalam Desulfurisasi dan Deashing Secara Flotasi Sistem Kontinyu. *Jurnal Rekayasa Proses, 3*(2), 50-56.

Alfredo, T., & Fadhillah. (2021). Pembuatan Prototipe Alat Pencucian Batubara dengan Metode Flotasi. *Jurnal Bina Tambang, 6*(2), 265-275.

Ayhan, F. D., Abakay, H., & Saydut, A. (2005). Desulfurization and Deashing of Hazro Coal via a Flotation Method. *Energy & Fuels, 19*, 1003-1007.

Bulatovic, S. M. (2007). *Handbook of Flotation Reagents.* Canada: Elsevier.

Ding, L. P. (2009). Investigation of Bituminous Coal Hydrophobicity and its Influence on Flotation. *Energy Fuels, 23*, 5536-5543.

Drzymala, J. (2007). *Mineral Processing Foundations of Theory and Practice of Minerallurgy*. Polandia: Wroclaw University of Technology.

Faizal, M., Saputra, M., & Zainal, F. A. (2015). Pembuatan Briket Bioarang dari Campuran Batubara dan Biomassa Sekam Padi dan Eceng Gondok. *Jurnal Teknik Kimia, 21*(4), 28-39.

Fitriyanti, R. (2016). Pertambangan Batuabra: Dampak Lingkungan, Sosial dan Ekonomi. *Jurnal Redoks, 1*(1), 34-40.

Haryono, D., Darmabakti, I., Oediyani, S., & Harjanto, S. (2020). Monitoring of Column Flotation Process in Collection Zone using ECVT with the Effect of Collector and Frother Doses to Recovery. *Mesin, 11*(1), 1-7.

Jaya, D., Widayati, T. W., Mustika, R. Y., & Suwardi, H. N. (2020). Peningkatkan Kualitas Tailing Batubara Dengan Metode Flotasi Menggunakan Biosurfaktan dari Lerak (Sapindusrarak De Candole). *Eksegi, 17*(1), 20-28.

Kasim, R. W. (2023). *Analisis Benefisiasi Batubara dengan Metode Flotasi Kolom Menggunakan Air Laut.* (Thesis Undergraduated, Universitas Hasanuddin).

Kuntaarsa, A., & Subagyo, P. (2020). Desulfurisasi Batubara dengan Metode Flotasi Menggunakan Gel Lidah Buaya. *Jurnal Teknologi Technoscientia, 12*(2), 102-113.

Nukman, & Poertadji, S. (2006). Pengurangan Kadar Abu dan Sulfur pada Batubara Sub Bituminus dengan Metode Aglomerasi Air-Minyak Sawit. *Jurnal Sains Materi Indonesia, 7*(3), 31-36.

, E., Idrus, A., Amijaya, H., & Pramumijoyo, S. (2011). Keterdapatan dan ipe Mineral pada Batubara serta Metode Analisisnya. *Jurnal Teknologi echnoscientia, 4*(1), 1-10.

Pasymi. (2008). *Batubara.* Padang: Bung Hatta University Press.

Polat, M., Polat, H., & Chander, S. (2003). Physical and Chemical Interactions in Coal Flotation. *International Journal of Mineral Processing, 72*, 199-213.

Pratama, H. S., & Fadhilah. (2021). Deashing Pada Batubara Menggunakan KOH dan HNO3 Sebagai Leaching Agent. *Jurnal Bina Tambang, 6*(2), 108-115.

Rao, D. V., & Gouricharan, T. (2016). *Coal Processing and Utilization.* United States: CRC Press.

Sastri, S. R. (1998). Column Flotation: Theory and Practice. *Froth Flotation: Recent Trends*, 44-63.

Sokolovic, J., & Miskovic, S. (2018). The Effect of Particle Size on Coal Flotation Kinetics: A Review. *Physicochemical Problems of Mineral Processing, 54*(4), 1172-1190.

Speight, J. G. (2005). *Handbook of Coal Analysis.* New Jersey: John Wiley & Sons.

Sugiarto, W., RA, T. L., & Winarti. (2023). The Effect of Ash Content on Coal Quality in the Labanan Formation in Berau District, East Kalimantan Province. *KURVATEK, 8*(1), 1-6.

Taliding, T. U., Widodo, S., & Ilyas, A. (2023). Proximate and Microscopy Analysis of Coal in Tamalea Village, Bonehau District, Mamuju Regency, West Sulawesi Province, Indonesia. *IOP Conference Series: Earth and Environmental Science, 1134*(1), 1-8.

Thomas, L. (2013). *Coal Geology.* New Jersey: John Wiley & Sons, Ltd.

Vapur, H., Bayat, O., & Ucurum, M. (2010). Coal Flotation Optimization Using Modified Flotation Parameters and Combustible Recovery in a Jameson Cell. *Energy Conversion and Management*(51), 1891-1897.

Warjito, Harinaldi, Hardwin, K. I., Yudistira, & Setyantono, M. (2015). Kinematika Partikel pada Proses Flotasi. *Proceeding Seminar Nasional Tahunan Teknik Mesin XIV*, 7-8.

Xia, W., Xie, G., & Peng, Y. (2015). Recent Advances in Beneficiation for Low Rank Coals. *Powder Technology, 277*, 206-221.

Yilmaz, S., Cuhadaroglu, D., & Toroglu, I. (2019). Correlation between Ash Content of Size & Density Fractionated Coal Samples and their Corresponding Calorific Values. *OP Conference Series: Earth and Environmental Science, 362*(1), 1-7.

APPENDICES

APPENDICE 1 ANALYSIS PROXIMATE CALCULATION

INITIAL SAMPLE PROXIMATE ANALYSIS CALCULATION

1. Moisture content analysis

Sample Code	W1 (gram)	W2 (gram)	W3 (gram)
U0W0C0	10.3835	11.3838	11.3308

Formula to determine the percentage of moisture content:

$$MC\ (\%) = \frac{W2 - W3}{W2 - W1} \times 100\%$$

$$MC\ (\%) = \frac{11.3838 - 11.3308}{11.3838 - 10.3835} \times 100\%$$

$$MC\ (\%) = 5.55\%$$

2. Ash content analysis

Sample Code	W1 (gram)	W2 (gram)	W3 (gram)
U0W0C0	10.8017	11.8022	10.8525

Formula to determine the percentage of ash content:

$$AC\ (\%) = \frac{W3 - W1}{W2 - W1} \times 100\%$$

$$AC\ (\%) = \frac{10.8525 - 10.8017}{11.8022 - 10.8017} \times 100\%$$

$$AC\ (\%) = 5.07\%$$

3. Volatile matter analysis

Sample Code	W1 (gram)	W2 (gram)	W3 (gram)
U0W0C0	18.5033	19.5036	19.1409

Formula to determine the percentage of volatile matter:

$$VM\ (\%) = \frac{W2 - W3}{W2 - W1} \times 100\%$$

$$VM\ (\%) = \frac{19.5036 - 19.1409}{19.5036 - 18.5033} \times 100\%$$

$$VM\ (\%) = 36.43\%$$

4. Fixed carbon analysis

Sample Code	MC (%)	AC (%)	VM (%)
U0W0C0	5.55	5.07	36.43

Formula to determine the percentage of fixed carbon:

FC (%) = 100 – (MC (%) + AC (%) + VM (%))

FC (%) = 100 – (5.55 + 5.07 + 36.43)

FC (%) = 52.95%

CALCULATION OF ASH CONTENT ANALYSIS AFTER BENEFICIATION USING COLUMN FLOTATION

Formula to determine the percentage of ash content:

$$AC\ (\%) = \frac{W3 - W1}{W2 - W1} \times 100\%$$

Sample Code	W1 (gram)	W2 (gram)	W3 (gram)
U1W1C1	11.4767	12.4768	11.5250
U1W2C1	10.9428	11.9431	10.9813
U1W3C1	11.1578	12.1584	11.1951
U1W2C2	11.2917	12.2920	11.3359
U1W2C3	11.0954	12.0955	11.1287
U2W2C1	10.6032	11.6033	10.6337
U3W2C1	10.1816	11.1821	10.2100
U4W2C1	11.4023	12.4026	11.4312

1. U1W1C1

$$AC\ (\%) = \frac{11.5250 - 11.4767}{12.4768 - 11.4767} \times 100\%$$

$$AC\ (\%) = 4.8295$$

2. U1W2C1

$$AC\ (\%) = \frac{10.9813 - 10.9428}{11.9431 - 10.9428} \times 100\%$$

$$AC\ (\%) = 3.8488$$

3. U1W3C1

$$AC\ (\%) = \frac{11.1951 - 11.1578}{12.1584 - 11.1578} \times 100\%$$

$$(\%) = 3.7278$$

W2C2

$$(\%) = \frac{11.3359 - 11.2917}{12.2920 - 11.2917} \times 100\%$$

$$AC\ (\%) = 4.4187$$

5. U1W2C3

$$AC\ (\%) = \frac{11.1287 - 11.0954}{12.0955 - 11.0954} \times 100\%$$

$$AC\ (\%) = 3.3297$$

6. U2W2C1

$$AC\ (\%) = \frac{10.6337 - 10.6032}{11.6033 - 10.6032} \times 100\%$$

$$AC\ (\%) = 3.0497$$

7. U3W2C1

$$AC\ (\%) = \frac{10.2100 - 10.1816}{11.1821 - 10.1816} \times 100\%$$

$$AC\ (\%) = 2.8386$$

8. U4W2C1

$$AC\ (\%) = \frac{11.4312 - 11.4023}{12.4026 - 11.4023} \times 100\%$$

$$AC\ (\%) = 2.8891$$

APPENDICE 2 ASH REDUCTION CALCULATION RESULTS

ASH REDUCTION CALCULATION

The formula for determining the reduction in ash content after flotation is:

$$\text{Ash content reduction (\%)} = \frac{\text{initial ash content (\%)} - \text{final ash content (\%)}}{\text{initial ash content (\%)}} \times 100\%$$

Variables			Ash Content (%)	
Grain size (mesh)	Flotation time (min)	Collector dosage (mL)	Initial	Final
100	5	20	5.07	4.82
100	10	20		3.84
100	15	20		3.72
100	10	30		4.41
100	10	40		3.32
80	10	20		3.04
60	10	20		2.83
40	10	20		2.88

1. 100# 5 min 20 mL (U1W1C1)

   $$\text{Ash content reduction (\%)} = \frac{5.07 - 4.82}{5.07} \times 100\%$$

   Ash content reduction (%) = 4.93%

2. 100# 10 min 20mL (U1W2C1)

   $$\text{Ash content reduction (\%)} = \frac{5.07 - 3.84}{5.07} \times 100\%$$

   Ash content reduction (%) = 24.26%

3. 100# 15 min 20 mL (U1W3C1)

   $$\text{Ash content reduction (\%)} = \frac{5.07 - 3.72}{5.07} \times 100\%$$

   Ash content reduction (%) = 26.63%

4. 100# 10 min 30 mL (U1W2C2)

   $$\text{Ash content reduction (\%)} = \frac{5.07 - 4.41}{5.07} \times 100\%$$

   Ash content reduction (%) = 13.02%

5. 100# 10 min 40 mL (U1W2C3)

   $$\text{Ash content reduction (\%)} = \frac{5.07 - 3.32}{5.07} \times 100\%$$

   Ash content reduction (%) = 34.52%

[illegible] 10 min 20 mL (U2W2C1)

[illegible] content reduction (%) $= \frac{5.07 - 3.04}{5.07} \times 100\%$

[illegible] content reduction (%) = 40.04%

7. 60# 10 min 20 mL (U3W2C1)

   Ash content reduction (%) = $\frac{5.07 - 2.83}{5.07} \times 100\%$

   Ash content reduction (%) = 44.18%

8. 40# 10 min 20mL (U4W2C1)

   Ash content reduction (%) = $\frac{5.07 - 2.88}{5.07} \times 100\%$

   Ash content reduction (%) = 43.20%

APPENDICE 3 CALORIFIC VALUE INCREASING CALCULATION RESULTS

CALORIFIC VALUE INCREASING CALCULATION

The formula for determining the increasing in calorific value after flotation is:

$$\text{Calorific value increasing} = \frac{\text{initial calorific value (cal/g)} - \text{final calorific value (cal/g)}}{\text{initial calorific value (cal/g)}} \times 100\%$$

Variables			Calorific Value (cal/g)	
Grain size (mesh)	Flotation time (min)	Collector dosage (mL)	Initial	Final
100	5	20	5,207	5,544
100	10	20		5,692
100	15	20		5,835
100	10	30		5,715
100	10	40		5,687
80	10	20		5,72
60	10	20		5,729
40	10	20		5,752

1. 100# 5 min 20 mL (U1W1C1)

   $$\text{Calorific value increasing} = \frac{5{,}207 - 5{,}544}{5{,}207} \times 100\%$$

   Calorific value increasing= 6.47%

2. 100# 10 min 20mL (U1W2C1)

   $$\text{Calorific value increasing} = \frac{5{,}207 - 5{,}5692}{5{,}207} \times 100\%$$

   Calorific value increasing= 9.31%

3. 100# 15 min 20 mL (U1W3C1)

   $$\text{Calorific value increasing} = \frac{5{,}207 - 5{,}835}{5{,}207} \times 100\%$$

   Calorific value increasing= 12.06%

4. 100# 10 min 30 mL (U1W2C2)

   $$\text{Calorific value increasing} = \frac{5{,}207 - 5{,}715}{5{,}207} \times 100\%$$

   Calorific value increasing= 9.76%

5. 100# 10 min 40 mL (U1W2C3)

   $$\text{Calorific value increasing} = \frac{5{,}207 - 5{,}687}{5{,}207} \times 100\%$$

   orific value increasing= 9.22%

6. 80# 10 min 20 mL (U2W2C1)

   Calorific value increasing= $\frac{5,207 - 5,720}{5,207} \times 100\%$

   Calorific value increasing= 9.85%

7. 60# 10 min 20 mL (U3W2C1)

   Calorific value increasing= $\frac{5,207 - 5,729}{5,207} \times 100\%$

   Calorific value increasing= 10.02%

8. 40# 10 min 20mL (U4W2C1)

   Calorific value increasing= $\frac{5,207 - 5,752}{5,207} \times 100\%$

   Calorific value increasing= 10.47%

APPENDICE 4 X-RAY DIFFRACTION (XRD) ANALYSIS RESULTS

Match! Phase Analysis Report

Sample: MnO2-Ac (5-70)

Sample Data	
File name	XRD-GAB.RAW
File path	F:/XRD-GAB - Copy
Data collected	Mar 19, 2024 11:28:25
Data range	5.000° - 70.000°
Original data range	5.000° - 70.000°
Number of points	3251
Step size	0.020
Rietveld refinement converged	No
Alpha2 subtracted	No
Background subtr.	No
Data smoothed	Yes
Radiation	X-rays
Wavelength	1.540600 Å

Matched Phases

Index	*Amount (%)*	*Name*	*Formula sum*
A	56.4	Carbon Graphite 2H	C
B	39.1	Quartz	O2 Si
C	4.4	Moganite	O2 Si
	16.9	*Unidentified peak area*	

A: Carbon Graphite 2H (56.4 %)*

Formula sum	C
Entry number	96-101-1061
Figure-of-Merit (FoM)	0.775861*
Total number of peaks	14
Peaks in range	6
Peaks matched	4
Intensity scale factor	0.34*
Space group	P 63 m c
Crystal system	hexagonal
Unit cell	a= 2.4700 Å c= 6.7900 Å
I/Ic	2.59
Meas. density	2.160 g/cm³
Calc. density	2.223 g/cm³
Reference	Hassel O, "Ueber die Kristallstruktur des Graphits.", Zeitschrift fuer Physik **25**, 317-337 (1924)

B: Quartz (39.1 %)*

Formula sum	O2 Si
Entry number	96-900-9667
Figure-of-Merit (FoM)	0.912912*
Total number of peaks	35
Peaks in range	16
Peaks matched	10
Intensity scale factor	0.29*
Space group	P 31 2 1
Crystal system	trigonal (hexagonal axes)
Unit cell	a= 4.9158 Å c= 5.4091 Å
I/Ic	3.17
Calc. density	2.644 g/cm³
Reference	Gualtieri A. F., "Accuracy of XRPD QPA using the combined Rietveld-RIR methodLocality: Baveno, Novara, Italy", Journal of Applied Crystallography **33**, 267-278 (2000)

C: Moganite (4.4 %)*

Formula sum	O2 Si
Entry number	96-900-2650
Figure-of-Merit (FoM)	0.701439*
Tota	132
Pea	58
Pea	18
Inte	0.02*
Spa	I m c b
Cry	orthorhombic
Uni	a= 8.8159 Å b= 4.9371 Å c= 10.7605 Å
I/Ic	2.17
Cal	2.556 g/cm³
Ref	Heaney P. J., Post J. E., "Evidence for an I2/a to Imab phase transition in the silicapolymorph moganite at ~570 KSample: T = 1354 K", American Mineralogist **86**, 1358-1366 (2001)

(*)*2theta values have been shifted internally for the calculation of the amounts, the intensity scaling factors as well as the figure-of-merit (FoM), due to the active search-match option 'Automatic zero point adaption'.*

Candidates

Name	*Formula*	*Entry No.*	*FoM*
Quartz	O2 Si	96-901-2601	0.8788
Quartz	O2 Si	96-901-3322	0.8787
Quartz	O2 Si	96-900-5018	0.8786
Silicon oxide $-alpha (Quartz low)	O2 Si	96-101-1173	0.8784
Quartz	O2 Si	96-900-9667	0.8784
Silicon oxide (Quartz)	O2 Si	96-500-0036	0.8783
Silicon oxide $-alpha (Quartz low)	O2 Si	96-101-1098	0.8782
	O2 Si	96-710-3015	0.8781
Quartz	O2 Si	96-900-0776	0.8777
	O2 Si	96-230-0371	0.8776
Quartz	O2 Si	96-901-0147	0.8766
Quartz	O2 Si	96-901-0146	0.8751
Silicon oxide (Quartz low)	O2 Si	96-101-1160	0.8745
Quartz	O2 Si	96-900-5019	0.8679
Si O2	O2 Si	96-153-8065	0.8673
Quartz	O2 Si	96-901-1494	0.8649
Si O2	O2 Si	96-152-6861	0.8603
Quartz	O2 Si	96-901-0145	0.8602
Silicon oxide - $-alpha (Quartz low)	O2 Si	96-101-1177	0.8566
Si O2	O2 Si	96-153-2513	0.8501
	Be F2	96-153-1932	0.8375
Berlinite	Al O4 P	96-900-6550	0.8238
Si O2	O2 Si	96-153-6390	0.8139
Quartz	O2 Si	96-900-5020	0.8120
Al P O4	Al O4 P	96-153-0003	0.8096
Bi2.938 Nb O7	Bi2.9375 Nb	96-152-1521	0.8063
	C12 H8 Cl2	96-500-0024	0.8000
Cesium_Indium_Chloride	Cl3 Cs In	96-400-3085	0.7922
Quartz	O2 Si	96-900-5021	0.7787
Porphyrazinealuminiumchloride	C16 Al Cl N16 S4	96-430-9965	0.7747
H2 Si2 O5	H2 O5 Si2	96-810-4232	0.7669
Quartz	O2 Si	96-900-5024	0.7650
	Al0.05 Li0.05 O2 Si0.95	96-900-2384	0.7631
Quartz	O2 Si	96-901-5023	0.7608
Quartz	O2 Si	96-900-5023	0.7594
	O7 P2 Pu	96-591-0295	0.7584
Ca4 (Te5 O14)	Ca4 O14 Te5	96-153-6341	0.7575
Li3 B14	B14 Li3	96-151-1410	0.7561
	O2 Si	96-900-6288	0.7552
	O2 Si	96-900-6289	0.7552
tricesium lithium dicobalt tetrakis(tetraoxomolybdate)	Co2 Cs3 Li Mo4 O16	96-201-4365	0.7519
	Al6 Ca4 Cr O16	96-900-4874	0.7514
	Al6 Ca4 Cr O16	96-900-4873	0.7513
	Al6 Ca4 Cr O16	96-900-4875	0.7507
	Al6 Ca4 Cr O16	96-900-4872	0.7506
	Al6 Ca4 Cr O16	96-900-4876	0.7491
	Al6 Ca4 Cr O16	96-900-4871	0.7487
(La1.75 Sr0.25) Ni O4.036	La1.75 Ni O14 Sr0.25	96-703-5744	0.7475
	Al6 Ca4 Cr O16	96-900-4877	0.7463
	Al6 Ca4 Cr O16	96-900-4878	0.7463
	Ba2 F44 Sb4 Xe10	96-433-9054	0.7458
	Al6 Ca4 Cr O16	96-900-4879	0.7454

and 6130 others...

Search-Match

Settings

Reference database used	COD-Inorg REV248644 2020.03.03
Automatic zeropoint adaptation	Yes
Minimum figure-of-merit (FoM)	0.50
2theta window for peak corr.	0.30 deg.
Minimum rel. int. for peak corr.	1
Parameter/influence 2theta	0.50
Parameter/influence intensities	0.50
Par[illegible]s)	0.50

Criteria for entries added by user

Ref

En 96-155-0017;96-155-0018;96-432-9331;96-900-2649;96-900-2650;96-900-5116

Peak List

No.	[illegible]	[illegible]	*I/I0*	*FWHM*	*Matched*
1	17.76	4.9901	60.65	0.5200	
2	20.80	4.2668	172.12	0.5200	B

3	22.80	3.8978	95.39	9.3200	
4	23.30	3.8139	107.00	8.3200	
5	26.14	3.4063	110.89	2.5600	A,C
6	26.62	3.3459	1000.00	0.2800	B,C
7	27.28	3.2665	72.40	0.7600	
8	28.30	3.1510	46.82	1.2400	C
9	33.06	2.7074	9.73	0.3892	C
10	36.54	2.4572	68.77	0.3200	B,C
11	39.48	2.2807	38.33	0.3130	B,C
12	40.28	2.2372	28.87	0.3019	B,C
13	42.50	2.1253	38.06	0.3692	A,B
14	44.32	2.0422	33.59	0.3633	A,C
15	45.82	1.9788	23.42	0.4738	B,C
16	50.10	1.8194	65.72	0.3200	A,B,C
17	59.91	1.5426	48.39	0.2800	B,C
18	64.61	1.4414	46.14	0.3200	
19	67.69	1.3830	56.26	0.2400	B,C

Integrated Profile Areas

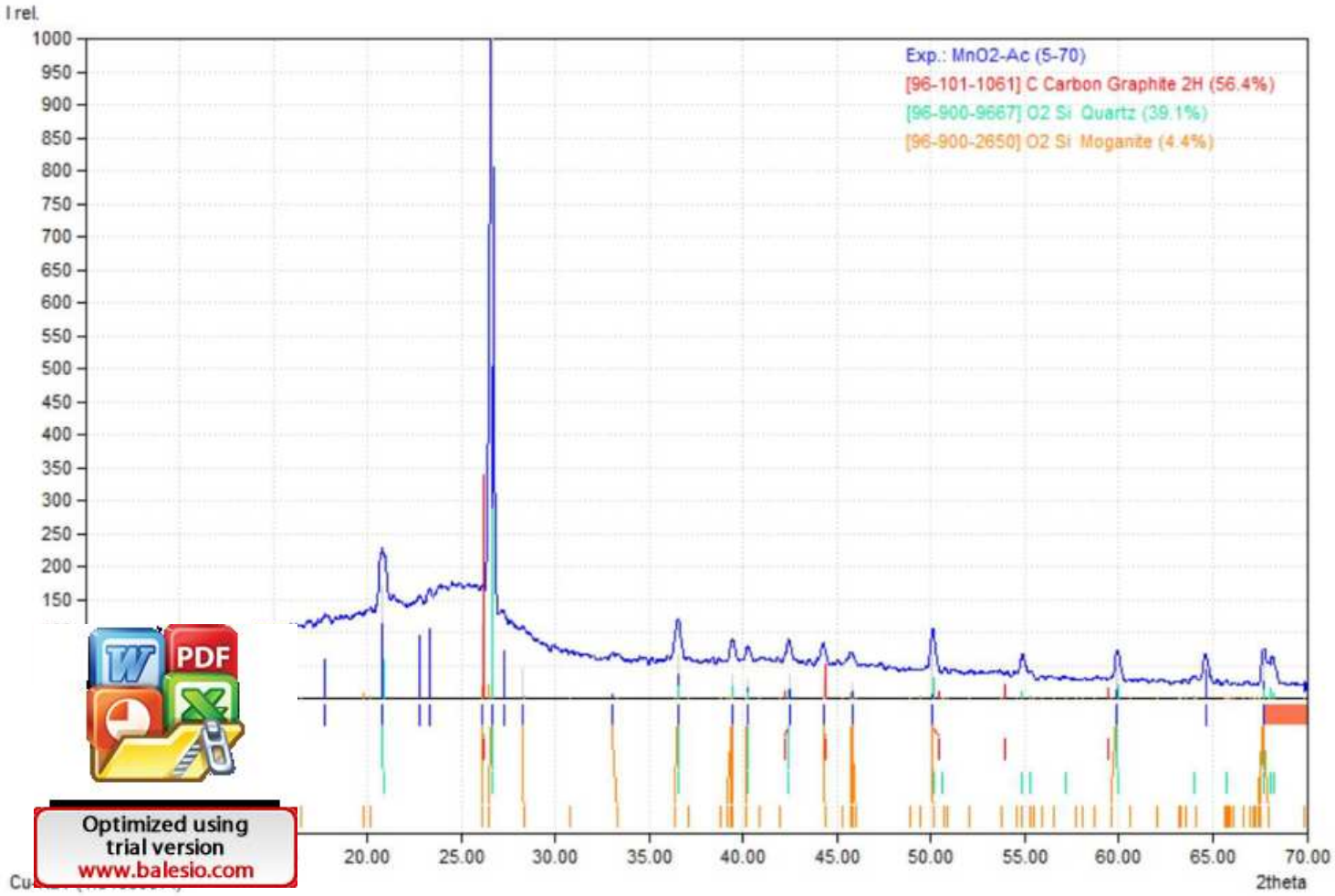
Based on calculated profile

Profile area	***Counts***	***Amount***
Overall diffraction profile	335086	100.00%
Background radiation	221454	66.09%
Diffraction peaks	113631	33.91%
Peak area belonging to selected phases	56976	17.00%
Peak area of phase A (Carbon Graphite 2H)	*22615*	*6.75%*
Peak area of phase B (Quartz)	*29940*	*8.94%*
Peak area of phase C (Moganite)	*4421*	*1.32%*
Unidentified peak area	56655	16.91%

Peak Residuals

Peak data	***Counts***	***Amount***
Overall peak intensity	4354	100.00%
Peak intensity belonging to selected phases	868	19.94%
Unidentified peak intensity	3486	80.06%

Diffraction Pattern Graphics



APPENDICE 5 CALORIFIC VALUE ANALYSIS RESULTS

LABORATORIUM MOTOR BAKAR
DEPARTEMEN TEKNIK MESIN
UNIVERSITAS HASANUDDIN
FAKULTAS TEKNIK

Jalan Poros Malino Km.6 Bontomarannu (92171) Gowa Sulawesi Selatan
Telp. (0411) 586015, 586162 Fax (0411) 586015

SURAT KETERANGAN HASIL ANALISIS SAMPEL

Nomor : 02/LMB-FT/UH/2024

Pengirim	: Gabriel Wendiarto Wiliam
NIM	: D111201033
Parameter Uji	: Nilai Kalor
Peralatan	: Bomb Kalorimeter
Jenis Sampel	: Batubara
Tanggal Uji	: 4 - 8 Maret 2024

No.	Kode Sampel	Nilai Kalor (Kalori/Gram)
1	U0 WO CO	5.207
2	U1 W1C1	5.544
3	U1 W2 C1	5.692
4	U1 W2 C2	5.715
5	U1 W2 C3	5.687
6	U1 W3 C1	5.835
7	U2 W2 C1	5.720
8	U3 W2 C1	5.729
9	U4 W2 C1	5.752

Gowa, 14 Maret 2024
Kepala Laboratorium Motor Bakar,

Prof.Dr.Eng. A. Erwin Eka Putra,S.T., M.T.
NIP. 19711221 199802 1 001

LABORATORIUM MOTOR BAKAR
DEPARTEMEN TEKNIK MESIN
UNIVERSITAS HASANUDDIN
FAKULTAS TEKNIK

Jalan Poros Malino Km.6 Bontomarannu (92171) Gowa Sulawesi Selatan
Telp. (0411) 586015, 586162 Fax (0411) 586015

Lampiran

HASIL PENGUJIAN

No	Kode Sampel	Data Pengujian		Foto Hasil Pengujian
1	U0 WO CO	waktu	ΔT	
		6		
		7	0	
		8	0.01	
		9	0	
		10	0	
		11	0.99	
		12	0.33	
		13	0.07	
		14	0.02	
		15	0	
		16	0	
		17	0	
		18	0	
		19	0	
		20	0	
2	U1 W1C1	waktu	ΔT	
		6		
		7	0	
		8	0	
		9	0	
		10	0	
		11	0.15	
		12	1.28	
		13	0.06	
		14	0.01	
		15	0	
		16	-0.01	
		17	0	
		18	0	
		19	0	
		20	0	

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3	U1 W2 C1	waktu ΔT 6 7 0 8 0 9 0 10 0 11 1.17 12 0.28 13 0.07 14 0.01 15 0.01 16 0 17 0 18 0 19 0 20 0	
4	U1 W2 C2	waktu ΔT 6 7 0.01 8 0.01 9 0.01 10 0 11 1.16 12 0.3 13 0.07 14 0.01 15 0.01 16 0.01 17 0 18 0 19 0 20 0	
5	U1 W2 C3	waktu ΔT 6 7 0 8 0 9 0.01 10 0 11 1.17 12 0.29 13 0.07 14 0.01	

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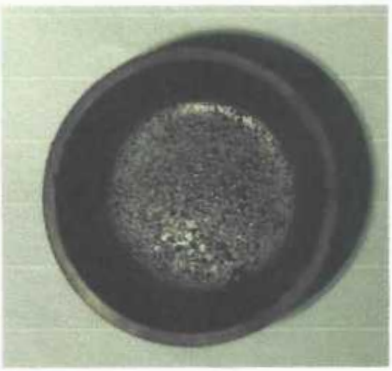
		15	0	
		16	0	
		17	0	
		18	0	
		19	0	
		20	0	
6	U1 W3 C1	waktu	ΔT	
		6		
		7	0.01	
		8	0	
		9	0	
		10	0	
		11	1.17	
		12	0.31	
		13	0.07	
		14	0.02	
		15	0.01	
		16	0	
		17	0	
		18	0	
		19	0	
		20	0	
7	U2 W2 C1	waktu	ΔT	
		6		
		7	0.01	
		8	0.01	
		9	0	
		10	0	
		11	1.18	
		12	0.3	
		13	0.06	
		14	0.01	
		15	0	
		16	0	
		17	0	
		18	0	
		19	0	
		20	0	

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8	U3 W2 C1	waktu ΔT 6 7 0 8 0 9 0 10 0 11 1.2 12 0.28 13 0.06 14 0.01 15 0 16 0 17 0 18 0 19 0 20 0	
9	U4 W2 C1	waktu ΔT 6 7 0.01 8 0 9 0 10 0 11 1.2 12 0.3 13 0.05 14 0.03 15 0 16 0 17 -0.01 18 0 19 -0.01 20 0	

APPENDICE 6 CONCULTATION CARD

Lampiran B 10

Kartu Konsultasi Tugas Akhir

JUDUL: Beneficiation Study of Coal from Bonehau, Mamuju Regency of West Sulawesi Province Using Column Flotation

(Konsultasi minimal 8 kali)

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
19/3/2024	- Perbaiki Judul - Perbaiki abstract - Perbaiki hasil dan Pembahasan - Perbaiki grammar	
1/4/2024	- tambahkan Persentase Peningkatan nilai kalori - Perbaiki grafik - tambahkan Persentase reduksi kadar abu	
2/4/2024	- Perbaiki Judul grafik - ganti kata addition jadi increase	
15/4/2024	- bimbingan terkait Poster - ganti template Jurnal	
17/4/2024	- Perbaiki abstrak Pada Jurnal	
18/4/2024	- Perbaiki metode Penelitian Pada Jurnal - Perbaiki grafik Pada angka titik dan koma	
20/4/2024	- Perbaiki grammar Past tense - Perbaiki format Pada Jurnal	
024	- Perbaiki kesimpulan ~~dan~~, tambah referensi dan daftar Pustaka.	

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
8/5/2024	- tambahkan Peta - gunakan kata yang lebih beragam - tambahkan kata-kata di gambar Poster	
30/5/2024	- Perbaiki gambar mikroskopis - Perbaiki kesimpulan	