















## **LAMPIRAN**







**Lampiran 1. Preparasi Awal**

No	Keterangan	Dokumentasi
1.	Proses pengambilan sampel sampah organik di TPST RDF Jeruk Legi Cilacap	
2.	Sampah organik dan tempurung kelapa	
3.	Proses pirolisis	
4.	Proses penghalusan	

5.	Proses pengayakan	
6.	Sampel 60 <i>mesh</i>	
7.	Sampel 100 <i>mesh</i>	
8.	Sampel 200 <i>mesh</i>	

**Lampiran 2.** Proses Pencetakan dan Pengeringan Briket





No	Keterangan	Dokumentasi
1.	Berat tempat kosong	
2.	Tempurung kelapa 60 mesh	
3.	Sampah organik 60 mesh	
4.	Tempurung kelapa 100 mesh	
5.	Sampah organik 100 mesh	
6.	Tempurung kelapa 200 mesh	






7.	Sampah organik 200 <i>mesh</i>	
8.	Perekat tepung tapioka 5 gram	
9.	Proses pencampuran	
10.	Proses pencetakan briket	
11.	Proses pengeringan briket menggunakan sinar matahari	
12.	Briket setelah pengeringan menggunakan oven	

### Lampiran 3. Dokumentasi Produk Briket






**Lampiran 4. Analisis Kadar Air**







No	Keterangan	Dokumentasi
1.	Kurs kosong 60 mesh	
2.	Tutup kurs kosong 60 mesh	
3.	Isi sampel 60 mesh	
4.	Setelah pemanasan menggunakan oven	







5.	Kurs kosong 100 <i>mesh</i>	
6.	Tutup kurs 100 <i>mesh</i>	
7.	Isi sampel 100 <i>mesh</i>	
8.	Setelah pemanasan menggunakan oven	
9.	Kurs kosong 200 <i>mesh</i>	








10.	Tutup kurs 200 <i>mesh</i>	
11.	Isi sampel 200 <i>mesh</i>	
12.	Setelah pemanasan menggunakan oven	





**Lampiran 5. Analisis Kadar Abu**

No	Keterangan	Dokumentasi
1.	Kurs kosong 60 mesh	
2.	Tutup kurs 60 mesh	
3.	Isi sampel 60 mesh	
4.	Setelah pemanasan menggunakan furnace	
5.	Kurs kosong 100 mesh	
6.	Tutup kurs 100 mesh	





7.	Isi sampel 100 <i>mesh</i>	
8.	Setelah pemanasan menggunakan <i>furnace</i>	
9.	Kurs kosong 200 <i>mesh</i>	
10.	Tutup kurs 200 <i>mesh</i>	
11.	Isi sampel 200 <i>mesh</i>	
12.	Setelah pemanasan menggunakan <i>furnace</i>	

**Lampiran 6. Analisis Kadar Zat Mudah Menguap**

No	Keterangan	Dokumentasi
1.	Kurs kosong 60 mesh	
2.	Isi sampel 60 mesh	
3.	Setelah pemanasan menggunakan furnace	
4.	Kurs kosong 100 mesh	
5.	Isi sampel	

6.	Setelah pemanasan menggunakan furnace	
7.	Kurs kosong 200 mesh	
8.	Isi sampel 200 mesh	
9.	Setelah pemanasan menggunakan furnace	

**Lampiran 7. Pengujian Nilai Kalor**

No	Keterangan	Dokumentasi												
1.	Sampel kurang dari 1 g													
2.	Preparasi sampel ke dalam komponen bom kalorimeter													
3.	Hasil nilai kalor													
4.	Data nilai kalor	 <table border="1" data-bbox="853 1400 1220 1601"> <thead> <tr> <th>Id</th> <th>Weight</th> <th>Result</th> <th>Vessel</th> </tr> </thead> <tbody> <tr> <td>sample 10..</td> <td>0.81630</td> <td>6880</td> <td>cal/g 10063</td> </tr> <tr> <td>sample 60..</td> <td>0.81720</td> <td>6891</td> <td>cal/g 10063</td> </tr> </tbody> </table>	Id	Weight	Result	Vessel	sample 10..	0.81630	6880	cal/g 10063	sample 60..	0.81720	6891	cal/g 10063
Id	Weight	Result	Vessel											
sample 10..	0.81630	6880	cal/g 10063											
sample 60..	0.81720	6891	cal/g 10063											

### Lampiran 8. Perhitungan Kadar Air

- 60 mesh :

$$\text{Kadar Air (\%)} = \frac{(m_0 + m_1) - m_2}{m_1} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{(42,5610 \text{ g} + 0,9997 \text{ g}) - 43,5468 \text{ g}}{0,9997 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{43,5607 \text{ g} - 43,5468 \text{ g}}{0,9997 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{0,0139 \text{ g}}{0,9997 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \mathbf{1,39 \%}$$

- 100 mesh

$$\text{Kadar Air (\%)} = \frac{(m_0 + m_1) - m_2}{m_1} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{(45,9183 \text{ g} + 1,0006 \text{ g}) - 46,8985 \text{ g}}{1,0006 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{46,9185 \text{ g} - 46,8985 \text{ g}}{1,0006 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{0,0204 \text{ g}}{1,0006 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \mathbf{2,03 \%}$$

- 200 mesh

$$\text{Kadar Air (\%)} = \frac{(m_0 + m_1) - m_2}{m_1} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{(45,7006 \text{ g} + 1,0003 \text{ g}) - 46,6717 \text{ g}}{1,0003 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{46,7009 \text{ g} - 46,6717 \text{ g}}{1,0003 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \frac{0,0292 \text{ g}}{1,0003 \text{ g}} \times 100\%$$

$$\text{Kadar Air (\%)} = \mathbf{2,91 \%}$$

### Lampiran 9. Perhitungan Kadar Abu

- 60 mesh :

$$\text{Kadar Abu (\%)} = \frac{\text{kurs setelah furnace} - \text{kurs kosong}}{\text{berat sampel}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \frac{43,5810 \text{ g} - 43,4573 \text{ g}}{2,0009 \text{ g}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \frac{0,1237 \text{ g}}{2,0009 \text{ g}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \mathbf{6,18\%}$$

- 100 mesh

$$\text{Kadar Abu (\%)} = \frac{\text{kurs setelah furnace} - \text{kurs kosong}}{\text{berat sampel}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \frac{45,7743 \text{ g} - 45,6742 \text{ g}}{2,0007 \text{ g}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \frac{0,1001 \text{ g}}{2,0007 \text{ g}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \mathbf{5\%}$$

- 200 mesh

$$\text{Kadar Abu (\%)} = \frac{\text{kurs setelah furnace} - \text{kurs kosong}}{\text{berat sampel}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \frac{46,0119 \text{ g} - 45,8922 \text{ g}}{2,0005 \text{ g}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \frac{0,1197 \text{ g}}{2,0005 \text{ g}} \times 100\%$$

$$\text{Kadar Abu (\%)} = \mathbf{5,98\%}$$



### Lampiran 10. Perhitungan Kadar Zat Mudah Menguap

- 60 mesh :

$$\text{Kadar Volatile (\%)} = \frac{(m_0 + m_1) - m_2}{m_1} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{(47,4932 \text{ g} + 2,0007 \text{ g}) - 48,3855 \text{ g}}{2,0007 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{49,4939 \text{ g} - 48,3855 \text{ g}}{2,0007 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{1,1084 \text{ g}}{2,0007 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \mathbf{55,4 \%}$$

- 100 mesh

$$\text{Kadar Volatile (\%)} = \frac{(m_0 + m_1) - m_2}{m_1} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{(46,1663 \text{ g} + 2,0001 \text{ g}) - 47,0526 \text{ g}}{2,0001 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{48,1664 \text{ g} - 47,0526 \text{ g}}{2,0001 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{1,1138 \text{ g}}{2,0001 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \mathbf{55,6 \%}$$

- 200 mesh

$$\text{Kadar Volatile (\%)} = \frac{(m_0 + m_1) - m_2}{m_1} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{(44,5755 \text{ g} + 2,0003 \text{ g}) - 45,4612 \text{ g}}{2,0003 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{46,5758 \text{ g} - 45,4612 \text{ g}}{2,0003 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \frac{1,1146 \text{ g}}{2,0003 \text{ g}} \times 100\%$$

$$\text{Kadar Volatile (\%)} = \mathbf{55,7 \%}$$

### Lampiran 11. Perhitungan Kadar Karbon Tetap

- 60 mesh :

$$\text{Nilai FC} = 100 \% - (\% \text{ kadar air} + \% \text{ volatile} + \% \text{ kadar abu})$$

$$\text{Nilai FC} = 100 \% - (1,39 \% + 55,4 \% + 6,18 \%)$$

$$\text{Nilai FC} = 100 \% - 62,97 \%$$

$$\text{Nilai FC} = \mathbf{37,03 \%}$$

- 100 mesh

$$\text{Nilai FC} = 100 \% - (\% \text{ kadar air} + \% \text{ volatile} + \% \text{ kadar abu})$$

$$\text{Nilai FC} = 100 \% - (2,03 \% + 55,6 \% + 5 \%)$$

$$\text{Nilai FC} = 100 \% - 62,63 \%$$

$$\text{Nilai FC} = \mathbf{37,37 \%}$$

- 200 mesh

$$\text{Nilai FC} = 100 \% - (\% \text{ kadar air} + \% \text{ volatile} + \% \text{ kadar abu})$$

$$\text{Nilai FC} = 100 \% - (2,91 \% + 55,7 \% + 5,98 \%)$$

$$\text{Nilai FC} = 100 \% - 62,59 \%$$

$$\text{Nilai FC} = \mathbf{37,41 \%}$$

## Lampiran 12. Sertifikat Analisis Kadar Klorin



F-LP-413.3 Rev.0

KEMENTERIAN ENERGI DAN SUMBER DAYA MINERAL REPUBLIK INDONESIA  
DIREKTORAT JENDERAL MINERAL DAN BATUBARA  
BALAI BESAR PENGUJIAN MINERAL DAN BATUBARA *tekMIRA*  
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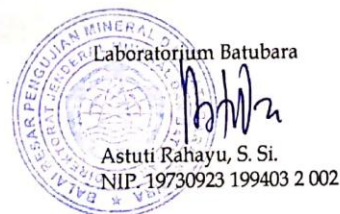
e-mail : laboratorium.tekmira@esdm.go.id

Nomor: 0379/LBB/III/2024

28 Maret 2024

### SERTIFIKAT ANALISIS CERTIFICATE OF ANALYSIS

Dibuat untuk : MUKHAMMAD RAZAK NUR FADHIL  
*Certified for*  
Jenis contoh : Briket Ukuran 60 mesh, 100 mesh & 200 mesh  
*Type of sample*  
Sifat / Kondisi Barang yang diuji : Halus  
*Description of sample*  
Asal contoh : -  
*Origin of sample*  
Jumlah contoh : 3 (tiga)  
*Amount of sample*  
Nomor laboratorium : 1854 - 1856/2024  
*Laboratory number*  
Contoh diterima : 25 Maret 2024  
*Sample received on*  
Tanggal Selesai Analisis : 27 Maret 2024  
*Date of analysis*  
Hasil analisis : Hasil Analisis Terlampir  
*Analysis results*



1 dari 2

**Catatan : 1. Hasil Pengujian/analisis ini hanya berlaku untuk contoh yang diuji**

Notes The analysis result are valid only for the tested samples

**2. Sertifikat tidak boleh diperbanyak (digandakan) tanpa izin dari Pengendali Teknis**

The certificate cannot be reproduced without a written permission from the Technical Controller

Tanggal Penerbitan/Revisi : 08-07-2022/-

Lampiran Sertifikat Nomor : 0379/LBB/III/2024

**HASIL ANALISIS / ANALYSIS RESULT:**

No	No. Lab	Sample Marks	Chlorine	STANDARD METHODE MENGACU KE
			%,adb	
1	1854/24	A1 (60 mesh)	0,24	ISO D587-2020 (E)
2	1855/24	A2 (100 mesh)	0,24	
3	1856/24	A3 (200 mesh)	0,48	

Laboratorium Batubara,



Astuti Rahayu, S. Si.

NIP. 19730923 199403 2 002

2 dari 2

**Catatan : 1. Hasil Pengujian/analisis ini hanya berlaku untuk contoh yang diuji**

Notes The analysis result are valid only for the tested samples

**2. Sertifikat tidak boleh diperbanyak (digandakan) tanpa izin dari Pengendali Teknis**

The certificate cannot be reproduced without a written permission from the Technical Controller

Tanggal Penerbitan/Revisi : 08-07-2022/-

Lampiran 13. Perhitungan Kadar *Hardgove Grindability Index* (HGI)

V

DETERMINATION OF HARDGROVE GRINDABILITY INDEX

REFERENCE NO : \_\_\_\_\_ REFERENCE METHOD : - ISO 5074:  
 SAMPEL ID : \_\_\_\_\_ DATE OF TEST : -ASTMD409/D409M-  
 : May 7, 2024

AIR - DRYING			
Air-dry pan mass (a) :	184.45 g	Ambient Temp :	26 °C
Initial sample & air-dry pan mass (b) :	857.80 g	Time to oven :	18:00
Final sample & air-dry pan mass (c) :	837.93 g	Time out of oven :	12:00
Air-dried sample mass (c - a) (d) :	653.48 g	Temperatur :	40 °C
Mass loss on drying, (b - c) (e) :	19.87 g	Heat on at :	
Initial sample mass, (b - a) (f) :	673.35 g	Heat off at :	
% Mass loss on drying, (e/f x 100%) (g) :	2.95 %	Fan on at :	
		Fan off at :	
INITIAL SIEVED MASSES			
+ 4.75 mm (+ No. 4) (h) :	4.78 g	1.18 x 0.600 mm (No. 16 x 30) (k) :	202.13 g
4.75 x 2.36 mm (no. 4 x 8) (i) :	34.15 g	- 0.600 (-No.30) (l) :	175.45 g
2.36 x 1.18 mm (No. 8 x 16) (j) :	234.12 g	Top Size :	4.75
Total recovered mass after sieving (h + i + j + k + l) (m) :	650.63 g	pan pating bawah	
Mass loss on sieving, d - m (n) :	2.85 g		
% Mass loss on sieving, (n/d) x 100% (o) :	0.44 %		
REDUCTION OF +1.18 mm (+ No. 16)			
Mass, +1.18 mm (+ No. 16)		Mass, +1.18 mm (+ No. 16)	
Initially, h + i + j (p) :	273.05 g	> 5th crushing of oversize, (u) :	g
< - > 1st crushing of oversize, (q) :	243.11 g	> 6th crushing of oversize, (v) :	g
> 2nd crushing of oversize, (r) :	182.14 g	> 7th crushing of oversize, (w) :	g
> 3rd crushing of oversize, (s) :	78.46 g	> 8th crushing of oversize, (x) :	g
> 4th crushing of oversize, (t) :	0.00 g	> 9th crushing of oversize, (y) :	g
Final total mass of 1.18 x 0.600 mm (A) :	337.15 g	Loss on crushing, (m-C) (D) :	2.04 g
Final total mass of -0.600 mm (B) :	311.44 g	% Loss on crushing, (D/d) x 100% (E) :	0.31 %
Final total recovered mass, (A+B) (C) :	648.59 g	% Yield of 1,18 x 0,600 mm, (A/d) x 100% (F) :	51.59 %
DEDUSTING 120 g OF 1,18 x 0,60 mm (No. 16 x No. 30) and MILING			
Mass of 1.18 x 0.60 mm dedusted sample placed into HGI bowl (G) :	50.00 g	Number of revolutions (I) :	60.00 g
No. of increments collected (H) :		Second to mill, (J) :	168.00 sec

DETERMINATION OF HARDGROVE GRINDABILITY INDEX

Start position :		RPM, (1/160) :	21.43	RPM
Stop position :		Start time :	10.00	
		Stop time :	10.03	
SIEVING OF MILLED PRODUCT (TEST 1)				
Tare mass of catch pan, (L) :	409.81 g	Mass of -75 µm (-No 200)sieve (N-L), (P) :	6.22	g
Tare mass of 75 µm (No. 200)sieve (M) :	282.71 g	Mass of +75 µm (+ No 200)sieve (O-M), (Q) :	43.67	g
Mass of catch pan and -75 µm (-No. 200)sieve (N) :	416.03 g	Total recover, (P + Q), (R) :	49.89	g
Mass of 75 µm (No. 200) sieve and +75 µm (+ No. 200)sieve (O) :	326.38 g	Loss (≤ 0.50 g), (G - R), (S) :	0.11	g
Calculated mass of -75 µm (-No.200) , (G-Q) (T) :	6.33 g			
SIEVING OF MILLED PRODUCT (TEST 2)				
Tare mass of catch pan, (L) :	408.45 g	Mass of -75 µm (-No 200)sieve (N-L), (P) :	6.16	g
Tare mass of 75 µm (No. 200)sieve (M) :	282.05 g	Mass of +75 µm (+ No 200)sieve (O-M), (Q) :	43.71	g
Mass of catch pan and -75 µm (-No. 200)sieve (N) :	414.61 g	Total recover, (P + Q), (R) :	49.87	g
Mass of 75 µm (No. 200) sieve and +75 µm (+ No. 200)sieve (O) :	325.76 g	Loss (≤ 0.50 g), (G - R), (S) :	0.13	g
Calculated mass of -75 µm (-No.200) , (G-Q) (T) :	6.29 g			
ANALYTICAL RESULTS				
Hgi Formula (from Least Square Regression) :	Y=12,9773 + 6.8404 (T)			
	(TEST 1)	(TEST 2)	Average	
HGI (U) :	56.30	55.98	56	
% moisture on 1.18 x 0.600 mm material :	%	%	%	

\* If difference test result A and B (duplo) > 3 index, analyze must be retest (ASTM D409/D409M-16 dan ISO 5074:2015)

Analyzed by :	Verified by :
Date :	Date :

## Lampiran 14. Biodata Penulis



Nama : Mukhammad Razak Nur Fadhil  
Tempat, tanggal lahir : Brebes, 13 September 2002  
NPM : 200107019  
Jurusan : Rekayasa Mesin dan Industri Pertanian  
Prodi : D4- Teknik Pengendalian Pencemaran Lingkungan  
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e-mail : m.razaknurfadhil@gmail.com  
Hobi : Futsal dan badminton

**Riwayat Pendidikan :**

- SD Negeri 02 Bumiayu : Tahun 2008-2014
- SMP Negeri 1 Paguyangan : Tahun 2014-2017
- SMA Islam Ta'allumul Huda Bumiayu : Tahun 2017-2020