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LAMPIRAN 1

GAMBAR ALAT PENELITIAN

1. Galon air 19 liter

2. Selang gas

3. Cat dop hitam

4. Ring gas

5. Gelas ukur

6. Kayu pengaduk

7. Solder listrik

8. Bor listrik

9. Lem *dextone*

10. Ember

11. Timbangan

12. *Soil analyzer* 4 in 1

13. *Stopwatch*

LAMPIRAN 2

GAMBAR BAHAN PENELITIAN

1. Limbah kotoran sapi

2. Ampas tebu

3. Air

4. EM4

LAMPIRAN 3
DOKUMENTASI PENELITIAN

I. Pembuatan Biogas

1. Kotoran sapi disiapkan sebanyak 4 kg

2. Masukkan air sebanyak 4 liter dengan pencampuran kotoran sapi dengan 1:1

3. Lakukan pengadukan pada kotoran sapi hingga bahan semua tercampur

4. Sebelum pencampuran bahan dilakukan terlebih dahulu proses penjemuran ampas tebu

5. Setelah sudah kering lakukan proses penghalusan menggunakan blender hingga menjadi buliran ampas tebu yang halus

6. Setelah semua bahan tercampur masukkan kedalam reaktor berupa galon 19 liter untuk melalui proses fermentasi

II. Pengujian Biogas

1. Pengujian pH

2. Pengujian Suhu

III. Pengujian Nyala Api

1. Perlakuan I

   - Hari ke-14

- Hari ke-21

- Hari ke-28

2. Perlakuan II
   - Hari ke-14

   - Hari ke-21

- Hari ke-28

LAMPIRAN 4

DATA HASIL PENGUJIAN pH, Suhu, dan Metana

I. Pengujian Ph

1. Pengujian pH Perlakuan I

Tabel Pengujian pH Pada Perlakuan I

Waktu (Hari)	pH			Nilai rata-rata
	Reaktor 1	Reaktor 2	Reaktor 3	
1	7,0	7,0	7,0	7
2	7,0	7,0	7,0	7
3	7,0	7,0	7,0	7
4	7,0	7,0	7,0	7
5	7,0	6,5	7,0	6,8
6	7,0	7,0	7,0	7
7	7,0	6,5	6,5	6,6
8	6,5	6,5	6,5	6,5
9	6,5	6,5	6,0	6,3
10	6,0	6,0	6,0	6
11	6,5	5,5	6,0	6
12	6,0	6,5	5,5	6,1
13	6,0	6,0	6,0	6
14	6,0	6,0	6,0	6
15	6,5	6,0	6,0	6,1
16	6,5	5,5	6,5	6,1
17	6,0	6,5	6,5	6,3
18	5,5	6,5	6,5	6,1
19	6,5	6,0	6,0	6,1
20	6,5	6,0	6,5	6,3
21	6,5	6,0	6,5	6,3
22	6,5	6,5	6,5	6,5
23	6,5	7,0	6,5	6,6

24	6,5	7,0	6,5	6,6
25	6,5	7,0	6,5	6,6
26	6,5	7,0	6,5	6,6
27	6,5	7,0	6,5	6,6
28	7,0	7,0	7,0	7

2. Pengujian pH Perlakuan II

Tabel Pengujian pH Pada Perlakuan II

Waktu (Hari)	Ph			Nilai rata-rata
	Reaktor 1	Reaktor 2	Reaktor 3	
1	6,0	6,5	6,0	6,1
2	5,5	7,0	6,5	6,3
3	6,0	6,5	6,0	6,1
4	6,0	6,5	6,0	6,1
5	6,0	6,0	6,0	6
6	6,0	6,0	6,5	6,1
7	6,5	6,0	6,0	6,1
8	5,5	6,5	6,0	6
9	5,0	6,0	5,5	5,5
10	5,0	5,5	5,5	5,3
11	5,0	6,0	5,0	5,3
12	5,0	6,0	5,0	5,3
13	5,0	5,0	5,0	5
14	5,0	6,0	5,0	5,3
15	5,0	5,0	5,0	5
16	5,0	6,5	5,0	5,5
17	5,0	6,0	5,5	5,5
18	5,0	5,5	5,0	5,1
19	5,0	5,0	5,0	5
20	5,0	5,0	5,0	5

21	5,0	6,0	5,0	5,3
22	5,0	5,5	5,0	5,1
23	4,5	5,5	5,0	5
24	4,0	6,0	5,0	5
25	4,0	6,0	5,0	5
26	4,5	6,0	5,0	5,1
27	4,0	6,0	5,0	5
28	4,0	6,0	5,0	5

I. Pengujian Suhu

1. Pengujian Suhu Perlakuan I

Tabel Pengujian Suhu Perlakuan I

Waktu (Hari)	Suhu (°C)			Nilai rata-rata
	Reaktor 1	Reaktor 2	Reaktor 3	
1	29	29	29	29
2	30	30	30	30
3	29	29	29	29
4	29	29	29	29
5	29	29	29	29
6	29	29	29	29
7	29	29	29	29
8	30	29	30	29,6
9	29	29	30	29,3
10	29	29	29	29
11	29	29	29	29
12	29	29	29	29
13	29	29	30	29,3
14	30	30	30	30
15	29	29	30	29,3
16	29	29	29	29

17	29	29	29	29
18	29	29	29	29
19	29	29	29	29
20	29	29	29	29
21	29	28	29	28,6
22	28	28	29	28,3
23	28	28	29	28,3
24	29	29	29	29
25	28	28	29	28,3
26	29	29	29	29
27	28	28	29	28,3
28	28	28	28	28

2. Pengujian Suhu Perlakuan II

Tabel Pengujian Suhu Perlakuan II

Waktu (Hari)	Suhu (°C)			Nilai rata-rata
	Reaktor 1	Reaktor 2	Reaktor 3	
1	29	30	29	29,3
2	30	30	29	29,6
3	29	30	29	29,3
4	29	30	29	29,3
5	29	30	29	29,3
6	29	30	29	29,3
7	29	30	29	29,3
8	29	30	29	29,3
9	29	30	29	29,3
10	29	30	29	29,3
11	29	30	29	29,3
12	29	30	29	29,3
13	29	30	29	29,3

14	30	30	29	29,6
15	29	30	29	29,3
16	29	30	29	29,3
17	29	30	29	29,3
18	29	30	29	29,3
19	29	30	29	29,3
20	29	30	28	29
21	29	30	28	29
22	28	29	28	28,3
23	28	29	28	28,3
24	29	30	29	29,3
25	29	29	28	28,6
26	29	30	29	29,3
27	28	29	29	28,6
28	28	29	28	28,3

3. Pengujian Metana

Pengujian metana pada setiap perlakuan

Tabel Pengujian Metana Pada Setiap Perlakuan

Perlakuan	Waktu (Hari)	Konsentrasi Metana (%)
Perlakuan I	14	25,85
	21	55,05
	28	63,94
Perlakuan II	14	7,02
	21	4,69
	28	10,60

Data pengujian metana dapat dihitung menggunakan rumus sebagai berikut :

$$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

Dimana :

C = Konsentrasi (%)

A = Luas area

Std = Standard

Spl = Sampel

a. Hari ke-7

- Perlakuan I (reaktor 1)

  Dik :

  C_{std} = 99,99% ➔ 0,9999

  A_{std} = 96.660.440

  A_{spl} = 24.986.822

  Dit : C_{spl} ?

  Penyelesaian :

  $$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

  $$C_{spl} = \frac{A_{spl} \text{ x } C_{std}}{A_{std}}$$

  $$= \frac{24.986.822 \text{ X } 0,9999}{96.660.440}$$

  $$= \frac{24.984.323,3}{96.660.440}$$

  = 0,258475166

  = 25%

- Perlakuan II (reaktor 1)

  Dik :

  C_{std} = 99,99% ➔ 0,9999

  A_{std} = 96.660.440

  A_{spl} = 6.791.817

  Dit : C_{spl} ?

Penyelesaian :

$$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

$$C_{spl} = \frac{A_{spl} \text{ x } C_{std}}{A_{std}}$$

$$= \frac{6.791.817 \text{ X } 0{,}9999}{96.660.440}$$

$$= \frac{6.791.137{,}82}{96.660.440}$$

= 0,0702576754

= 7%

b. Hari ke-21

- Perlakuan I (reaktor 2)

Dik :

C_{std} = 99,99% ➔ 0,9999

A_{std} = 96.660.440

A_{spl} = 53.221.036

Dit : C_{spl} ?

Penyelesaian :

$$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

$$C_{spl} = \frac{A_{spl} \text{ x } C_{std}}{A_{std}}$$

$$= \frac{53.221.036 \text{ X } 0{,}9999}{96.660.440}$$

$$= \frac{53.215.713{,}9}{96.660.440}$$

= 0,550542848

= 55%

- Perlakuan II (reaktor 2)

Dik :

C_{std} = 99,99% ➔ 0,9999

A_{std} = 96.660.440

A_{spl} = 4.535.900

Dit : C_{spl} ?

Penyelesaian :

$$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

$$C_{spl} = \frac{A_{spl} \text{ x } C_{std}}{A_{std}}$$

$$= \frac{4.535.900 \text{ X } 0,9999}{96.660.440}$$

$$= \frac{4.535.446,41}{96.660.440}$$

= 0,0469214335

= 4%

c. Hari ke-28

- Perlakuan I (reaktor 3)

Dik :

C_{std} = 99,99% ➔ 0,9999

A_{std} = 96.660.440

A_{spl} = 61.809.580

Dit : C_{spl} ?

Penyelesaian :

$$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

$$C_{spl} = \frac{A_{spl} \text{ x } C_{std}}{A_{std}}$$

$$= \frac{61.809.580 \text{ X } 0,9999}{96.660.440}$$

$$= \frac{61.803.3999}{96.660.440}$$

= 0,639386692

= 63%

- Perlakuan II (reaktor 3)

  Dik :

  C_{std} = 99,99% ➔ 0,9999

  A_{std} = 96.660.440

  A_{spl} = 10.245.297

  Dit : C_{spl} ?

  Penyelesaian :

  $$\frac{A_{std}}{C_{std}} = \frac{A_{spl}}{C_{spl}}$$

  $$C_{spl} = \frac{A_{spl} \text{ x } C_{std}}{A_{std}}$$

  $$= \frac{10.245.297 \text{ X } 0,9999}{96.660.440}$$

  $$= \frac{10.244.272,5}{96.660.440}$$

  = 0,105982059

  = 10%

LAMPIRAN 5

HASIL UJI GAS CHROMATOGHRAPHY

LABORATORIUM TERPADU
PENGUJIAN DAN KALIBRASI
UNIVERSITAS ISLAM INDONESIA

Gedung Lab Terpadu
Jl. Kaliurang Km 14,5 Yogyakarta
(0274)898444 ext. 4027
http://labterpadu.uii.ac.id
lab.terpadu@uii.ac.id

Nomor : 15451123B/LT-UII/XII/2023
Number

HASIL PENGUJIAN
TEST RESULT

No	Label Pelanggan	Label Lab. Terpadu	Parameter	Hasil Uji	Satuan	Metode
1	KS (1)	15451123-1	CH_4	25,85	%	Kromatografi Gas
2	KS (2)	15451123-2	CH_4	55,05	%	Kromatografi Gas
3	KS (3)	15451123-3	CH_4	63,94	%	Kromatografi Gas
4	KS + AT (1)	15451123-4	CH_4	7,026	%	Kromatografi Gas
5	KS + AT (2)	15451123-5	CH_4	4,692	%	Kromatografi Gas
6	KS + AT (3)	15451123-6	CH_4	10,60	%	Kromatografi Gas
7	Standard CH_4	15451123-7	CH_4	99,99	%	Kromatografi Gas

Yogyakarta 15 Desember 2023
Koordinator Teknis

Thorikul Huda, S.Si., M.Sc.
NIP. 052316003

Catatan : 1. Hasil pengujian ini hanya berlaku untuk sampel yang diuji
Notes *The results are available exclusively to the tested samples*
2. Sertifikat ini hanya dapat digandakan secara utuh
The certificate can be reproduced (copied) only for all this reported sheets
3. Pengambilan sampel diluar tanggung jawab Laboratorium Terpadu UII
The Integrated Laboratory of UII disclaimes all responsibility for the sampling

LABORATORIUM TERPADU
PENGUJIAN DAN KALIBRASI
UNIVERSITAS ISLAM INDONESIA

Gedung Lab Terpadu
Jl. Kaliurang Km 14,5 Yogyakarta
(0274)898444 ext. 4027
http://labterpadu.uii.ac.id
lab.terpadu@uii.ac.id

No. Dok : Form-37.P/Sert. Uji Rev. 1
Tgl. Terbit : 21 September 2023

Nomor : 15451123B/LT-UII/XII/2023
Number

SERTIFIKAT PENGUJIAN
Certificate of Testing

Dibuat untuk : Siti Khairani Br Sinaga
Certified to

Jenis/Nama Sampel : Gas/ Gas
Type/Name of sample

Asal Sampel : Universitas Islam Negeri Sumatera Utara
Origin of sample

Jumlah Sampel : 7
Amount of sample

Kode Sampel : 15451123/G/L.T.-UII/2023
Sample code

Parameter : CH_4
Parameters

Tanggal Pengambilan Sampel : -
Sample taken on

Tanggal Penerimaan Sampel : 05 Desember 2023
Sample received on

Tanggal Pengujian Sampel : 13 Desember 2023
Sample tested on

LABORATORIUM TERPADU
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UNIVERSITAS ISLAM INDONESIA

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lab.terpadu@uii.ac.id

No. Dok : Form-37.P/Sert. Uji Rev. 0
Tgl. Terbit : 15 Desember 2023

Nomor : 15451123B/LTUII/XII/2023
Number

SERTIFIKAT PENGUJIAN
Certificate of Testing

Dibuat untuk *Certified to*	: Siti Khairani Br Sinaga
Jenis/Nama Sampel *Type/Name of sample*	: Gas (KS (1)); Gas (KS (2)); Gas (KS (3)); Gas (KS + AT (1)); Gas (KS + AT (2)); Gas (KS + AT (3)); Gas (Standard CH4)
Asal Sampel *Origin of sample*	: Universitas Islam Negeri Sumatera Utara
Jumlah Sampel *Amount of sample*	: 1; 1; 1; 1; 1; 1; 1
Kode Sampel *Kode Sampel*	: 15451123/G/LTUII/1; 15451123/G/LTUII/2; 15451123/G/LTUII/3; 15451123/G/LTUII/4; 15451123/G/LTUII/5; 15451123/G/LTUII/6; 15451123/G/LTUII/7
Parameter *Parameters*	: CH4; CH4; CH4; CH4; CH4; CH4; CH4
Tanggal Pengambilan Sampel *Sample taken on*	: 20 Desember 2023
Tanggal Penerimaan Sampel *Sample received on*	: 5 Desember 2023
Tanggal Pengujian Sampel *Sample tested on*	: 13 Desember 2023

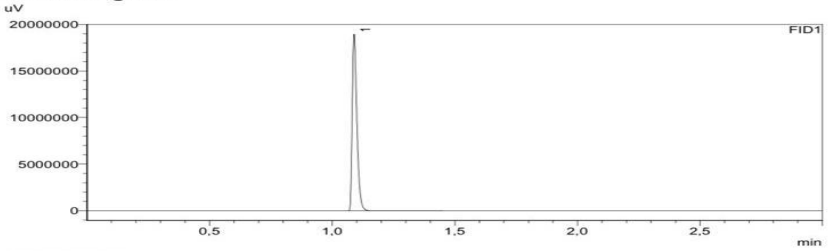
I. Perlakuan I

SHIMADZU LabSolutions **Analysis Report**

<Sample Information>

Sample Name	: KS (1)		
Sample ID	: 15451123-1		
Data Filename	: 15451123-1 i.gcd		
Method Filename	: 15451123_methana.gcm		
Batch Filename	: 15451123.gcb		
Vial #	: 1	Sample Type	: Unknown
Injection Volume	: 200 uL		
Date Acquired	: 12/13/2023 10:25:05 AM	Acquired by	: System Administrator
Date Processed	: 12/13/2023 11:02:41 AM	Processed by	: System Administrator

<Chromatogram>



<Peak Table>

FID1

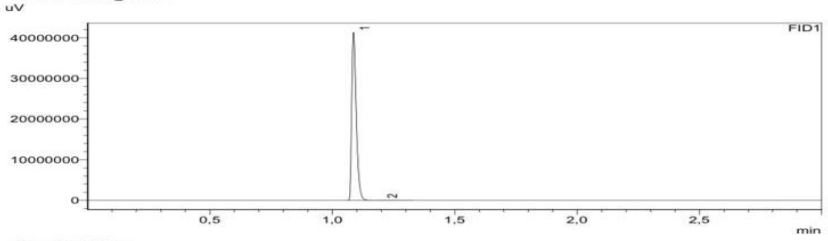
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	1,090	24986822	18619280	25,848	%	S	Methane
Total		24986822	18619280				

SHIMADZU LabSolutions **Analysis Report**

<Sample Information>

Sample Name	: KS (2)		
Sample ID	: 15451123-2		
Data Filename	: 15451123-2.gcd		
Method Filename	: 15451123_methana.gcm		
Batch Filename	: 15451123.gcb		
Vial #	: 1	Sample Type	: Unknown
Injection Volume	: 200 uL		
Date Acquired	: 12/13/2023 9:58:39 AM	Acquired by	: System Administrator
Date Processed	: 12/13/2023 11:02:42 AM	Processed by	: System Administrator

<Chromatogram>



<Peak Table>

FID1

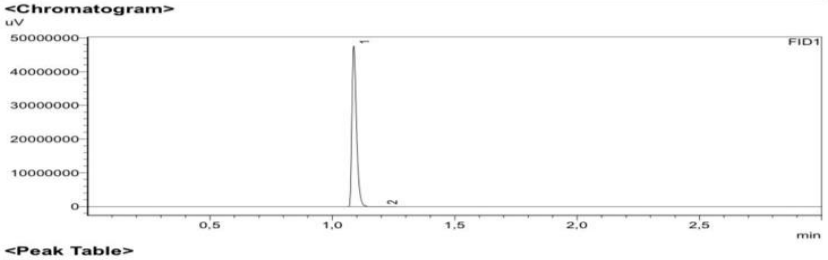
Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	1,087	53221036	40609036	55,054	%	S	Methane
2	1,199	7722	5927	0,000		T	
Total		53228757	40614963				

SHIMADZU LabSolutions **Analysis Report**

<Sample Information>

Sample Name	: KS (3)		
Sample ID	: 15451123-3		
Data Filename	: 15451123-3.gcd		
Method Filename	: 15451123_methana.gcm		
Batch Filename	: 15451123.gcb		
Vial #	: 1	Sample Type	: Unknown
Injection Volume	: 200 uL		
Date Acquired	: 12/13/2023 10:05:19 AM	Acquired by	: System Administrator
Date Processed	: 12/13/2023 11:02:42 AM	Processed by	: System Administrator

<Chromatogram>



<Peak Table>

FID1

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	1,088	61809580	45954333	63,939	%	S	Methane
2	1,200	10662	7851	0,000		T	
Total		61820243	45962185				

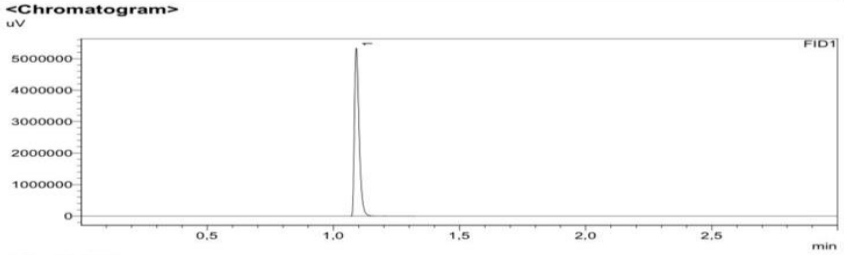
SHIMADZU LabSolutions

Analysis Report

<Sample Information>

Sample Name	: KS + AT (1)		
Sample ID	: 15451123-4		
Data Filename	: 15451123-4.gcd		
Method Filename	: 15451123_methana.gcm		
Batch Filename	: 15451123.gcb		
Vial #	: 1	Sample Type	: Unknown
Injection Volume	: 200 uL		
Date Acquired	: 12/13/2023 10:10:26 AM	Acquired by	: System Administrator
Date Processed	: 12/13/2023 11:02:42 AM	Processed by	: System Administrator

<Chromatogram>



<Peak Table>

FID1

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	1,091	6791817	5261819	7,026	%	S	Methane
Total		6791817	5261819				

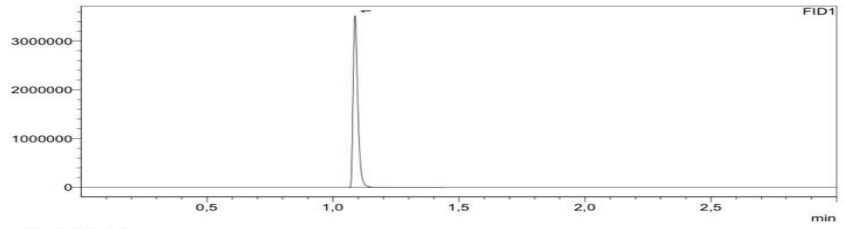
SHIMADZU LabSolutions

Analysis Report

<Sample Information>

Sample Name	: KS + AT (2)		
Sample ID	: 15451123-5		
Data Filename	: 15451123-5 i.gcd		
Method Filename	: 15451123_methana.gcm		
Batch Filename	: 15451123.gcb		
Vial #	: 1	Sample Type	: Unknown
Injection Volume	: 200 uL		
Date Acquired	: 12/13/2023 10:52:07 AM	Acquired by	: System Administrator
Date Processed	: 12/13/2023 11:02:44 AM	Processed by	: System Administrator

<Chromatogram>



<Peak Table>

FID1

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	1,087	4535900	3421923	4,692	%	S	Methane
Total		4535900	3421923				

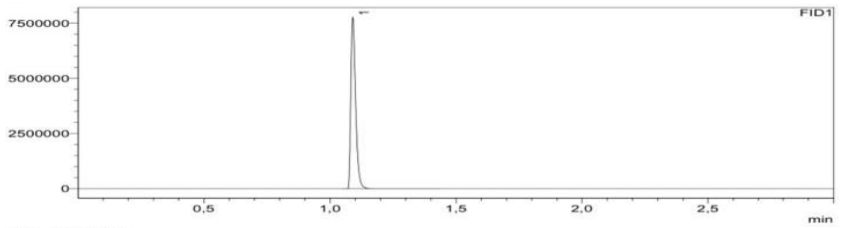
SHIMADZU LabSolutions

Analysis Report

<Sample Information>

Sample Name	: KS + AT (3)		
Sample ID	: 15451123-6		
Data Filename	: 15451123-6.gcd		
Method Filename	: 15451123_methana.gcm		
Batch Filename	: 15451123.gcb		
Vial #	: 1	Sample Type	: Unknown
Injection Volume	: 200 uL		
Date Acquired	: 12/13/2023 10:20:55 AM	Acquired by	: System Administrator
Date Processed	: 12/13/2023 11:02:43 AM	Processed by	: System Administrator

<Chromatogram>



<Peak Table>

FID1

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	1,090	10245297	7662141	10,598	%	S	Methane
Total		10245297	7662141				