

## DAFTAR PUSTAKA

- Agarry, S. E. (2012). Comparison of Biogas production from Cow dung and Pig dung under Mesophilic condition . *International Refereed Journal of Engineering and Science (IRJES)*, 1(4), 16–21.
- Aji, K. W. (2015). *Pengaruh Penambahan EM4 ( Effective Microorganism -4 ) pada Pembuatan Biogas dari Eceng Gondok dan Rumen Sapi Diajukan dalam rangka menyelesaikan Studi Diploma III. 4.*
- Alkire, S. (2015). Global multidimensional poverty index. *Pakistan Development Review*, Vol. 54, pp. 287–299.
- Callen, H. B., & Griffiths, R. B. (1987). Thermodynamics and an Introduction to Thermostatistics. *American Journal of Physics*, 55(9), 860–861.  
<https://doi.org/10.1119/1.14986>
- Contained Energy Indonesia. (2013). *Buku Panduan Energi yang Terbarukan.*
- Deublein, D., & Steinhauser, A. (2010). Biogas from Waste and Renewable Resources: An Introduction, Second Edition. In *Biogas from Waste and Renewable Resources: An Introduction, Second Edition.*  
<https://doi.org/10.1002/9783527632794>
- E, D. a B. P. (2001). Dairy Waste Anaerobic Digestion Handbook. In *Time* (Vol. 20). Retrieved from <http://www.sciencedirect.com/science/article/B6WYV-4HJ3VM2-2/2/ddf81cc8e21efc39b285d358a28bcea2>
- Gerardi, M. H. (2003). The Microbiology of Anaerobic Digesters. In *The Microbiology of Anaerobic Digesters*. <https://doi.org/10.1002/0471468967>
- Ghazali, A. M., Ubaid, A., Wardhana, A. R., Masud, I., Mohammad, J., Ma'afi, M., ... Budiarto, R. (2017). *FIKIH ENERGI TERBARUKAN Pandangan dan Respons Islam atas Pembangkit Listrik Tenaga Surya ( PLTS ).*

, D. (2013). *Produksi Biogas sebagai Sumber Energi Alternatif dari Ruminan Sapi*. 1(2), 1–3.



Hariastuti, N., & Diponegoro, U. (2014). *Study of Activated Carbon and Zeolite Integrated Application*. 65–72.

Here, R. R. M. (2012). *FISIOLOGI\_VETERINER\_II\_MIKROORGANISME\_RU*. UNIVERSITAS UDAYANA DENPASAR.

I Gede Bawa Susana, & I. M. S. (2017). *RANCANGAN BIODIGESTER UNTUK RUMAH TANGGA*. 17(3), 164–166.

Ingredients, H. F. (2015). Enzyme Preparations Used in Food (Partial List). *Evaluating the Safety of Microbial Enzyme Preparations Used in Food Processing: Update for a New Century*, (16), 3–6. Retrieved from <http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/EnzymePreparations/default.htm>

islamiyah, M., & Soehartanto, T. (n.d.). *PURIFIKASI BIOGAS (CO<sub>2</sub>, H<sub>2</sub>S) Dengan ABSORBEN (CaO, NaOH)*. 2–5.

Isnaini, W. L. (2012). *Pengaruh Paparan Gas Karbon Monoksida (CO) Terhadap Kelelahan Kerja Pada Pedagang Asongan Di Terminal Tirtonadi Surakarta*.

J, M. (2010). *Fundamentals of Engineering Thermodynamics 7th* (p. 1026). p. 1026. <https://doi.org/10.1177/004057368303900411>

Jørgensen, P. J. (n.d.). *Biogas - green energy*.

Kengo Yamada, H. L. X. (2001). Properties and Applications of an Organic Fertilizer Inoculated with Effective Microorganisms. *Journal of Crop Production*, (March 2015), 37–41. <https://doi.org/10.1300/J144v03n01>

Khalid, A., & Naz, S. (2013). Isolation and Characterization of Microbial Community in Biogas Production from Different Commercially Active Fermentors in Different Regions of Gujranwala. *International Journal of Water Resources and Environmental Sciences*, 2(2), 28–33.

<https://doi.org/10.5829/idosi.ijwres.2013.2.2.11124>

C. B. D. (2007). *KALOR dan TERMODINAMIKA*.



- Kurniawan, B. (2018). *Produksi Biogas Dan Pupuk Organik Cair Dari Campuran Air Limbah Pabrik Kelapa Sawit Dan Kotoran Sapi*. 14–15.
- Maryani, S. (2016). Potensi Campuran Sampah Sayur Dan Kotoran Sapi Sebagai Penghasil Biogas. *Jurusan Biologi. Fakultas Sains Dan Teknologi .Universitas Islam Negeri Maulana Malik Ibrahim Malang*, 2–126.
- Noel R. Krieg, et. al. (2010). *Bergey's Manual® of Systematic Bacteriology*. In W. B. Whitman (Ed.), *Bergey's Manual® of Systematic Bacteriology* (Second Vol). <https://doi.org/10.1007/978-0-387-68572-4>
- Pezaro, S., Clyne, W., & Fulton, E. A. (2017). A systematic mixed-methods review of interventions, outcomes and experiences for midwives and student midwives in work-related psychological distress. *Midwifery*, 50, 163–173. <https://doi.org/10.1016/j.midw.2017.04.003>
- Prasetyo, B. H., Adiningsih, J. S., & Subagyono, K. (2004). Mineralogi, Kimia, Fisika, Dan Biologi Tanah Sawah. *Sawah Bukaan Baru*, 29–82.
- Rachmawan Budiarto, Ahmad R Wardhana, & Aishah Prastowo. (2016). *Implementation of Islamic Economics in Indonesia by Developing Green Economy through Renewable Energy Technologies*. (May). Retrieved from [https://www.researchgate.net/profile/Rachmawan\\_Budiarto/publication/303235481\\_Implementation\\_of\\_Islamic\\_Economics\\_in\\_Indonesia\\_By\\_Developing\\_Green\\_Economy\\_through\\_Renewable\\_Energy\\_Technologies/links/5739b35d08ae9ace840da715.pdf?origin=publication\\_detail&](https://www.researchgate.net/profile/Rachmawan_Budiarto/publication/303235481_Implementation_of_Islamic_Economics_in_Indonesia_By_Developing_Green_Economy_through_Renewable_Energy_Technologies/links/5739b35d08ae9ace840da715.pdf?origin=publication_detail&)
- Sanjaya, D., Haryanto, A., & Tamrin. (2015). Produksi Biogas dari Campuran Kotoran Sapi dengan Kotoran Ayam. *Jurnal Teknik Pertanian Lampung*, 4, 127–136.
- Sasse, L. (1988). *Biogas Plants by Ludwig Sasse*. 1–66.

ayu, dkk. (2009). PEMANFAATAN KOTORAN TERNAK SAPI SEBAGAI SUMBER ENERGI ALTERNATIF RAMAH LINGKUNGAN DARI ASPEK SOSIO KULTURALNYA. *INOTEK*, 13(2), 11.



- Sugiarto, S., Oerbandono, T., Widhiyanuriyawan, D., & Permana Putra, F. S. (2013). Purifikasi Biogas Sistem Kontinyu Menggunakan Zeolit. *Rekayasa Mesin*, 4(1), pp.1-10.
- Sunaryo, & Widiatmo, W. (2014). Penelitian Nilai Kalor Bahan Bakar Biomassa Pada Kotoran Hewan. *Jurnal Aptek*, 6(1), 87–96.
- SUPRIANTI, Y. (2018). Pemurnian Biogas untuk meningkatkan Nilai Kalor melalui Adsorpsi Dua Tahap Susunan Seri dengan Media Karbon Aktif. *ELKOMIKA: Jurnal Teknik Energi Elektrik, Teknik Telekomunikasi, & Teknik Elektronika*, 4(2), 185. <https://doi.org/10.26760/elkomika.v4i2.185>
- Susanto, A. (2011). Studi Pengolahan Sampah Daun di Kampus Universitas Hasanuddin. *Studi Pengolahan Sampah Daun Di Kampus Universitas Hasanuddin*.
- Suyitno, Nizam, M., & Darmanto. (2010). Teknologi Biogas. *Teknologi Biogas*, (Graha Ilmu), 24. Retrieved from [info@grahailmu.co.id](mailto:info@grahailmu.co.id)
- UNIDO. (2007). *Biomass Conversion Technology On-line Information Platform - Phase 1 Opportunity study*.
- Verlina, wa ode. (2014). Potensi Arang Akif Tempurung Kelapa sebagai Adsorben Emisi Gas CO, NO, dan NO. *Kimia FMIPA UNHAS*.
- Werner, U., Stöhr, U., & Hees, N. (1989). Biogas plants in animal husbandry. *A Publication of the Deutsches Zentrum Für Entwicklungstechnologien*, 1–55.
- Wicaksono, L. B. (2015). Kajian Termodinamika Biogas Berbahan Dasar Kotoran Sapi. *Jurnal Fisika Dan Aplikasinya*, 11(2), 75. <https://doi.org/10.12962/j24604682.v11i2.1060>
- Yahya, Y., Tamrin, T., & Triyono, S. (2018). PRODUKSI BIOGAS DARI

MPURAN KOTORAN AYAM, KOTORAN SAPI, DAN RUMPUT  
 AH MINI (*Pennisetum Purpureum* cv. Mott) DENGAN SISTEM  
 TCH. *Jurnal Teknik Pertanian Lampung (Journal of Agricultural*



*Engineering*), 6(3), 151. <https://doi.org/10.23960/jtep-l.v6i3.151-160>

Yokoyama, S. (2008). Buku Panduan Biomassa Asia: Panduan untuk Produksi dan Pemanfaatan Biomassa. *The Japan Institute of Energy*. Retrieved from [http://www.jie.or.jp/biomass/AsiaBiomassHandbook/Indonesian/All\\_I.pdf](http://www.jie.or.jp/biomass/AsiaBiomassHandbook/Indonesian/All_I.pdf)



### Lampiran 1. Data Tekanan, Volume, dan Temperatur

Waktu	Tekanan (psi)						Volume (ml)						Temperatur (°C)					
	15%		10%		5%		15%		10%		5%		15%		10%		5%	
	siang	malam	siang	malam	siang	malam	siang	malam	siang	malam	siang	malam	siang	malam	siang	malam	siang	malam
15/07/2019	0	0	0	0	0	0	0	0	0	0	0	0	28	28	29	29	28	28
16/07/2019	0	0	0	0	0	0	0	0	0	0	0	0	29	29	29	28	29	28
17/07/2019	3,2	2,5	0,7	1,5	0,7	0	115,84	101,63	65,91	79,9	65,91	0	29	29	29	29	29	28
18/07/2019	3,8	3,5	1,5	1,5	1,5	1,1	130,18	123,17	79,9	79,9	79,9	72,41	30	29	30	29	30	29
19/07/2019	5,6	4,2	3,2	3,6	2,2	1,7	183,79	145,07	115,84	125,03	94,76	83,94	30	30	30	29	29	29
20/07/2019	7	8	3,6	4,6	2,9	3	229,98	263,24	125,03	109,54	119,94	111,78	31	30	30	30	30	30
21/07/2019	10,8	9	5,5	5,8	3,6	4,4	369,55	299,82	181,67	190,17	133,97	150,49	31	30	30	30	30	30
22/07/2019	0	0	0	0	0	0	0	0	0	0	0	0	29	29	29	29	29	29
23/07/2019	2,4	2	1,5	2,6	3,3	2,9	99,03	90,55	79,9	104,24	118,57	109,54	30	29	30	30	30	29
24/07/2019	3,8	3,6	3,6	2,9	4,9	4,4	130,18	125,03	125,03	109,54	162,52	150,59	30	29	30	30	30	30
25/07/2019	4,3	4	4,4	4,1	5,8	5,1	148,02	139,25	150,44	142,15	190,17	168,66	30	30	30	29	30	30
26/07/2019	4,8	4,5	6,1	5,2	7	6,5	159,48	152,97	199,89	172,27	229,98	212,53	29	29	31	29	29	29
27/07/2019	4,8	4,8	7,3	6,7	8,7	7,3	159,48	159,48	239,16	229,96	228,68	239,16	30	29	30	29	30	29
28/07/2019	0	0	0	0	0	0	0	0	0	0	0	0	29	29	29	29	29	29
29/07/2019	4	3,5	2,9	3,6	4,4	3,6	139,25	123,17	109,54	125,03	150,49	125,03	29	29	29	29	30	29
30/07/2019	4	5,8	2,9	2,9	5,8	7,3	139,25	190,17	109,54	109,54	190,17	239,16	30	30	29	29	30	30
31/07/2019	4	4,5	2,6	2,2	2,8	2,6	139,25	152,97	104,24	94,76	106,88	104,24	29	29	29	29	29	29
01/08/2019	4	4	2,9	2,2	2,8	2,8	139,25	139,25	109,54	94,76	106,88	106,88	29	29	30	29	30	29
02/08/2019	4,3	4,5	2,6	1,5	2,2	1,9	148,02	152,97	104,24	79,9	94,76	88,05	30	29	29	29	30	29
03/08/2019	0	0	0	0	0	0	0	0	0	0	0	0	29	29	29	29	29	29



## Lampiran 2. Hasil Analisis Kandungan Biogas Kode A.2



GAS KODE A 2

**GasVision** **Dräger**

Instrument type	X-am 7000		Serial number	ARHF0321	
Time interval	9/24/2019 8:32:59 PM - 9/24/2019 8:39:49 PM				
DL setting	Avg	Location	1	Personal ID	PERSONAL-ID

	ch4	O2	CO	SO2
Sensor type	HPP-IR	EC	EC	EC
Serial number	ARHE0046	ARHE0110	ARHE0116	ARHE0020
Part number	6810460	6809130	6809105	6809160
Cal. date	7/27/2016	7/27/2016	7/27/2016	7/27/2016
Meas. range	100.00 %LEL	25.00 Vol%	2000.00 ppm	20.00 ppm
A1 setting	20.00 %LEL	19.00 Vol%	30.00 ppm	2.00 ppm
A2 setting	40.00 %LEL	23.00 Vol%	60.00 ppm	4.00 ppm

Date	time	ch4	O2	CO	SO2
9/24/2019	8:32:59 PM	0.000	20.89	0.000	0.000
9/24/2019	8:33:09 PM	0.000	20.89	0.000	0.000
9/24/2019	8:33:19 PM	0.000	20.89	0.000	0.000
9/24/2019	8:33:29 PM	0.000	20.89	0.000	0.000
9/24/2019	8:33:39 PM	0.000	20.89	0.000	0.000
9/24/2019	8:33:49 PM	0.000	20.89	0.000	0.000
9/24/2019	8:33:49 PM	Pump on(2,255)			
9/24/2019	8:33:50 PM	Pump off(2,255)			
9/24/2019	8:33:59 PM	0.000	20.89	0.000	0.000
9/24/2019	8:34:09 PM	0.000	20.89	0.000	0.000
9/24/2019	8:34:19 PM	0.000	20.89	0.000	0.000
9/24/2019	8:34:29 PM	0.000	20.89	0.000	0.000
9/24/2019	8:34:39 PM	0.000	20.89	0.000	0.000
9/24/2019	8:34:49 PM	0.000	20.89	0.000	0.000
9/24/2019	8:34:59 PM	0.000	20.89	0.000	0.000
9/24/2019	8:35:09 PM	0.000	20.89	0.000	0.000
9/24/2019	8:35:19 PM	0.000	20.89	0.000	0.000
9/24/2019	8:35:29 PM	0.000	20.89	0.000	0.000
9/24/2019	8:35:39 PM	0.000	20.89	0.000	0.000
9/24/2019	8:35:49 PM	0.000	20.89	0.000	0.000
9/24/2019	8:35:59 PM	0.000	20.89	0.000	0.000
9/24/2019	8:36:09 PM	0.000	20.89	0.000	0.000
9/24/2019	8:36:19 PM	0.000	20.89	0.000	0.000
9/24/2019	8:36:29 PM	0.000	20.89	0.000	0.000
9/24/2019	8:36:30 PM	Pump on(2,255)			
9/24/2019	8:36:39 PM	0.000	20.89	0.000	0.000
9/24/2019	8:36:49 PM	0.000	20.89	0.000	0.000
9/24/2019	8:36:59 PM	7.400	20.89	0.000	0.000
9/24/2019	8:37:02 PM	Alarm A1 on (3,0)			
9/24/2019	8:37:05 PM	Alarm A2 on (3,0)			
9/24/2019	8:37:09 PM	101.7	20.81	0.000	0.000
9/24/2019	8:37:19 PM	121.4	20.81	0.000	0.000

9/24/2019 8:30:53 PM

1 (X-am 7000 ARHF0321 24 9 2019.txt)



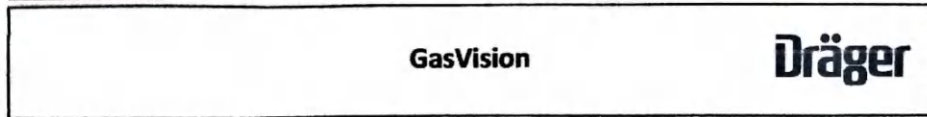


9/24/2019	8:37:29 PM	90.76		20.67	0.000	0.000
9/24/2019	8:37:39 PM	84.94		20.72	0.000	0.000
9/24/2019	8:37:49 PM	60.02		20.78	0.000	0.000
9/24/2019	8:37:59 PM	55.84		20.80	0.000	0.000
9/24/2019	8:38:09 PM	48.97		20.83	0.000	0.000
9/24/2019	8:38:11 PM	Alarm acknowledged(3,0)				
9/24/2019	8:38:13 PM	Alarm A2 off(3,0)				
9/24/2019	8:38:16 PM	Alarm A1 off(3,0)				
9/24/2019	8:38:19 PM	29.03		20.86	0.000	0.000
9/24/2019	8:38:29 PM	10.47		20.87	0.000	0.000
9/24/2019	8:38:39 PM	5.020		20.89	0.000	0.000
9/24/2019	8:38:40 PM	Pump off(2,255)				
9/24/2019	8:38:49 PM	0.000		20.89	0.000	0.000
9/24/2019	8:38:59 PM	0.000		20.89	0.000	0.000
9/24/2019	8:39:09 PM	0.000		20.89	0.000	0.000
9/24/2019	8:39:19 PM	0.000		20.89	0.000	0.000
9/24/2019	8:39:29 PM	0.000		20.89	0.000	0.000
9/24/2019	8:39:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:39:49 PM	0.000		20.89	0.000	0.000



### Lampiran 3. Hasil Analisis Kandungan Biogas Kode A.1

GAS KODE A.1



Instrument type	X-am 7000		Serial number	ARHF0321	
Time interval	9/24/2019 8:22:59 PM - 9/24/2019 8:29:49 PM				
DL setting	Avg.	Location	1	Personal ID	PERSONAL-ID

	ch4		O2	CO	SO2
Sensor type	HPP-IR		EC	EC	EC
Serial number	ARHE0046		ARHE0110	ARHE0116	ARHE0020
Part number	6810460		6809130	6809105	6809160
Cal. date	7/27/2016		7/27/2016	7/27/2016	7/27/2016
Meas. range	100.00 %LEL		25.00 Vol%	2000.00 ppm	20.00 ppm
A1 setting	20.00 %LEL		19.00 Vol%	30.00 ppm	2.00 ppm
A2 setting	40.00 %LEL		23.00 Vol%	60.00 ppm	4.00 ppm

Date	time	ch4		O2	CO	SO2
9/24/2019	8:22:59 PM	0.000		20.89	0.000	0.000
9/24/2019	8:23:09 PM	0.000		20.89	0.000	0.000
9/24/2019	8:23:19 PM	0.000		20.89	0.000	0.000
9/24/2019	8:23:29 PM	0.000		20.89	0.000	0.000
9/24/2019	8:23:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:23:49 PM	0.000		20.89	0.000	0.000
9/24/2019	8:23:59 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:09 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:19 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:29 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:49 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:59 PM	0.000		20.89	0.000	0.000
9/24/2019	8:24:09 PM	0.000		20.89	0.000	0.000
9/24/2019	8:25:19 PM	Pump on(2,255)				
9/24/2019	8:25:19 PM	0.000		20.89	0.000	0.000
9/24/2019	8:25:29 PM	0.000		20.89	0.000	0.000
9/24/2019	8:25:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:25:49 PM	0.000		20.89	0.000	0.000
9/24/2019	8:25:59 PM	0.000		20.89	0.000	0.000
9/24/2019	8:26:09 PM	0.000		20.89	0.000	0.000
9/24/2019	8:26:19 PM	0.000		20.89	0.000	0.000
9/24/2019	8:26:29 PM	0.000		20.89	0.000	0.000
9/24/2019	8:26:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:26:49 PM	5.200		20.89	0.000	0.000
9/24/2019	8:26:51 PM	Alarm A1 on (3,0)				
9/24/2019	8:26:54 PM	Alarm A2 on (3,0)				
9/24/2019	8:26:59 PM	75.12		20.86	0.000	0.000
9/24/2019	8:27:09 PM	89.11		20.75	0.000	0.000
9/24/2019	8:27:19 PM	108.5		20.69	0.000	0.000
9/24/2019	8:27:29 PM	78.90		20.65	0.000	0.000
9/24/2019	8:27:31 PM	Alarm A2 off(3,0)				



9/24/2019 8:25:32 PM

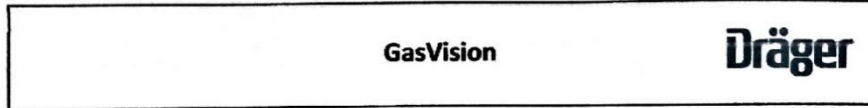
1 (X-am 7000 ARHF0321 24 9 2019.txt)

9/24/2019	8:27:34 PM	Alarm A1 off(3,0)				
9/24/2019	8:27:37 PM	Alarm acknowledged(3,0)				
9/24/2019	8:27:39 PM	Alarm acknowledged(3,0)				
9/24/2019	8:27:49 PM	30.17		20.60	0.000	0.000
9/24/2019	8:27:59 PM	16.10		20.81	0.000	0.000
9/24/2019	8:28:09 PM	1.250		20.89	0.000	0.000
9/24/2019	8:28:19 PM	0.500		20.89	0.000	0.000
9/24/2019	8:28:29 PM	0.060		20.89	0.000	0.000
9/24/2019	8:28:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:28:40 PM	Pump off (2,255)				
9/24/2019	8:28:49 PM	0.000		20.89	0.000	0.000
9/24/2019	8:28:59 PM	0.000		20.89	0.000	0.000
9/24/2019	8:29:09 PM	0.000		20.89	0.000	0.000
9/24/2019	8:29:19 PM	0.000		20.89	0.000	0.000
9/24/2019	8:29:29 PM	0.000		20.89	0.000	0.000
9/24/2019	8:29:39 PM	0.000		20.89	0.000	0.000
9/24/2019	8:29:49 PM	0.000		20.89	0.000	0.000



### Lampiran 4. Hasil Analisis Kandungan Biogas Kode C

GAS KODE C



Instrument type	X-am 7000		Serial number	ARHF0321	
Time interval	9/24/2019 8:10:28 PM – 9/24/2019 8:17:58				
DL setting	Avg.	Location	1	Personal ID	PERSONAL-JD

	ch4		O2	CO	SO2
Sensor type	HPP-IR		EC	EC	EC
Serial number	ARHE0046		ARHE0110	ARHE0116	ARHE0020
Part number	6810460		6809130	6809105	6809180
Cal. date	7/27/2016		7/27/2016	7/27/2016	7/27/2016
Meas. range	100.00 %LEL		25.00 Vol%	2000.00 ppm	20.00 ppm
A1 setting	20.00 %LEL		19.00 Vol%	30.00 ppm	2.00 ppm
A2 setting	40.00 %LEL		23.00 Vol%	60.00 ppm	4.00 ppm

Date	time	ch4		O2	CO	SO2
9/24/2019	8:10:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:10:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:10:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:10:58 PM	0.000		20.89	0.000	0.000
9/24/2019	8:11:08 PM	0.000		20.89	0.000	0.000
9/24/2019	8:11:09 PM	Pump on(2,255)				
9/24/2019	8:11:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:11:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:11:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:11:58 PM	0.000		20.89	0.000	0.000
9/24/2019	8:11:58 PM	Pump off(2,255)				
9/24/2019	8:11:59 PM	Pump on(2,255)				
9/24/2019	8:12:08 PM	0.000		20.89	0.000	0.000
9/24/2019	8:12:18 PM	0.000		20.89	0.000	0.000
9/24/2019	8:12:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:12:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:12:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:12:58 PM	0.000		20.89	0.000	0.000
9/24/2019	8:13:08 PM	0.000		20.89	0.000	0.000
9/24/2019	8:13:18 PM	0.000		20.89	0.000	0.000
9/24/2019	8:13:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:13:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:13:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:13:58 PM	0.000		20.89	0.000	0.000
9/24/2019	8:14:08 PM	0.000		20.89	0.000	0.000
9/24/2019	8:14:18 PM	0.000		20.89	0.000	0.000
9/24/2019	8:14:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:14:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:14:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:14:58 PM	0.000		20.89	0.000	0.000
9/24/2019	8:15:08 PM	6.010		20.89	0.000	0.000
9/24/2019	8:15:10 PM	Alarm A1 on (3,0)				

9/24/2019 8:19:24 PM

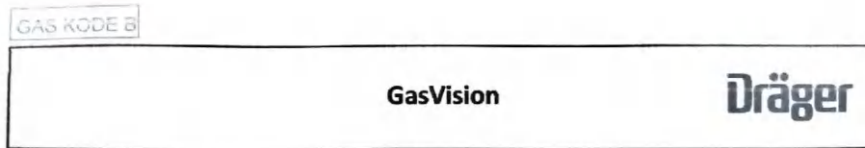
1 (X-am 7000 ARHF0321 24 9 2019.txt)



9/24/2019	8:15:13 PM	Alarm A2 on (3,0)				
9/24/2019	8:15:18 PM	29.01		20.82	0.000	0.000
9/24/2019	8:15:28 PM	38.45		20.76	0.000	0.000
9/24/2019	8:15:38 PM	43.89		20.74	0.000	0.000
9/24/2019	8:15:48 PM	32.06		20.65	0.000	0.000
9/24/2019	8:15:51 PM	Alarm A2 off(3,0)				
9/24/2019	8:15:52 PM	Alarm acknowledge(3,0)				
9/24/2019	8:15:55 PM	Alarm A1 off(3,0)				
9/24/2019	8:15:58 PM	2.030		20.82	0.000	0.000
9/24/2019	8:16:08 PM	0.030		20.89	0.000	0.000
9/24/2019	8:16:18 PM	0.000		20.89	0.000	0.000
9/24/2019	8:16:19 PM	Pump off(2,255)				
9/24/2019	8:16:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:16:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:16:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:16:58 PM	0.000		20.89	0.000	0.000
9/24/2019	8:17:08 PM	0.000		20.89	0.000	0.000
9/24/2019	8:17:18 PM	0.000		20.89	0.000	0.000
9/24/2019	8:17:28 PM	0.000		20.89	0.000	0.000
9/24/2019	8:17:38 PM	0.000		20.89	0.000	0.000
9/24/2019	8:17:48 PM	0.000		20.89	0.000	0.000
9/24/2019	8:17:58 PM	0.000		20.89	0.000	0.000



## Lampiran 5. Hasil Analisis Kandungan Biogas Kode B



Instrument type	X-am 7000	Serial number	ARHF0321
Time interval	9/24/2019 8:00:43 PM – 9/24/2019 8:08:23 PM		
DL setting	Avg.	Location	1
		Personal ID	PERSONAL-ID

	ch4	O2	CO	SO2
Sensor type	HPP-IR	EC	EC	EC
Serial number	ARHE0046	ARHE0110	ARHE0116	ARHE0020
Part number	6810460	6809130	6809105	6809160
Cal. date	7/27/2016	7/27/2016	7/27/2016	7/27/2016
Meas. range	100.00 %LEL	25.00 Vol%	2000.00 ppm	20.00 ppm
A1 setting	20.00 %LEL	19.00 Vol%	30.00 ppm	2.00 ppm
A2 setting	40.00 %LEL	23.00 Vol%	60.00 ppm	4.00 ppm

Date	time	ch4	O2	CO	SO2
9/24/2019	8:00:43 PM	0.000	20.89	0.000	0.000
9/24/2019	8:00:53 PM	0.000	20.89	0.000	0.000
9/24/2019	8:01:03 PM	0.000	20.89	0.000	0.000
9/24/2019	8:01:13 PM	0.000	20.89	0.000	0.000
9/24/2019	8:01:23 PM	0.000	20.89	0.000	0.000
9/24/2019	8:01:33 PM	0.000	20.89	0.000	0.000
9/24/2019	8:01:43 PM	0.000	20.89	0.000	0.000
9/24/2019	8:01:53 PM	0.000	20.89	0.000	0.000
9/24/2019	8:02:03 PM	0.000	20.89	0.000	0.000
9/24/2019	8:02:13 PM	0.000	20.89	0.000	0.000
9/24/2019	8:02:23 PM	0.000	20.89	0.000	0.000
9/24/2019	8:02:33 PM	0.000	20.89	0.000	0.000
9/24/2019	8:02:43 PM	0.000	20.89	0.000	0.000
9/24/2019	8:02:53 PM	0.000	20.89	0.000	0.000
9/24/2019	8:03:03 PM	0.000	20.89	0.000	0.000
9/24/2019	8:03:13 PM	0.000	20.89	0.000	0.000
9/24/2019	8:03:23 PM	0.000	20.89	0.000	0.000
9/24/2019	8:03:33 PM	0.000	20.89	0.000	0.000
9/24/2019	8:03:43 PM	0.000	20.89	0.000	0.000
9/24/2019	8:03:53 PM	0.000	20.89	0.000	0.000
9/24/2019	8:04:03 PM	0.000	20.89	0.000	0.000
9/24/2019	8:04:13 PM	0.000	20.89	0.000	0.000
9/24/2019	8:04:23 PM	0.000	20.89	0.000	0.000
9/24/2019	8:04:33 PM	0.000	20.89	0.000	0.000
9/24/2019	8:04:43 PM	5.000	20.89	0.000	0.000
9/24/2019	8:04:44 PM	Pump on(2,255)			
9/24/2019	8:04:53 PM	52.66	20.83	0.000	0.000
9/24/2019	8:05:03 PM	47.18	20.74	0.000	0.000
9/24/2019	8:05:14 PM	Alarm A1 on (3,0)			
9/24/2019	8:05:17 PM	Alarm A2 on (3,0)			
9/24/2019	8:05:23 PM	22.38	20.71	0.000	0.000
9/24/2019	8:05:33 PM	20.84	20.81	0.000	0.000

9/24/2019 8:12:13 PM 1 (X-am 7000 ARHF0321 24 9 2019.txt)

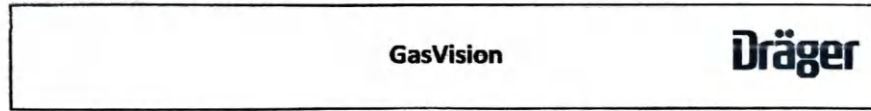


9/24/2019	8:05:43 PM	Alarm A2 off(3,0)				
9/24/2019	8:05:45 PM	Alarm acknowledged(3,0)				
9/24/2019	8:05:46 PM	Alarm A1 off(3,0)				
9/24/2019	8:05:53 PM	5.300		20.89	0.000	0.000
9/24/2019	8:06:03 PM	4.900		20.89	0.000	0.000
9/24/2019	8:06:13 PM	3.050		20.89	0.000	0.000
9/24/2019	8:06:23 PM	2.710		20.89	0.000	0.000
9/24/2019	8:06:33 PM	1.400		20.89	0.000	0.000
9/24/2019	8:06:43 PM	0.500		20.89	0.000	0.000
9/24/2019	8:06:53 PM	0.000		20.89	0.000	0.000
9/24/2019	8:06:56 PM	Pump off(2,255)				
9/24/2019	8:07:03 PM	0.000		20.89	0.000	0.000
9/24/2019	8:07:13 PM	0.000		20.89	0.000	0.000
9/24/2019	8:07:23 PM	0.000		20.89	0.000	0.000
9/24/2019	8:07:33 PM	0.000		20.89	0.000	0.000
9/24/2019	8:07:43 PM	0.000		20.89	0.000	0.000
9/24/2019	8:07:53 PM	0.000		20.89	0.000	0.000
9/24/2019	8:08:03 PM	0.000		20.89	0.000	0.000
9/24/2019	8:08:13 PM	0.000		20.89	0.000	0.000
9/24/2019	8:08:23 PM	0.000		20.89	0.000	0.000



## Lampiran 6 Hasil Analisis Kandungan Biogas Kode A

GAS KODE A



Instrument type	X-am 7000		Serial number	ARHF0321	
Time interval	9/24/2019 7:54:26 PM – 9/24/2019 7:59:56 PM				
DL setting	Avg.	Location	1	Personal ID	PERSONAL-JD

	ch4	O2	CO	SO2
Sensor type	HPP-IR	EC	EC	EC
Serial number	ARHE0046	ARHE0110	ARHE0116	ARHE0020
Part number	6810460	6809130	6809105	6809160
Cal. date	7/27/2016	7/27/2016	7/27/2016	7/27/2016
Meas. range	100.00 %LEL	25.00 Vol%	2000.00 ppm	20.00 ppm
A1 setting	20.00 %LEL	19.00 Vol%	30.00 ppm	2.00 ppm
A2 setting	40.00 %LEL	23.00 Vol%	60.00 ppm	4.00 ppm

Date	time	ch4	O2	CO	SO2
9/24/2019	7:54:26 PM	0.000	20.89	0.000	0.000
9/24/2019	7:54:36 PM	0.000	20.89	0.000	0.000
9/24/2019	7:54:46 PM	0.000	20.89	0.000	0.000
9/24/2019	7:54:56 PM	0.000	20.89	0.000	0.000
9/24/2019	7:54:06 PM	0.000	20.89	0.000	0.000
9/24/2019	7:55:16 PM	0.000	20.89	0.000	0.000
9/24/2019	7:55:17 PM	Pump on(2,255)			
9/24/2019	7:55:26 PM	0.000	20.89	0.000	0.000
9/24/2019	7:55:36 PM	0.000	20.89	0.000	0.000
9/24/2019	7:55:46 PM	0.000	20.89	0.000	0.000
9/24/2019	7:55:56 PM	0.000	20.89	0.000	0.000
9/24/2019	7:56:06 PM	0.000	20.89	0.000	0.000
9/24/2019	7:56:16 PM	0.000	20.89	0.000	0.000
9/24/2019	7:56:26 PM	4.200	20.89	0.000	0.000
9/24/2019	7:56:36 PM	Alarm A1 on (3,0)			
9/24/2019	7:56:38 PM	Alarm A2 on (3,0)			
9/24/2019	7:56:46 PM	45.30	20.89	0.000	0.000
9/24/2019	7:56:56 PM	59.12	20.78	0.000	0.000
9/24/2019	7:57:06 PM	38.19	20.69	0.000	0.000
9/24/2019	7:57:06 PM	Alarm A2 off (3,0)			
9/24/2019	7:57:09 PM	Alarm A1 off (3,0)			
9/24/2019	7:57:11 PM	Alarm acknowledged(3,0)			
9/24/2019	7:57:16 PM	12.11	20.83	0.000	0.000
9/24/2019	7:57:26 PM	5.400	20.89	0.000	0.000
9/24/2019	7:57:36 PM	3.200	20.89	0.000	0.000
9/24/2019	7:57:46 PM	2.500	20.89	0.000	0.000
9/24/2019	7:57:56 PM	2.000	20.89	0.000	0.000
9/24/2019	7:58:06 PM	1.700	20.89	0.000	0.000
9/24/2019	7:58:16 PM	0.400	20.89	0.000	0.000
9/24/2019	7:58:26 PM	0.000	20.89	0.000	0.000
9/24/2019	7:58:36 PM	0.000	20.89	0.000	0.000
9/24/2019	7:58:37 PM	Pump off(2,225)			
9/24/2019	7:58:46 PM	0.000	20.89	0.000	0.000

9/24/2019 8:05:11 PM

1 (X-am 7000 ARHF0321 24 9 2019.txt)



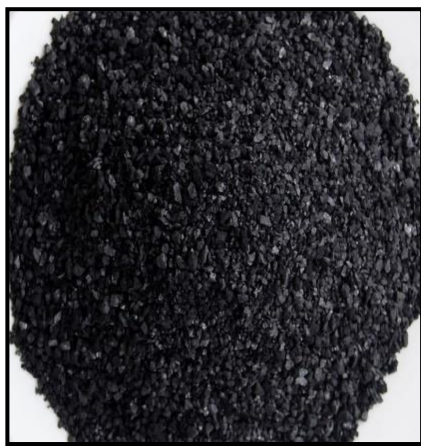


9/24/2019	7:58:56 PM	0.000		20.89	0.000	0.000
9/24/2019	7:59:06 PM	0.000		20.89	0.000	0.000
9/24/2019	7:59:16 PM	0.000		20.89	0.000	0.000
9/24/2019	7:59:26 PM	0.000		20.89	0.000	0.000
9/24/2019	7:59:36 PM	0.000		20.89	0.000	0.000
9/24/2019	7:59:46 PM	0.000		20.89	0.000	0.000
9/24/2019	7:59:56 PM	0.000		20.89	0.000	0.000



## Lampiran 7. Dokumentasi Alat dan Bahan





Optimization Software:  
[www.balesio.com](http://www.balesio.com)

## Lampiran 8. Data Sekuder

Day 18								
sample	Temp °C	CH <sub>4</sub> (%)	CO <sub>2</sub> (%)	O <sub>2</sub> (%)	Balance (%)	CO (ppm)	H <sub>2</sub> (ppm)	H <sub>2</sub> S (ppm)
A1	28	46.3	25.3	0.8	27.5	3	Low	>>
A2	28	41.1	25.6	0.5	32.8	3	Low	>>
A3	28	48.5	29.6	0.5	21.4	2	Low	272

