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DAFTAR PUSTAKA

Adelabu, B. A., & Kareem, S. O. (2022). Cellulase Production by Immobilized Cells of *Candida Tropicalis* Isolated from *Grasshopper Zonocerus Variegatus* In Saw Dust And Rice Husk Medium. *Polish Journal of Natural Sciences*, *37*(2). https://doi.org/10.31648/pjns.7538

Agnihotri, S., Yin, D. M., Mahboubi, A., Sapmaz, T., Varjani, S., Qiao, W., Koseoglu-Imer, D. Y., & Taherzadeh, M. J. (2022). A Glimpse of the World of Volatile Fatty Acids Production and Application: A review. In *Bioengineered* (Vol. 13, Issue 1). https://doi.org/10.1080/21655979.2021.1996044

Ahmad, A. L., Ismail, S., Ibrahim, N., & Bhatia, S. (2003). Removal of suspended solids and residual oil from palm oil mill effluent. *Journal of Chemical Technology and Biotechnology*, *78*(9). https://doi.org/10.1002/jctb.892

Ahmadi, N., Khosravi-Darani, K., & Mortazavian, A. M. (2017). An overview of biotechnological production of propionic acid: From upstream to downstream processes. In *Electronic Journal of Biotechnology* (Vol. 28). https://doi.org/10.1016/j.ejbt.2017.04.004

Al-Battashi, H. S., Annamalai, N., Sivakumar, N., Al-Bahry, S., Tripathi, B. N., Nguyen, Q. D., & Gupta, V. K. (2019). Lignocellulosic biomass (LCB): a potential alternative biorefinery feedstock for polyhydroxyalkanoates production. In *Reviews in Environmental Science and Biotechnology* (Vol. 18, Issue 1). https://doi.org/10.1007/s11157-018-09488-4

Alfa, I. M., Dahunsi, S. O., Iorhemen, O. T., Okafor, C. C., & Ajayi, S. A. (2014). Comparative evaluation of biogas production from Poultry droppings, Cow dung and Lemon grass. *Bioresource Technology*, *157*. https://doi.org/10.1016/j.biortech.2014.01.108

Andlar, M., Rezić, T., Marđetko, N., Kracher, D., Ludwig, R., & Šantek, B. (2018). Lignocellulose degradation: An overview of fungi and fungal enzymes involved in lignocellulose degradation. In *Engineering in Life Sciences* (Vol.

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

18, Issue 11). https://doi.org/10.1002/elsc.201800039

Angelidaki, I., & Ahring, B. K. (2000). Methods for increasing the biogas potential from the recalcitrant organic matter contained in manure. *Water Science and Technology*, *41*(3). https://doi.org/10.2166/wst.2000.0071

AOAC. (2016). Official Methods of Analysis of AOAC International - 20th Edition, 2016. *20th Ed. Gaithersburg: AOAC.*

APHA. (2005). Standard Methods for the Examination of Water and Wastewater. *Standard Methods*. https://doi.org/ISBN 9780875532356

Atasoy, M., Owusu-Agyeman, I., Plaza, E., & Cetecioglu, Z. (2018). Bio-based volatile fatty acid production and recovery from waste streams: Current status and future challenges. In *Bioresource Technology* (Vol. 268). https://doi.org/10.1016/j.biortech.2018.07.042

Aydin, S., Yıldırım, E., Ince, O., & Ince, B. (2017). Rumen anaerobic fungi create new opportunities for enhanced methane production from microalgae biomass. *Algal Research, 23*. https://doi.org/10.1016/j.algal.2016.12.016

Azman, N. F., Abdeshahian, P., Al-Shorgani, N. K. N., Hamid, A. A., & Kalil, M. S. (2016). Production of hydrogen energy from dilute acid-hydrolyzed palm oil mill effluent in dark fermentation using an empirical model. *International Journal of Hydrogen Energy*, *41*(37). https://doi.org/10.1016/j.ijhydene.2016.05.085

Aznury, M., & Setiadi, T. (2021). Identifikasi Senyawa Asam Lemak Volatil dari Air Limbah Industri Minyak Kelapa Sawit untuk Produksi Polihidroksialkanoat oleh Ralstonia eutropha JMP 134. *JURNAL SELULOSA*, *11*(01). https://doi.org/10.25269/jsel.v11i01.340

Baas, P. (2014). Wood - Chemistry, ultrastructure, reactions. D. Fengel and G. Wegener, xiii + 613 pp., 351 mus., 1984. Walter de Gruyter, Berlin, New York. Price: DM 245.00 (cloth). *IAWA Journal*, *6*(1). https://doi.org/10.1163/22941932-90000910

Badan Pusat Statistik. (2020). Statistik Hortikultura 2019-2020. *Horticulture Statistic*.

Barmina, I., Lickrastina, A., Valdmanis, R., Zake, M., Arshanitsa, A., Solodovnik,

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

V., & Telysheva, G. (2013). Effects of biomass composition variations on gasification and combustion characteristics. *Engineering for Rural Development*.

Bartacek, J., Zabranska, J., & Lens, P. N. L. (2007). Developments and constraints in fermentative hydrogen production. In *Biofuels, Bioproducts and Biorefining* (Vol. 1, Issue 3). https://doi.org/10.1002/bbb.17

Bhatia, S. K., & Yang, Y. H. (2017). Microbial production of volatile fatty acids: current status and future perspectives. In *Reviews in Environmental Science and Biotechnology* (Vol. 16, Issue 2). https://doi.org/10.1007/s11157-017-9431-4

Boyd, C. E. (1990). Water quality in ponds for aquaculture. *Alabama*.

BPS. (2023). Luas Panen Dan Produksi Padi Di Indonesia 2022. *Badan Pusat Statistik*, *4*(1).

BPS Indonesia. (2023). Indonesian Palm Oil Statistics. *Bps*, *16*(ISSN 1978-9947).

Castoldi, R., Correa, V. G., de Morais, G. R., de Souza, C. G. M., Bracht, A., Peralta, R. A., Peralta-Muniz Moreira, R. F., & Peralta, R. M. (2017). Liquid nitrogen pretreatment of eucalyptus sawdust and rice hull for enhanced enzymatic saccharification. *Bioresource Technology*, *224*. https://doi.org/10.1016/j.biortech.2016.11.099

Chandel, A. K., ES, C., Rudravaram, R., Narasu, L., Rao, V., & Ravindra, P. (2007). Economics and environmental impact of bioethanol production technologies: an appraisal. *Biotechnology and Molecular Biology Review*, *2*(1).

Chandrasekhar, K., Lee, Y. J., & Lee, D. W. (2015). Biohydrogen production: Strategies to improve process efficiency through microbial routes. In *International Journal of Molecular Sciences* (Vol. 16, Issue 4). https://doi.org/10.3390/ijms16048266

Cheng, Y. F., Edwards, J. E., Allison, G. G., Zhu, W. Y., & Theodorou, M. K. (2009). Diversity and activity of enriched ruminal cultures of anaerobic fungi and methanogens grown together on lignocellulose in consecutive batch culture. *Bioresource Technology*, *100*(20). https://doi.org/10.1016/j.biortech.2009.04.031

Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Chesson, A. (1981). Effects of sodium hydroxide on cereal straws in relation to the enhanced degradation of structural polysaccharides by rumen microorganisms. *Journal of the Science of Food and Agriculture*, *32*(8). https://doi.org/10.1002/jsfa.2740320802

Chong, M. L., Sabaratnam, V., Shirai, Y., & Hassan, M. A. (2009). Biohydrogen production from biomass and industrial wastes by dark fermentation. In *International Journal of Hydrogen Energy* (Vol. 34, Issue 8). https://doi.org/10.1016/j.ijhydene.2009.02.010

Comlekcioglu, U., Gunes, M., Altun, H., Ekiz, D. O., & Aygan, A. (2017). Coexpression of rumen fungal xylanase and bifunctional cellulase genes in Escherichia coli. *Brazilian Archives of Biology and Technology*, *60*. https://doi.org/10.1590/1678-4324-2017160462

Dagar, S. S., Kumar, S., Mudgil, P., & Puniya, A. K. (2018). Comparative evaluation of lignocellulolytic activities of filamentous cultures of monocentric and polycentric anaerobic fungi. *Anaerobe*, *50*. https://doi.org/10.1016/j.anaerobe.2018.02.004

Dahmen, N., Lewandowski, I., Zibek, S., & Weidtmann, A. (2019). Integrated lignocellulosic value chains in a growing bioeconomy: Status quo and perspectives. *GCB Bioenergy*, *11*(1). https://doi.org/10.1111/gcbb.12586

Darwin., D. (2018). Prinsip Dan Aplikasi Teknologi Anaerobik Digesi, Teknik Pengolahan Limbah Dan Produksi Energi Terbarukan. In *Angewandte Chemie International Edition, 6(11), 951–952.*

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

Dipaningrum, P. K., Ulfa, A. M., & Khoirunnisa, S. M. (2022). PENETAPAN KADAR ALKALI BEBAS PADA SABUN CUCI KRIM YANG DIJUAL DI MINI MARKET SECARA ASIDIMETRI. *Jurnal Analis Farmasi*, *6*(2). https://doi.org/10.33024/jaf.v6i2.5956

Dollhofer, V., Dandikas, V., Dorn-In, S., Bauer, C., Lebuhn, M., & Bauer, J. (2018).

UNIVERSITAS
GADJAH MADA
**Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Accelerated biogas production from lignocellulosic biomass after pre-treatment with Neocallimastix frontalis. *Bioresource Technology*, *264*. https://doi.org/10.1016/j.biortech.2018.05.068

Ezeilo, U. R., Wahab, R. A., & Mahat, N. A. (2020). Optimization studies on cellulase and xylanase production by Rhizopus oryzae UC2 using raw oil palm frond leaves as substrate under solid state fermentation. *Renewable Energy*, *156*. https://doi.org/10.1016/j.renene.2019.11.149

Feng, S., Ngo, H. H., Guo, W., Chang, S. W., Nguyen, D. D., Liu, Y., Zhang, S., Phong Vo, H. N., Bui, X. T., & Ngoc Hoang, B. (2022). Volatile fatty acids production from waste streams by anaerobic digestion: A critical review of the roles and application of enzymes. In *Bioresource Technology* (Vol. 359). https://doi.org/10.1016/j.biortech.2022.127420

Fengel, D. dan G. W. (1995). Kayu: Kimia, Ultrastruktur, Reaksi-Reaksi. Terjemahan Hardjono Sastro Hamidjojo. In *Gadjah Mada University Press*.

Ferraro, A., Dottorini, G., Massini, G., Mazzurco Miritana, V., Signorini, A., Lembo, G., & Fabbricino, M. (2018). Combined bioaugmentation with anaerobic ruminal fungi and fermentative bacteria to enhance biogas production from wheat straw and mushroom spent straw. *Bioresource Technology*, *260*. https://doi.org/10.1016/j.biortech.2018.03.128

Flad, V., Young, D., Seppälä, S., Hooker, C., Youssef, N., Podmirseg, S. M., Nagler, M., Reilly, M., Li, Y., Fliegerová, K., Cheng, Y., Griffith, G. W., Elshahed, M., Solomon, K. V., O'Malley, M. A., & Theodorou, M. K. (2020). 17 The Biotechnological Potential of Anaerobic Gut Fungi. In *Genetics and Biotechnology*. https://doi.org/10.1007/978-3-030-49924-2_17

France, J., Theodorou, M. K., & Davies, D. (1990). Use of zoospore concentrations and life cycle parameters in determining the population of anaerobic fungi in the rumen ecosystem. *Journal of Theoretical Biology*, *147*(3). https://doi.org/10.1016/S0022-5193(05)80496-5

García-Depraect, O., Castro-Muñoz, R., Muñoz, R., Rene, E. R., León-Becerril, E., Valdez-Vazquez, I., Kumar, G., Reyes-Alvarado, L. C., Martínez-Mendoza, L. J., Carrillo-Reyes, J., & Buitrón, G. (2021). A review on the factors

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

influencing biohydrogen production from lactate: The key to unlocking enhanced dark fermentative processes. In *Bioresource Technology* (Vol. 324). https://doi.org/10.1016/j.biortech.2020.124595

García-Depraect, O., Lebrero, R., Rodriguez-Vega, S., Bordel, S., Santos-Beneit, F., Martínez-Mendoza, L. J., Aragão Börner, R., Börner, T., & Muñoz, R. (2022). Biodegradation of bioplastics under aerobic and anaerobic aqueous conditions: Kinetics, carbon fate and particle size effect. *Bioresource Technology*, *344*. https://doi.org/10.1016/j.biortech.2021.126265

Ghimire, A., Frunzo, L., Pirozzi, F., Trably, E., Escudie, R., Lens, P. N. L., & Esposito, G. (2015). A review on dark fermentative biohydrogen production from organic biomass: Process parameters and use of by-products. In *Applied Energy* (Vol. 144). https://doi.org/10.1016/j.apenergy.2015.01.045

Ghose, T. K. (1987). Measurement of cellulase activities. *Pure and Applied Chemistry*, *59*(2). https://doi.org/10.1351/pac198759020257

Gilbert, H. J., & Hazlewood, G. P. (1993). Bacterial cellulases and xylanases. In *Journal of General Microbiology* (Vol. 139, Issue 2). https://doi.org/10.1099/00221287-139-2-187

Girisuta, B., Janssen, L. P. B. M., & Heeres, H. J. (2007). Kinetic study on the acid-catalyzed hydrolysis of cellulose to levulinic acid. *Industrial and Engineering Chemistry Research*, *46*(6). https://doi.org/10.1021/ie061186z

Gkamarazi N, & Gkamarazi, N. (2015). Implementing anaerobic digestion for municipal solid waste treatment: challenges and prospects. *International Conference on Environmental Science and Technology, CEST, Rhodes, Greece*, *September*.

Gordon, G. L. R., & Phillips, M. W. (1998). The role of anaerobic gut fungi in ruminants. *Nutrition Research Reviews*, *11*(1). https://doi.org/10.1079/nrr19980009

Grenet, E., Breton, A., Barry, P., & Fonty, G. (1989). Rumen anaerobic fungi and plant substrate colonization as affected by diet composition. *Animal Feed Science and Technology*, *26*(1–2). https://doi.org/10.1016/0377-8401(89)90006-0

UNIVERSITAS
GADJAH MADA
**Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Haitjema, C. H., Gilmore, S. P., Henske, J. K., Solomon, K. V., De Groot, R., Kuo, A., Mondo, S. J., Salamov, A. A., LaButti, K., Zhao, Z., Chiniquy, J., Barry, K., Brewer, H. M., Purvine, S. O., Wright, A. T., Hainaut, M., Boxma, B., Van Alen, T., Hackstein, J. H. P., … O'Malley, M. A. (2017). A parts list for fungal cellulosomes revealed by comparative genomics. *Nature Microbiology*, *2*. https://doi.org/10.1038/nmicrobiol.2017.87

Haitjema, C. H., Solomon, K. V., Henske, J. K., Theodorou, M. K., & O'Malley, M. A. (2014). Anaerobic gut fungi: Advances in isolation, culture, and cellulolytic enzyme discovery for biofuel production. *Biotechnology and Bioengineering*, *111*(8). https://doi.org/10.1002/bit.25264

Hanafy, R. A., Elshahed, M. S., Liggenstoffer, A. S., Griffith, G. W., & Youssef, N. H. (2017). Pecoramyces ruminantium, gen. nov., sp. nov., an anaerobic gut fungus from the feces of cattle and sheep. *Mycologia*, *109*(2). https://doi.org/10.1080/00275514.2017.1317190

Haryanti, A., Norsamsi, N., Fanny Sholiha, P. S., & Putri, N. P. (2014). STUDI PEMANFAATAN LIMBAH PADAT KELAPA SAWIT. *Konversi*, *3*(2). https://doi.org/10.20527/k.v3i2.161

Hay, J. X. W., Wu, T. Y., Juan, J. C., & Md. Jahim, J. (2013). Biohydrogen production through photo fermentation or dark fermentation using waste as a substrate: Overview, economics, and future prospects of hydrogen usage. *Biofuels, Bioproducts and Biorefining*, *7*(3). https://doi.org/10.1002/bbb.1403

Hazwan, M., Hussin, B., Hazwan, M., & Hussin, B. (2018). Extraction , modification and characterization of lignin from oil palm fronds as corrosion inhibitors for mild steel in acidic solution. *HAL Open Sciences*, *July*.

Henske, J. K., Wilken, S. E., Solomon, K. V., Smallwood, C. R., Shutthanandan, V., Evans, J. E., Theodorou, M. K., & O'Malley, M. A. (2018). Metabolic characterization of anaerobic fungi provides a path forward for bioprocessing of crude lignocellulose. *Biotechnology and Bioengineering*, *115*(4). https://doi.org/10.1002/bit.26515

Hooker, C. A., Lee, K. Z., & Solomon, K. V. (2019). Leveraging anaerobic fungi for biotechnology. In *Current Opinion in Biotechnology* (Vol. 59).

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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https://doi.org/10.1016/j.copbio.2019.03.013

Hwang, S., Lee, Y., & Yang, K. (2001). Maximization of acetic acid production in partial acidogenesis of swine wastewater. *Biotechnology and Bioengineering*, *75*(5). https://doi.org/10.1002/bit.10068

Jiang, J., Zhang, Y., Li, K., Wang, Q., Gong, C., & Li, M. (2013). Volatile fatty acids production from food waste: Effects of pH, temperature, and organic loading rate. *Bioresource Technology*, *143*. https://doi.org/10.1016/j.biortech.2013.06.025

Joshi, A., Lanjekar, V. B., Dhakephalkar, P. K., Callaghan, T. M., Griffith, G. W., & Dagar, S. S. (2018). Liebetanzomyces polymorphus gen. et sp. nov., a new anaerobic fungus (Neocallimastigomycota) isolated from the rumen of a goat. *MycoKeys*, *40*. https://doi.org/10.3897/mycokeys.40.28337

Karimi, K., Kheradmandinia, S., & Taherzadeh, M. J. (2006). Conversion of rice straw to sugars by dilute-acid hydrolysis. *Biomass and Bioenergy*, *30*(3). https://doi.org/10.1016/j.biombioe.2005.11.015

Kazda, M., Langer, S., & Bengelsdorf, F. R. (2014). Fungi open new possibilities for anaerobic fermentation of organic residues. *Energy, Sustainability and Society*, *4*(1). https://doi.org/10.1186/2192-0567-4-6

Khullar, E., Dien, B. S., Rausch, K. D., Tumbleson, M. E., & Singh, V. (2013). Effect of particle size on enzymatic hydrolysis of pretreated Miscanthus. *Industrial Crops and Products*, *44*. https://doi.org/10.1016/j.indcrop.2012.10.015

Kim, B. H., & Gadd, G. M. (2008). Bacterial physiology and metabolism. In *Bacterial Physiology and Metabolism*. https://doi.org/10.1017/CBO9780511790461

Kim, I. S., Hwang, M. H., Jang, N. J., Hyun, S. H., & Lee, S. T. (2004). Effect of low pH on the activity of hydrogen utilizing methanogen in bio-hydrogen process. *International Journal of Hydrogen Energy*, *29*(11). https://doi.org/10.1016/j.ijhydene.2003.08.017

Kim, N. U., & Lee, Y. L. (2018). Blocking-artifact detection in frequency domain for frame-rate up-conversion. *Personal and Ubiquitous Computing*, *22*(1).

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

https://doi.org/10.1007/s00779-017-1019-z

Kurniati, Y., Rahmat, A., Malianto, B. I., Nandayani, D., & Pratiwi, W. S. W. (2021). Review Analisa Kondisi Optimum Dalam Proses Pembuatan Biogas. *Rekayasa*, *14*(2). https://doi.org/10.21107/rekayasa.v14i2.11305

Lee, S. S., Ha, J. K., & Cheng, K. J. (2000). Influence of an anaerobic fungal culture administration on in vivo ruminal fermentation and nutrient digestion. *Animal Feed Science and Technology*, *88*(3–4). https://doi.org/10.1016/S0377-8401(00)00216-9

Li, T., Mazéas, L., Sghir, A., Leblon, G., & Bouchez, T. (2009). Insights into networks of functional microbes catalysing methanization of cellulose under mesophilic conditions. *Environmental Microbiology*, *11*(4). https://doi.org/10.1111/j.1462-2920.2008.01810.x

Lin, C. Y., & Lay, C. H. (2005). A nutrient formulation for fermentative hydrogen production using anaerobic sewage sludge microflora. *International Journal of Hydrogen Energy*, *30*(3). https://doi.org/10.1016/j.ijhydene.2004.03.002

Liu, H., Wang, J., Liu, X., Fu, B., Chen, J., & Yu, H. Q. (2012). Acidogenic fermentation of proteinaceous sewage sludge: Effect of pH. *Water Research*, *46*(3). https://doi.org/10.1016/j.watres.2011.11.047

Liu, Y., Nie, Y., Lu, X., Zhang, X., He, H., Pan, F., Zhou, L., Liu, X., Ji, X., & Zhang, S. (2019). Cascade utilization of lignocellulosic biomass to high-value products. In *Green Chemistry* (Vol. 21, Issue 13). https://doi.org/10.1039/c9gc00473d

Logroño, W., Nikolausz, M., Harms, H., & Kleinsteuber, S. (2022). Physiological Effects of 2-Bromoethanesulfonate on Hydrogenotrophic Pure and Mixed Cultures. *Microorganisms*, *10*(2). https://doi.org/10.3390/microorganisms10020355

Lovato, G., Augusto, I. M. G., Ferraz Júnior, A. D. N., Albanez, R., Ratusznei, S. M., Etchebehere, C., Zaiat, M., & Rodrigues, J. A. D. (2021). Reactor start-up strategy as key for high and stable hydrogen production from cheese whey thermophilic dark fermentation. *International Journal of Hydrogen Energy*, *46*(54). https://doi.org/10.1016/j.ijhydene.2021.06.010

UNIVERSITAS
GADJAH MADA
**Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Luo, K., Pang, Y., Yang, Q., Wang, D., Li, X., Lei, M., & Huang, Q. (2019). A critical review of volatile fatty acids produced from waste activated sludge: enhanced strategies and its applications. In *Environmental Science and Pollution Research* (Vol. 26, Issue 14). https://doi.org/10.1007/s11356-019-04798-8

Magama, P., Chiyanzu, I., & Mulopo, J. (2022). A systematic review of sustainable fruit and vegetable waste recycling alternatives and possibilities for anaerobic biorefinery. In *Bioresource Technology Reports* (Vol. 18). https://doi.org/10.1016/j.biteb.2022.101031

Merlin Christy, P., Gopinath, L. R., & Divya, D. (2014). A review on anaerobic decomposition and enhancement of biogas production through enzymes and microorganisms. In *Renewable and Sustainable Energy Reviews* (Vol. 34). https://doi.org/10.1016/j.rser.2014.03.010

Monlau, F., Sambusiti, C., Ficara, E., Aboulkas, A., Barakat, A., & Carrère, H. (2015). New opportunities for agricultural digestate valorization: Current situation and perspectives. In *Energy and Environmental Science* (Vol. 8, Issue 9). https://doi.org/10.1039/c5ee01633a

Moon, M., Park, W. K., Lee, S. Y., Hwang, K. R., Lee, S., Kim, M. S., Kim, B., Oh, Y. K., & Lee, J. S. (2022). Utilization of whole microalgal biomass for advanced biofuel and biorefinery applications. *Renewable and Sustainable Energy Reviews*, *160*. https://doi.org/10.1016/j.rser.2022.112269

Moreno-Dávila, I. M. M., Ríos-González, L. J., Rodríguez-de la Garza, J. A., Morales-Martínez, T. K., & Garza-García, Y. (2019). Biohydrogen production from paper industry wastes by SSF: A study of the influence of temperature/enzyme loading. *International Journal of Hydrogen Energy*, *44*(24). https://doi.org/10.1016/j.ijhydene.2019.01.061

Murali, N., Srinivas, K., & Ahring, B. K. (2017). Biochemical production and separation of carboxylic acids for biorefinery applications. In *Fermentation* (Vol. 3, Issue 2). https://doi.org/10.3390/fermentation3020022

Mussoline, W., Esposito, G., Giordano, A., & Lens, P. (2013). The anaerobic digestion of rice straw: A review. *Critical Reviews in Environmental Science*

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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and Technology, *43*(9). https://doi.org/10.1080/10643389.2011.627018

Mustakim, Muarifah, R. F., & Awwaly, K. U. Al. (2012). Pembuatan Keju dengan Menggunakan Enzim Renin Mucor pusillus amobil. *Jurnal Ilmu-Ilmu Peternakan*, *19*(2).

Niya, B., Yaakoubi, K., Azaroual, S. E., Beraich, F. Z., Arouch, M., & Meftah Kadmiri, I. (2023). Anaerobic Digestion of Agricultural Waste Using Microbial Inocula: Performance and Characterization of Bacterial Communities Using 16S rRNA Sequencing Approach. *Energies*, *16*(8). https://doi.org/10.3390/en16083300

Nkemka, V. N., Gilroyed, B., Yanke, J., Gruninger, R., Vedres, D., McAllister, T., & Hao, X. (2015). Bioaugmentation with an anaerobic fungus in a two-stage process for biohydrogen and biogas production using corn silage and cattail. *Bioresource Technology*, *185*. https://doi.org/10.1016/j.biortech.2015.02.100

Pratama, A. S. C., & Sa'diyah, K. (2023). PENGARUH JENIS BIOMASSA TERHADAP KARAKTERISTIK ASAP CAIR MELALUI METODE PIROLISIS. *DISTILAT: Jurnal Teknologi Separasi*, *8*(1). https://doi.org/10.33795/distilat.v8i1.260

Procházka, J., Mrázek, J., Štrosová, L., Fliegerová, K., Zábranská, J., & Dohányos, M. (2012). Enhanced biogas yield from energy crops with rumen anaerobic fungi. *Engineering in Life Sciences*, *12*(3). https://doi.org/10.1002/elsc.201100076

Puniya, A. K., Salem, A. Z. M., Kumar, S., Dagar, S. S., Griffith, G. W., Puniya, M., Ravella, S. R., Kumar, N., Dhewa, T., & Kumar, R. (2015). Role of live microbial feed supplements with reference to anaerobic fungi in ruminant productivity: A review. In *Journal of Integrative Agriculture* (Vol. 14, Issue 3). https://doi.org/10.1016/S2095-3119(14)60837-6

Rachim, P. F., Mirta, E. L., & Thoha, M. Y. (2012). Pembuatan Surfaktan Natrium Lignosulfonat dari Tandan Kosong Kelapa Sawit dengan Sulfonasi Langsung. *Jurnal Teknik Kimia*, *18*(1).

Sarwono E. (2008). Pemanfaatan Janjang Kosong Sebagai Substitusi Pupuk Tanaman Kelapa Sawit. In *APLIKA Jurnal Ilmu Pengetahuan dan Teknologi*

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

(Vol. 8, Issue 1).

Schirmaier, C., Jossen, V., Kaiser, S. C., Jüngerkes, F., Brill, S., Safavi-Nab, A., Siehoff, A., van den Bos, C., Eibl, D., & Eibl, R. (2014). Scale-up of adipose tissue-derived mesenchymal stem cell production in stirred single-use bioreactors under low-serum conditions. *Engineering in Life Sciences*, *14*(3). https://doi.org/10.1002/elsc.201300134

Shahbaz, M., Raghutla, C., Chittedi, K. R., Jiao, Z., & Vo, X. V. (2020). The effect of renewable energy consumption on economic growth: Evidence from the renewable energy country attractive index. *Energy*, *207*. https://doi.org/10.1016/j.energy.2020.118162

Sikora, A., Detman, A., Chojnacka, A., & Blaszczyk, M. K. (2017). Anaerobic Digestion: I. A Common Process Ensuring Energy Flow and the Circulation of Matter in Ecosystems. II. A Tool for the Production of Gaseous Biofuels. In *Fermentation Processes*. https://doi.org/10.5772/64645

Singh Nee Nigam, P., Gupta, N., & Anthwal, A. (2009). Pre-treatment of agro-industrial residues. In *Biotechnology for Agro-Industrial Residues Utilisation: Utilisation of Agro-Residues*. https://doi.org/10.1007/978-1-4020-9942-7_2

Singhania, R. R., Patel, A. K., Christophe, G., Fontanille, P., & Larroche, C. (2013). Biological upgrading of volatile fatty acids, key intermediates for the valorization of biowaste through dark anaerobic fermentation. *Bioresource Technology*, *145*. https://doi.org/10.1016/j.biortech.2012.12.137

Sirohi, S. K., Choudhury, P. K., Dagar, S. S., Puniya, A. K., & Singh, D. (2013). Isolation, characterization and fibre degradation potential of anaerobic rumen fungi from cattle. *Annals of Microbiology*, *63*(3). https://doi.org/10.1007/s13213-012-0577-6

Song, Y., Zhou, J., Zhang, L., & Wu, X. (2008). Homogenous modification of cellulose with acrylamide in NaOH/urea aqueous solutions. *Carbohydrate Polymers*, *73*(1). https://doi.org/10.1016/j.carbpol.2007.10.018

Spicher, G. (1991). Gerhartz, W. (Ed.): Enzymes in Industry - Production and Application. VCH Verlagsgesellschaft mbH, Weinheim 1990, XVII, 322 Seiten, mit 57 Abb. und 43 Tab., Hardcover DM 118,–. *Starch - Stärke*, *43*(5).

UNIVERSITAS
GADJAH MADA
**Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap
Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit**
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https://doi.org/10.1002/star.19910430517

Strazzera, G., Battista, F., Garcia, N. H., Frison, N., & Bolzonella, D. (2018). Volatile fatty acids production from food wastes for biorefinery platforms: A review. *Journal of Environmental Management*, *226*. https://doi.org/10.1016/j.jenvman.2018.08.039

Sudarmadji, S. ., & Haryono, B. (2007). Prosedur Analisa untuk Bahan Makanan dan Pertanian. *Yogyakarta: Edisi Ketiga, Liberty*.

Sukumaran, R. K., Singhania, R. R., & Pandey, A. (2005). Microbial cellulases - Production, applications and challenges. In *Journal of Scientific and Industrial Research* (Vol. 64, Issue 11).

Suparjo. (2018). Degradasi Komponen Lignoselulosa Oleh Kapang Pelapuk Putih. *Jajo 66*, *1*(3).

Suryani, A., Mangunwidjaja, D., Hambali, E., & Anwar, K. (1999). PROSES OPTIMASI SUHU DAN KONSENTRASI SODIUM BISULFIT (NAHSO3) PADA PEMBUATAN SODIUM LIGNOSULFONAT BERBASIS TANDAN KOSONG KELAPA SAWIT (TKKS). *Jurnal Teknik Industri Pertanian*, *18*(2).

Taherzadeh, M. J., & Karimi, K. (2008). Pretreatment of lignocellulosic wastes to improve ethanol and biogas production: A review. In *International Journal of Molecular Sciences* (Vol. 9, Issue 9). https://doi.org/10.3390/ijms9091621

Ulinhua, I. P. (2016). Analisis Pengendalian Kualitas Air Limbah Industri di Pabrik Gula Tjoekir Kabupaten Jombang. *Tugas Akhir Program Studi Diploma III Jurusan Statistika Fakultas Matematika Dan Ilmu Pengetahuan Alam Institut Teknologi Sepuluh Nopember*, *1*.

Van Ginkel, S., Sung, S., & Lay, J. J. (2001). Biohydrogen production as a function of pH and substrate concentration. *Environmental Science and Technology*, *35*(24). https://doi.org/10.1021/es001979r

Wainaina, S., Lukitawesa, Kumar Awasthi, M., & Taherzadeh, M. J. (2019). Bioengineering of anaerobic digestion for volatile fatty acids, hydrogen or methane production: A critical review. In *Bioengineered* (Vol. 10, Issue 1). https://doi.org/10.1080/21655979.2019.1673937

UNIVERSITAS GADJAH MADA
Efek Penambahan Jamur Anaerobik Pada Produksi Asam Lemak Volatil Melalui Proses Fermentasi Gelap Menggunakan Limbah Jerami Padi dan Tandan Kosong Kelapa Sawit
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Wang, L., Zhou, Q., & Li, F. T. (2006). Avoiding propionic acid accumulation in the anaerobic process for biohydrogen production. *Biomass and Bioenergy*, *30*(2). https://doi.org/10.1016/j.biombioe.2005.11.010

Wang, T. Y., Chen, H. L., Lu, M. Y. J., Chen, Y. C., Sung, H. M., Mao, C. T., Cho, H. Y., Ke, H. M., Hwa, T. Y., Ruan, S. K., Hung, K. Y., Chen, C. K., Li, J. Y., Wu, Y. C., Chen, Y. H., Chou, S. P., Tsai, Y. W., Chu, T. C., Shih, C. C. A., … Shih, M. C. (2011). Functional characterization of cellulases identified from the cow rumen fungus Neocallimastix patriciarum W5 by transcriptomic and secretomic analyses. *Biotechnology for Biofuels*, *4*. https://doi.org/10.1186/1754-6834-4-24

Xue, Y., Shen, R., Li, Y., Sun, Z., Sun, X., Li, F., Li, X., Cheng, Y., & Zhu, W. (2022). Anaerobic Fungi Isolated From Bactrian Camel Rumen Contents Have Strong Lignocellulosic Bioconversion Potential. *Frontiers in Microbiology*, *13*. https://doi.org/10.3389/fmicb.2022.888964

Yıldırım, E., Ince, O., Aydin, S., & Ince, B. (2017). Improvement of biogas potential of anaerobic digesters using rumen fungi. *Renewable Energy*, *109*. https://doi.org/10.1016/j.renene.2017.03.021

Yu, H. Q., & Fang, H. H. P. (2003). Acidogenesis of gelatin-rich wastewater in an upflow anaerobic reactor: Influence of pH and temperature. *Water Research*, *37*(1). https://doi.org/10.1016/S0043-1354(02)00256-7

Yu, Q., Liu, R., Li, K., & Ma, R. (2019). A review of crop straw pretreatment methods for biogas production by anaerobic digestion in China. In *Renewable and Sustainable Energy Reviews* (Vol. 107). https://doi.org/10.1016/j.rser.2019.02.020

Zacharof, M. P., & Lovitt, R. W. (2014). Recovery of volatile fatty acids (VFA) from complex waste effluents using membranes. *Water Science and Technology*, *69*(3). https://doi.org/10.2166/wst.2013.717

Zhang, B., Zhang, L. L., Zhang, S. C., Shi, H. Z., & Cai, W. M. (2005). The influence of pH hydrolysis and acidogenesis of kitchen wastes in two-phase anaerobic digestion. *Environmental Technology*, *26*(3). https://doi.org/10.1080/09593332608618563

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GADJAH MADA
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Zhong, C., Lau, M. W., Balan, V., Dale, B. E., & Yuan, Y. J. (2009). Optimization of enzymatic hydrolysis and ethanol fermentation from AFEX-treated rice straw. *Applied Microbiology and Biotechnology*, *84*(4). https://doi.org/10.1007/s00253-009-2001-0