DAFTAR PUSTAKA

Akinmulewo, A.B., and Nwinyi, O.C. 2019. Polyhydroxyalkanoate: A Biodegradable Polymer (A Mini Review). *Jornal of Physics: Conference Series* . 1378(**4**): 042007.

Arfiati, D., Lailiyah, S., Dina, K.F., dan Cokrowati, N. 2020. Dinamika Jumlah Bakteri *Bacillus subtilis* dalam Penurunan Kadar Bahan Organik TOM Limbah Budidaya Ikan Lele Sangkuriang (*Clarias gariepinus*). *Journal of Fisheries and Marine Research* . 4(**2**): 222-226.

Averous, L. 2008. *Polylactic Acid: Synthesis, Properties and Applications, in Monomers, Polymers, and Composites from Renewable Resource (Ed Mohamed Naceur Belgacem and Alessandro Gandini*). 1st Edition, Chapter 21. Elsevier Ltd. Amsterdam.

Barekaa, M.M., and Thawadi, A.M.A. 2012. Biosynthesis of Polyhydroxybutyrate (PHB) biopolymer by Bacillus megaterium SW1-2: Application of Box-Behnken Design for Optimization off Process Parameters. African Journal of Microbiology Research. 6(**9**): 2101-2108.

Bhat, S.G., and Nambisan, P. 2014. *Microbial Bioproducts*. Cochin University of Science and Technology. India.

Bhuwal, A.K., Singh, G., Anggarwal, N.K., Goyal, V., and Yadav, A. 2013. Isolation and Screening of Polyhydroxyalkanoates Producing Bacteria From Pulp, Paper, and Cardboard Industry Wastes. *International Journal of Biomaterials*. 2013: 1-10.

Boey, J.Y., Mohamad, L., Khok, Y.S., Tay, G.S., and Baidurah, S. 2021. A Review of The Applications and Biodegradation of Polyhydroxyalkanoates and Poly(Lactic Acid) and Its Composites. *Polymers*. 13(**1544**): 1-21.

Cardozo, J.R.G., Velasco-Bucheli, R., Marin-Pareja, N., Ruiz-Villadiego, O.S., Correa-Londono, G.A., and Mora-Martinez, A.L .2020. Fed-Batch Production and Characterization of Polyhydroxybutyrate by *Bacillus megaterium* LVN01 from Residual Glycerol. Revista DYNA. 87(**214**): 111-120.

Chadijah, S., Baharuddin, M., and Firnanelty. 2019. Potensi Instrumen FTIR dan GC-MS Dalam Mengkarakterisasi dan Membedakan Gelatin Lemak Ayam, Itik, dan Babi. *Jurnal Al-Kimia*. 7(**2**): 126-135.

Chanasit, W., Hodgson, B., Sudesh, K., and Umsakul, K. 2016. Efficient Production of Polyhydroxyalkanoates (PHAs) from Pseudomonas mendocina PSU Using a Biodesel Liquid Waste (BLW) as The Sole Carbon Source. *Bioscience, Biotechnology, and Biochemistry*. 80(**7**): 1440-1450.

Chen, Y., Awasthi, A.K., Wei, F., Tan, Q., and Li, J. 2021. Single-Use Plastic: Production, Usage, Disposal, and Adverse Impacts. *Science of The Total Environment*. 752: 1-15.

Chin, J.H-C., Samian, M.R., and Normi, Y.M. 2022. Characterization of Polyhydroxyalkanoate Production Capacity, Composition and Weight Synthesized by *Burkholderia cepacia* JC-1 From Various Carbon Sources. *Heliyon*. 8(**3**): 1-11.

Damle, P., and Vaidya, V.K. 2016. Isolation, Identification and Characterization of Polyhydroxybutyrate Producing *Bacillus flexus*. *International Journal of Engineering Sciences & Research Technology*. 5(**11**): 106-114.

Darus, N., Tamimi, M., Tirawaty, S., and Muchtazar, M. 2020. An Overview of Plastic Waste Recycling in The Urban Areas of Java Island in Indonesia. *Journal of Environment Science and Sustainable Development*. 3(**2**): 402-415.

Devi, A.B., Nachiyar, C.V., Kaviyarasi, T., and Samrot, A.V. 2015. Characterization of Polyhydroxybutyrate Synthesized by *Bacillus cereus*. *International Journal of Pharmacy and Pharmaceutical Sciences*. 7(**3**): 140-144.

Divyashree, M.S., and Shamala, T.R. 2010. Extractability of Polyhydroxyalkanoate Synthesized by *Bacillus flexus* Cultivated in Organic and Inorganic Nutrient Media. *Indian Journal of Microbiology*. 50(**1**): 63-69.

Dobrogojski, J., Spychalski, M., Lucinski, R., and Borek, S. 2018. Transgenic Plants as a Source of Polyhydroxyalkanoates. *Acta Physiologiae Plantarum*. 40(**162**): 1-17.

Elfidiah, Roni, K.A., and Rosyidah. 2020. Pyrolysis Tool Prototype for Coversion of Plastic Bag Waste to Liquid Fuel. *TEST Engineering and Management*. 82: 7528-7266.

Geethu, M., Chandrashekar, H.R., and Divyashree, M.S. 2021. Statistical Optimisation of Polyhydroxyalkanoate Production in *Bacillus endophyticus* Using Sucrose as Sole Sorce of Carbon. *Archives of Microbiology*. 203: 5993-6005.

Godbole, S. 2016. Methods for Identification, Quantification, and Characterization of Polyhydroxyalkanoates-A Review. International Journal of Bioassays. 5(**4**): 4977-4983.

Gomaa, E.Z. 2014. Production of Polyhydroxyalkanoates (PHAs) by *Bacillus subtilis* and *Escherichia coli* Grown on Cane Molasses Fortified with Ethanol. *Brazilian Archives of Biology and Technology an International Journal*. 57(**1**): 145-154.

Gosh, K.A., and Jones, B.H. 2021. Roadmap to Biodegradable Plastics-Current State and Research Needs. *ACS Sustainable Chemistry & Engineering*. 9: 6170-6187.

Haedar, N., Fahruddin, Firdaus, Z., and Nurlela, N. 2014. *Produksi Poli-Β-Hidroksi Butirat (Phb) Pada Isolat Bakteri dari Molasses dan Tanah Pabrik Gula*. Publikasi Jurusan Biologi dan Kimia. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Hasanuddin.

Hasibuan, H.A. 2020. Peluang Limbah Kelapa Sawit Untuk Produksi Polihidroksialkanoat Sebagai Bioplastik. *Jurnal Perspektif*. 19(**2**): 79-94.

Hassanpour, M., and Unnisa, S.A. 2017. Plastic Application Materials Processing and Techniques. *Plastic Surgery and Modern Techniques*. 2017: PSMT-109.

Hendrawan, Y., Alvianto, D., Sumarlan, S.H., dan Wibisono, Y. 2020. Characterization of *Pseudomonas fluorescens* Polyhydroxyalkanoate Produced From Molasses as a Carbon Source. *Advances in Food Science, Sustainable Agriculture and Agroindustrial Engineering*. 3(**1**): 1-10.

Huang, P., Okoshi, T., Mizuno, S., Hiroe, A., and Tsuge, T. 2018. Gass Chromatography-Mass Spectrometry-Based Monomer Composition Analysis of Medium-Chain-Length Polyhydroxyalkanoates Biosynthesized by *Pseudomonas* spp. *Bioscience, Biotechnology, and Biochemistry*. 82(**9**): 1615-1623

Hyakutake, M.I., Mizuno, S., and Tsuge, T. 2018. Biosynthesis and Characteristics of Aromatic Polyhydroxyalkanoates. *Polymers*. 10(**11**): 1-24.

Irwandi, Djamaan, A., dan Agustien, A. 2018. Pengaruh Konsentrasi Minyak Kelapa Sawit Mentah Terhadap Jumlah Biomassa Bakteri *Bacillus* spp. Penghasil Biopolimer Poli (3-Hidroksibutirat). *SCIENTIA Jurnal Farmasi dan Kesehatan*. 8(**1**): 64-72.

Irwandi, Djamaan, A., dan Agustien, A. 2018. Produksi Bioplastik (P3HB) dari Bahan Dasar Minyak Kelapa Sawit dengan Isolat *Bacillus* sp. Chempublish Journal. 3(**2**): 85-93.

Javaid, H., Nawaz, A., Riaz, N., Mukhtar, H., Ul-Haq, I., Shah, K.A., Khan, H., Naqvi, S.M., Shakoor, S., Rasool, A., Ullah, K., Manzoor, R., Kaleem, I., and Murtaza, G. 2020. Biosynthesis of Polyhydroxyalkanoates (PHAs) by The Valorization of Biomass and Synthetic Waste. *Molecules*. 25(**5539**): 1-23.

Jeremic, S., Milovanoic, J., Mojicevic, M., Bogojevic, S.S., and Nikodinovic-Runic, J. 2020. Understanding Bioplastic Materials-Current State and Trends. *Journal of The Serbian Chemical Society*. 85(**0**): 1-33.

Keskin, G., Kizil, G., Bechelany, M., Pochat-Bohatier, C., and Oner, M. 2017. Potential of Polyhydroxyalkanoate (PHA) Polymers Family as Substitutes of Petroleum Based Polymers for Packaging Applications and Solutions Brought by Their Composites to Form Barrier Materials. *Pure and Applied Chemistry*. 89(**12**): 1841-1848.

Khattab, A.M., Esmael, M.E., Farrag, A.A., and Ibrahim, M.I.A. 2021. Structural Assessment of The Bioplastic (Poly-3-Hydroxybutyrate) Produced by *Bacillus flexus* Azu-A2 Through Cheese Whey Valorization. *International Journal of Biological Macromolecules*. 190: 319-332.

Kourmentza, C., and Komaros, M. 2016. Biotransformation of Volatile Fatty Acids to Polyhydroxyalkanoates by Employing Mixed Microbial Consortia: The Effect of pH and Carbon Source. *Bioresource Technology*.222: 388-398.

Kresnawaty, I., Mulyatni, A.S., Eris, D.D., dan Prakoso, H.T. 2014. Karakterisasi PHA yang Dihasilkan Oleh *Pseudomonas aeruginosa* dan *Bacillus subtilis* yang Ditumbuhkan dalam Media Limbah Cair Pabrik Kelapa Sawit. *Jurnal Menara Perkebunan*. 82(**2**): 57-63.

Kumar, S., and Thakur, KS. 2017. Bioplastics-Classification, Production and Their Potential Food Applications. *Journal of Hill Agriculture*. 8(**2**): 118-129.

Mazhandu, Z.S., Muzenda, E., Mamvura, T.A., Belaid, M., and Nhubu, T. 2020. Integrated and Consolidated Review of Plastic Waste Management and Bio-Based Biodegradable Plastics: Challenges and Opportunities. *Sustainability*. 12(**8360**): 1-57.

Mizuno, S., Enda, Y., Saika, A., Hiroe, A., and Tsuge, T. 2017. Biosynthesis of Polyhydroxyalkanoates Containing 2-Hydroxy-4-Methylvalerate and 2-Hydroxy-3-Phenylpropionate Units From A Related or Unrelated Carbon Source. *Journal of Bioscience and Bioengineering*. 1-6.

Mumtaz, T., Yahaya, N.A., Abd-Aziz, S., Rahman, N.A., Yee, P.L., Shirai, Y., and Hassan, M.A. 2010. Turning Waste to Wealth-Biodegradable Plastics Polyhydroxyalkanoates From Palm Oil Mill Effluent-A Malaysian Perspective. *Journal of Cleaner Production*. 18(**14**): 1393-1402.

Muneer, F., Rasul, I., Azeem, F., Siddique, M.H., Zubair, M., and Nadeem, H. 2020. Microbial Polyhydroxyalkanoates (PHAs): Efficient Replacement of Synthetic Polymers. *Journal of Polymers and The Environment*. 1-22.

Murab, T., Gothalwal, R., and Tripathi, N. 2021. Poly-Hydroxyalkanoates (PHA): Biological Competition to Plastic World. *Journal of Advanced Scientific Research*. 12(**1**): 34-43.

Mohapatra, S., Mohanta, P.R., Sarkar, B., Daware, A., Kumar, C., and Samantaray, D.P. 2015. Production of Polyhydroxyalkanoates (PHAs) by *Bacillus* Strain Isolated From Waste Water and Its Biochemical Characterization. Proceedings of The National Academy of Science.

Montoya, C., Cochard, B., Flori, A., Cros, D., Lopes, R., Cuellar, T., Espeout, S., Syaputra, I., Villeneuve, P., Pina, M., Ritterm E., Leroy, T., and Bilotte, N. 2014. Genetic Architecture of Palm Oil Fatty Acid Composition in Cultivated Oil Palm (*Elaeis guineensis* Jacq.) Compared to Its Wild Relative *E. oleifera* (H.B.K) Cortés. *PLos ONE*. 9(**5**): 1-13.

Mozejko-Ciesielska, J., and Kiewisz, R. 2016. Bacterial Polyhydroxyalkanoates: Still Fabulous. *Microbiological Research*. 192: 271-282.

Narayanan, A., and Ramana, K.V. 2012. Polyhydroxybutyrate Production in *Bacillus mycoides* DFC1 Using Response Surface Optimization for Physico-Chemical Process Parameters. *3 Biotech*. 2: 287-296.

Nurhayati, Radjasa, O.K., and Prijambada, I.D. 2017. Seleksi Isolat Bakteri Amilolitik dari Rhizosfer *Canna edulis* Kerr. Untuk Produksi Poli Hidroksi Alkanoat dari Limbah Cair Tapioka. *Jurnal Rekayasa Proses*. 11(**2**): 101-105.

Obulisamy, P.K., and Mehariya, S. 2021. Polyhydroxyalkanoates From Extremophiles: A Review. *Bioresource Technology*. 325: 1-13.

Ogawa, R. 2020. Marine-Degradable Plastics Progressing for Popularization Under New International Standards. *Global Strategic Studies Institute*. 1-8.

Pagliano, G., Gugliucci, W., Torrieri, E., Piccolo, A., Cangemi, S., Giuseppe, F.A.D., Robertiello, A., Faraco, V., Pepe, O., and Ventorino, V. 2020. Polyhydroxyalkanoates (PHAs) From Dairy Wastewater Effluent: Bacterial Accumulation, Structural Characterization, and Physical Properties. *Chemical and Biological Technologies in Agriculture*. 7(**29**): 1-14.

Pakalapati, H., Chang, C.K., Show, P.L., Arumugasamy, S.K., and Lan, J.C.W. 2018. Development of Polyhydroxyalkanoates Production From Waste

Feedstocks and Applications. *Journal of Bioscience and Bioengineering*. 126(**3**): 282-292

Permatasari, V.R., Pentacolis, K.M., Hidayat, N., and Suprayogi. 2021. Produksi Polihidroksialkanoat (PHA) Oleh Mikroba Konsorsia dengan Penambahan Substrat *Crude Glycerol*. *Jurnal Teknologi Industri Pertanian AGROINTEK*. 15(**3**): 886-892.

Pillai, A.B., Kumar, A.J., Thulasi, K., and Kumarapillai, H. 2017. Evaluation of Short-Chain-Length Polyhydroxyalkanoate Accumulation in *Bacillus aryabhattai*. *Brazilian Journal of Microbiology*. 48: 451-460.

PubChem https://pubchem.ncbi.nlm.nih.gov diakses pada 20 Juni.

Pradani, L., Rohman, M..S., and Margino, S. 2020. The Structural Insight of Class III of Polyhydroxyalkanoates Synthase From *Bacillus* sp. PSA10 as Revealed by In Silico Analysis. *Indonesian Journal of Biotechnology*. 25(**1**): 33-42.

Prihanto, A.A., Timur, H.D.L., Jaziri, A.A., Nurdiani, R., dan Pradarameswari, K.A. Isolasi dan Identifikasi Bakteri Endofit Mangrove *Sonneratia alba* Penghasil Enzim Gelatinase dari Pantai Sendang Biru, Malang, Jawa Timur. *Indonesian Journal of Halal*. 1(**1**): 31-42.

Ramsay, B.A., Lomaliza, K., Chavarie, C., Dube, B., Bataille, P., and Ramsay, J.A. 1990. Production of Poly-(Beta-Hydroxybutyric-co-Beta-Hydroxyvaleric) Acids. *Applied and Environmental Microbiology*. 56(**7**): 2093-2098.

Reddy, V.U.N., Ramanaiah, S.V., Reddy, M.V., and Chang, Y.C. 2022. Review of the Developments of Bacterial Medium-Chain-Length Polyhydroxyalkanoates (mcl-PHAs). *Bioengineering*. 9(**225**): 1-24.

Riaz, S., Rhee, K.Y., and Park, S.J. 2021. Polyhydroxyalkanoates (PHAs): Biopolymers for Biofuel and Biorefineries. *Polymers*. 13(**253**): 1-21.

Sangkharak, S., and Prasertsan, P. 2013. The Production of Polyhydroxyalkanoate by *Bacillus licheniformis* Using Sequential Mutagenesis and Optimization. *Biotechnology and Bioprocess Engineering*. 18: 272-279.

Shah, S., and Kumar, A. 2020. Polyhydroxyalkanoates: Advances in The Synthesis of Sustainable Bio-Plastic. *European Journal of Enviromental Sciences*. 10(**2**): 76-88.

Shah, S., and Kumar, A. 2021. Production and Characterization of Polyhydroxyalkanoates From Industrial Waste Using Soil Bacterial Isolates. *Brazilian Journal of Microbiology*. 57: 715-726.

Shah, M., Rajhans, S., Pandya, H.A., and Mankad, A.U. 2021. Bioplastic for Future: A Review Then and Now. *World Journal of Advanced Research and Reviews*. 9(**2**): 56-67.

Shamala, T.R., Vijayendra, S.V.N., and Joshi, G.J. 2012. Agro-Industrial Residues and Starch for Growth and Co-Production of Polyhydroxyalkanoate Copolymer and α-amylase by Bacillus sp. CFR-67. Brazilian Journal of Microbiology. 1094-1102.

Simo-Cabrera, L., Garcia-Chumillas, S., Hagagy, N., Saddiq, A., Tag, H., Selim, S., AbdElgawad, H., Aguero, A.A., Sanchez, F.M., Canovas, V., Pire, C., and Martinez-Espinosa, R.M. 2021. Haloarchaea as Cell Factories to Produce Bioplastics. *Marine Drugs*. 19(**159**): 1-28.

Sriyapai, T., Chuarung, T., Kimbara, K., Samosorn, S., and Sriyapai, P. 2022. Production and Optimization of Polyhydroxyalkanoates (PHAs) From *Paraburkholderia* sp. PFN 29 Under Submerged Fermentation. *Electronic Journal of Biotechnology*. 56: 1-11.

Sudesh, K., Bhubalan, K., Chuah, J., Kek, Y.K., Kamilah, H., Sridewi, N., and Lee, Y.F. 2011. Synthesis of Polyhydroxyalkanoate From Palm Oil and Some New Applications. *Applied Microbiology and Biotechnology*. 85(**9**): 1373-1386.

Suherman, D. 2021. *Isolasi dan Identifikasi Bakteri Penghasil Polyhydroxyalkanoate (PHA) Asal Limbah Pabrik Kelapa Sawit Kabupaten Morowali Utara*. Universitas Hasanudddin. Makassar.

Suman, T.Y., Li, W.G., Alif, S., Faris, V.R.P., Amarnath, D.J., Ma, J.G., and Pei, D.S. 2020. Characterization of Petroleum-Based Plastics and Their Absorbed Trace Metals From The Sediments of The Marina Beach in Chennai, India. *Environmental Sciences Europe*. 32(**110**): 1-10.

Szacherska, K., Oleskowicz-Popiel, P., Ciesielski, S., and Mojezko-Ciesielska, J. 2021. Volatile Fatty Acids as Carbon Sources for Polyhydroxyalkanoates Production. *Polymers*. 13(**321**): 1-21.

Tan, G.Y.A., Chen, C.L., Li, L., Ge, L., Wang, L., Razaad, I.M.N., Li, Y., Zhao, L., Mo, Y., and Wang, J.Y. 2014. Start a Research on Biopolymer Polyhydroxyalkanoate (PHA): A Review. Polymers. 6: 706-754.

Tan, W.A., Wijaya, I., and Purwadaria, T. 2019. Bioprospecting of Polyhydroxyalkanoates-Producing Bacteria From Indonesian Marine Environment. *Biodiversitas*. 20(**5**): 1309-1315.

Tanikkul, P., Sullivan, G.L., Sarp, S., and Pisutpaisal, N. 2020. Biosynthesis of Medium Chain Length Polyhydroxyalkanoates (mcl-PHAs) From Palm Oil. *Case Studies in Chemical and Environment Engineering*. 2:1-4.

Thirumala, M., Reddy, S.V., dan Mahmood, S.K. 2010. Production and Characterization of PHB From Two Novel Strains of *Bacillus* spp. Isolated From Soil and Activated Sludge. *Journal of Industrial Microbiology and Biotechnology*. 37(**3**): 271-278.

Tufail, S., Munir, S., and Jamil, N. 2017. Variation Analysis of Bacterial Polyhydroxyalkanoates Production Using Saturated and Unsaturated Hydrocarbons. *Brazilian Journal of Microbiology*. 48: 629-636.

Vigneswari, S., Noor, M.S.M., Amelia, T.S.M., Balakrishnan, K., Adnan, A., Bhubalan, K., Amirul, A.A., and Ramakrishna, S. 2021. Recent Advances in The Biosynthesis of Polyhydroxyalkanoates from Lignocellulosic Feedstocks. *Journal of Life*. 11(**807**): 1-25.

Vu, D.H., Wainaina, S., Taherzadeh, M.J., Akesson, D., and Ferreira, J.A. 2021. Production of Polyhydroxyalkanoates (PHAs) by *Bacillus megaterium* Using Food Waste Acidogenic Fermentation-Derived Volatile Fatty Acids. *Bioengineered*. 12(**1**): 2480-2498.

Wahyudiono, J., Adlan, R., Permanadewi, S., and Gibran, A.K. 2018. Karakteristik Minyak Bumi di Blok Bula dan Blok Oseil, Pulau Seram, Maluku. *Jurnal Geologi dan Sumberdaya Mineral*. 19(**4**): 233-241.

Wahyuningtiyas, N.E., and Suryanto, H. 2017. Analysis of Biodegradation of Bioplastics Made of Cassava Starch. *Journal of Mechanical Engineering Science and Technology*. 1(**1**): 24-31.

Williams, S.F., and Martin D.P. 2014. Applications of PHAs in Medicine and Pharmacy. Historical Outline. 1-37.

Yani, I., Rosiliani, D., Khona'ah, B., and Almahdini, F.A. 2019. Identification and Plastic Type and Classification of PET, HDPE, and Using RGB Method. *IOP Conference Series: Materials Science and Engineering*. 857: 1-6.

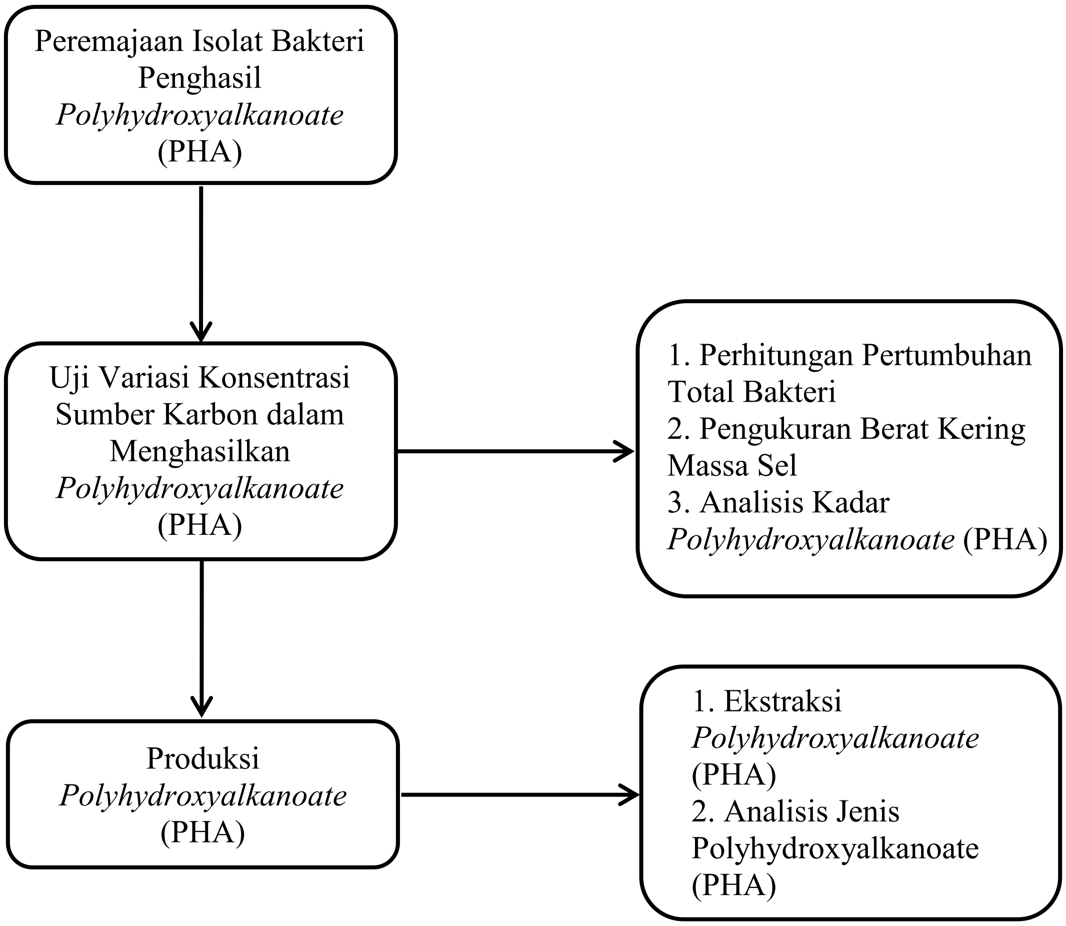
Yustinah, Hidayat, N., Alamsyah, R., Roslan, A.M., Hermasnyah, H., and Gozan, M. 2019. Production of Polyhydroxybutyrate From Oil Palm Empty Fruit Bunch (OPEFB) Hydrolysates By *Bacillus Cereus* Suaeda B-001. *Biocatalysis and Agricultural Biotechnology*. 18: 1-6.

Zain, N.F.M., Paramasivam, M., Tan, J.S., Lim, V., and Lee C.K. 2020. Response Surface Methodology Optimization of Polyhydroxyalkanoate Production by *Burkholderia cepacia* BPT1213 Using Waste Glycerol From Oil Based Biodesel Production. *Biotechnology Progress*. 37: 1-11

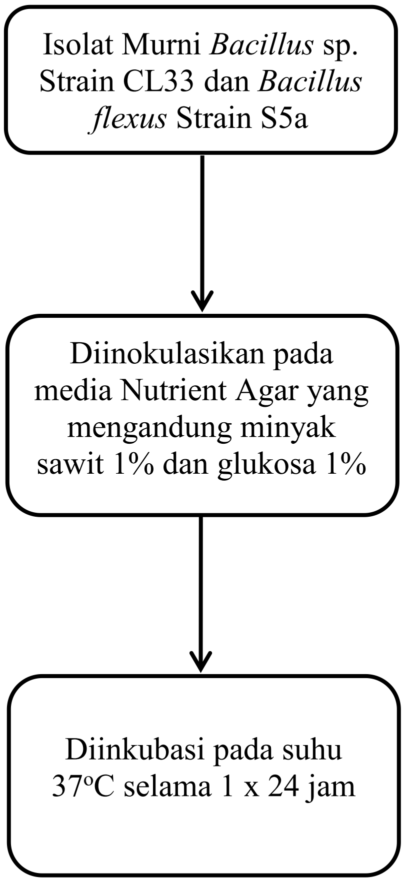
Zhila., N.O., Sapozhnikova, K.Y., Kiselev, E.G., Vasiliev, A.D., Nemtsev, I.V., Shishatskaya, E.I., and Volova, T.G. 2021. Properties of Degradable Polyhydroxyalkanoates (PHAs) Synthesized by A New Strain, *Cupriavidus necator* IBP/SFU-1, From Various Carbon Sources. *Polymers*. 13: 1-19.

Zhu, J., Tian, Q., Zhu, Y., Yang, J., and Wang, M. 2018. Factors for Promoting Polyhydroxyalkanoate (PHA) Synthesis in Bio-Nutrient-Removal and Recovery System. *IOP Conference Series: Earth and Environmental Science*. 178: 1-4.

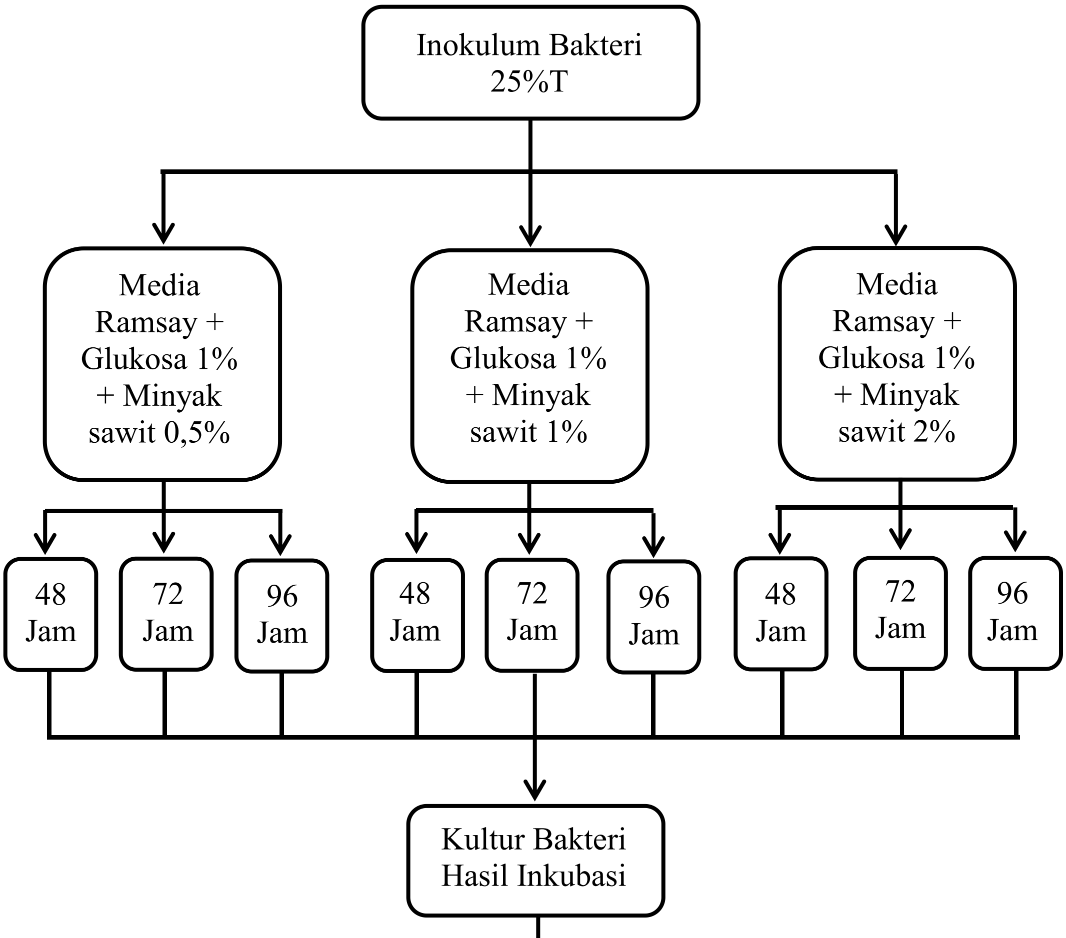
Lampiran 1. Skema Penelitian



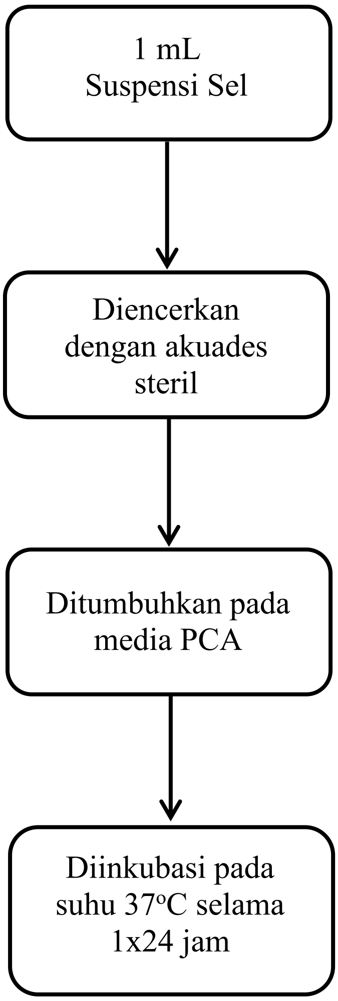
Lampiran 2. Skema Kerja Peremajaan Peremajaan Isolat Bakteri Penghasil *Polyhydroxyalkanoate* (PHA)



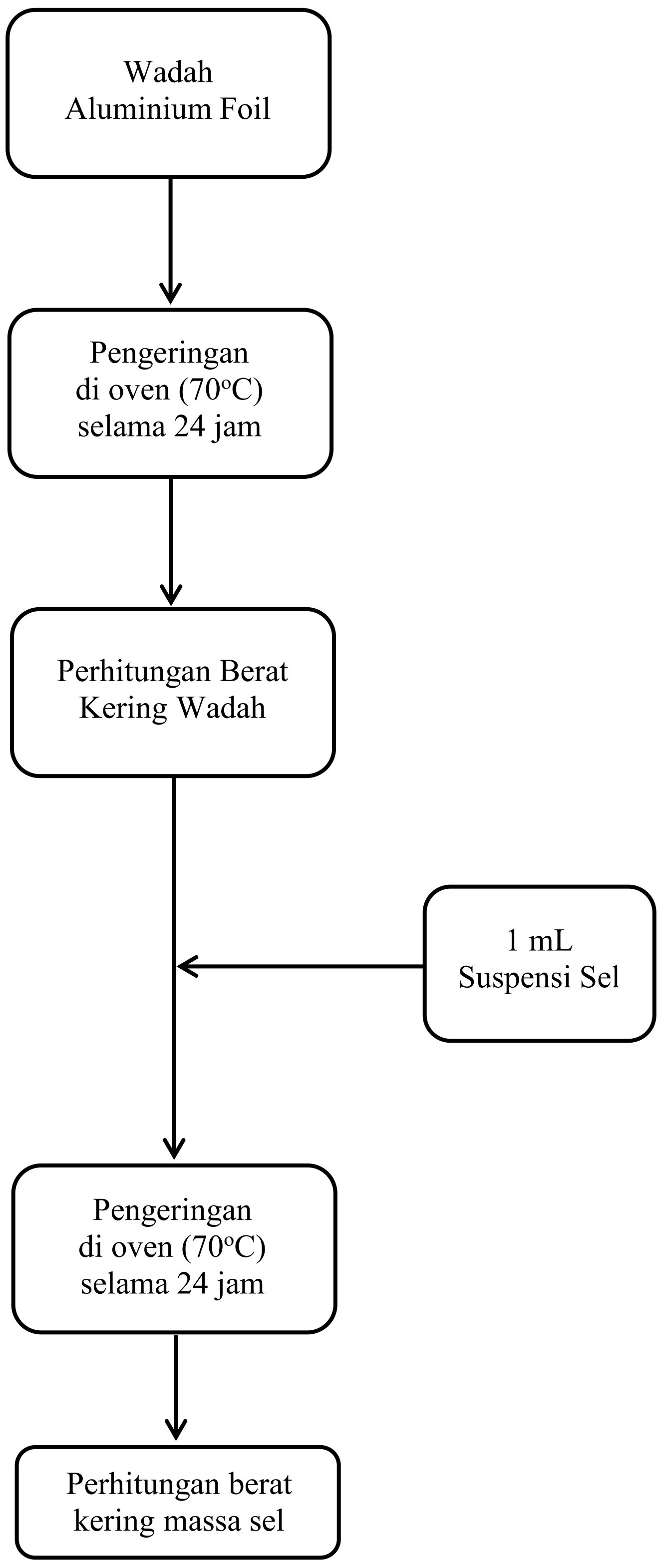
Lampiran 3. Uji Variasi Konsentrasi Sumber Karbon Dalam Menghasilkan *Polyhydroxyalkanoate* (PHA)



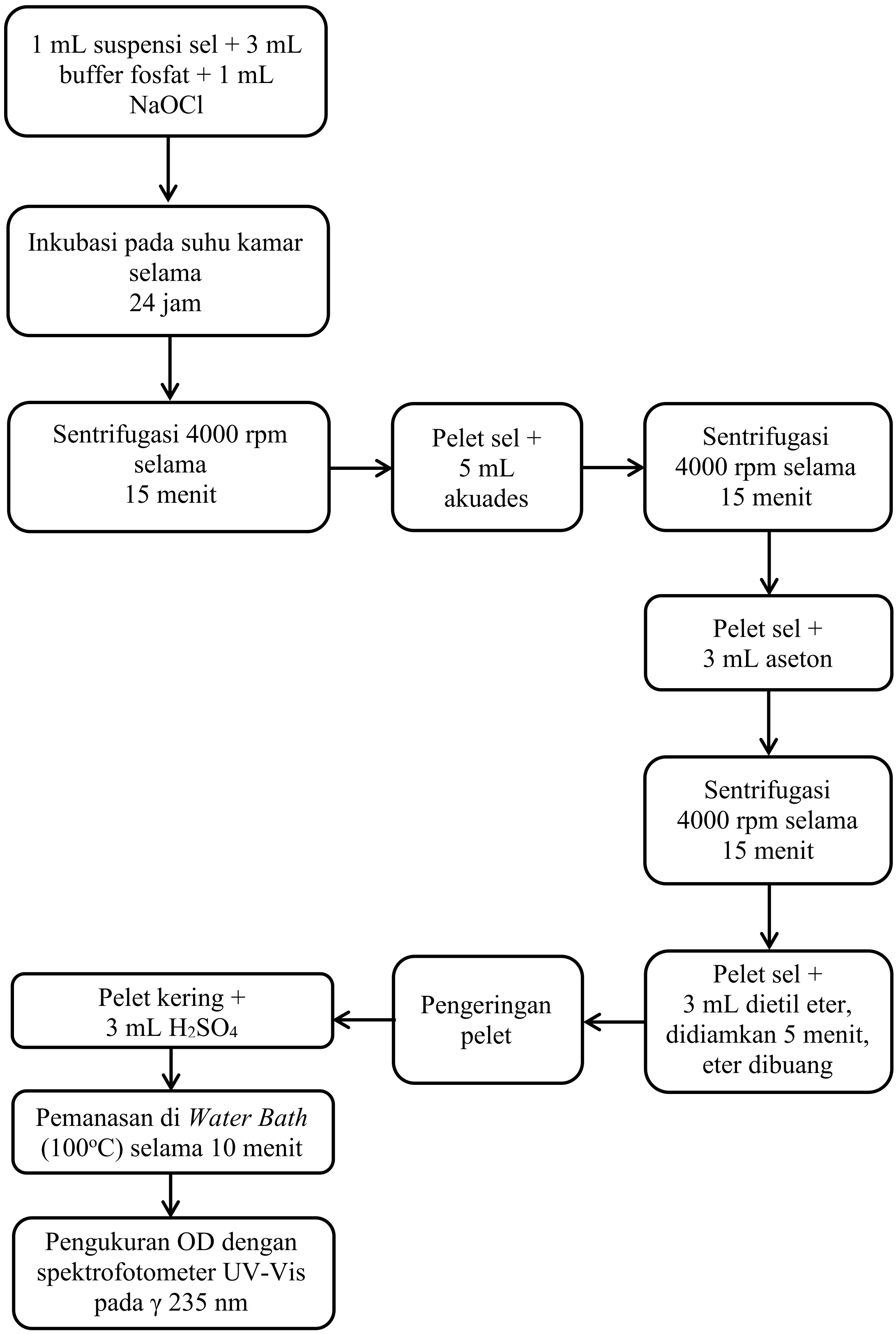
Lampiran 4. Skema kerja Perhitungan Total Bakteri Menggunakan Metode Standard Plate Count (SPC)



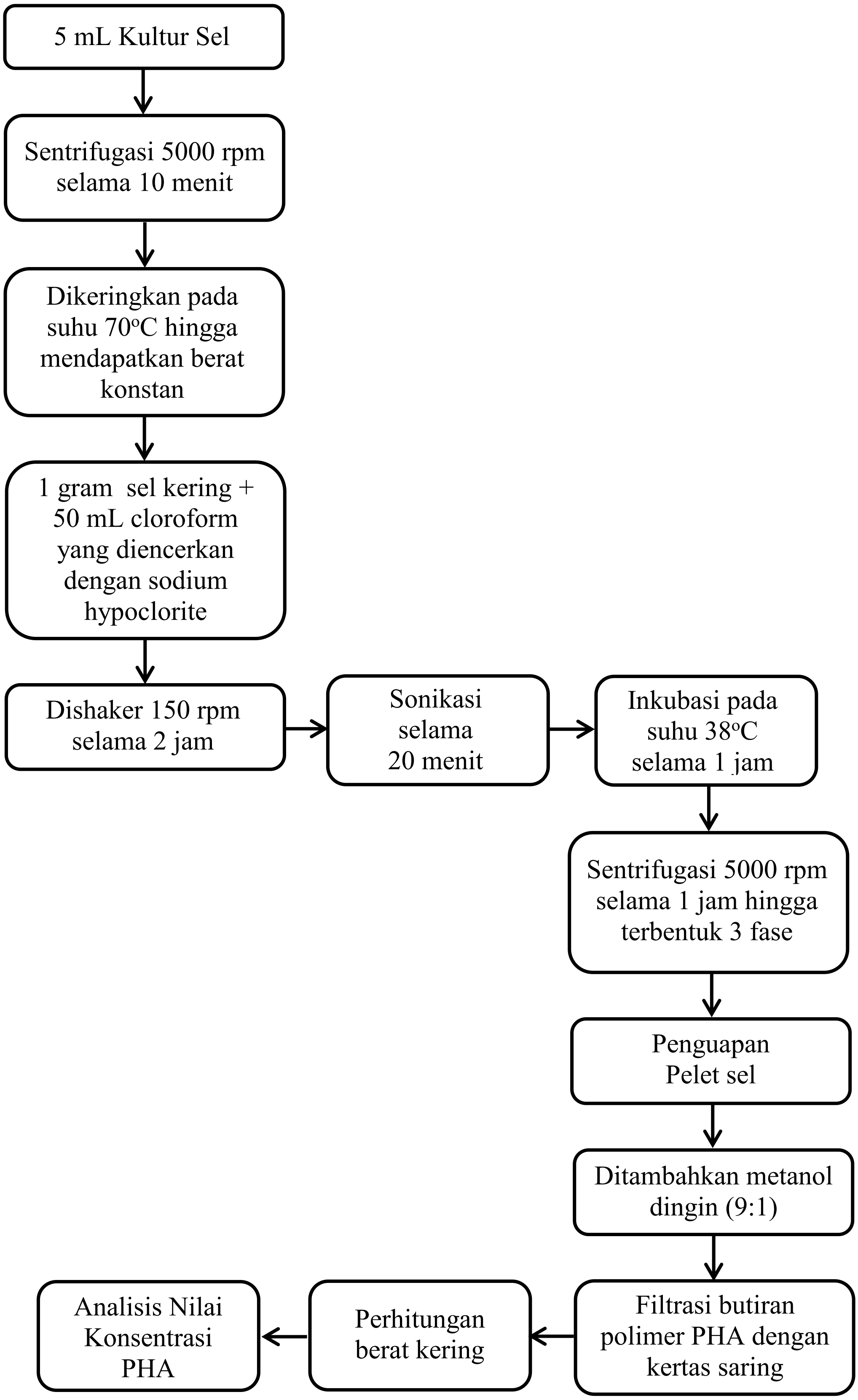
Lampiran 5. Skema Kerja Analisis Berat Kering Sel



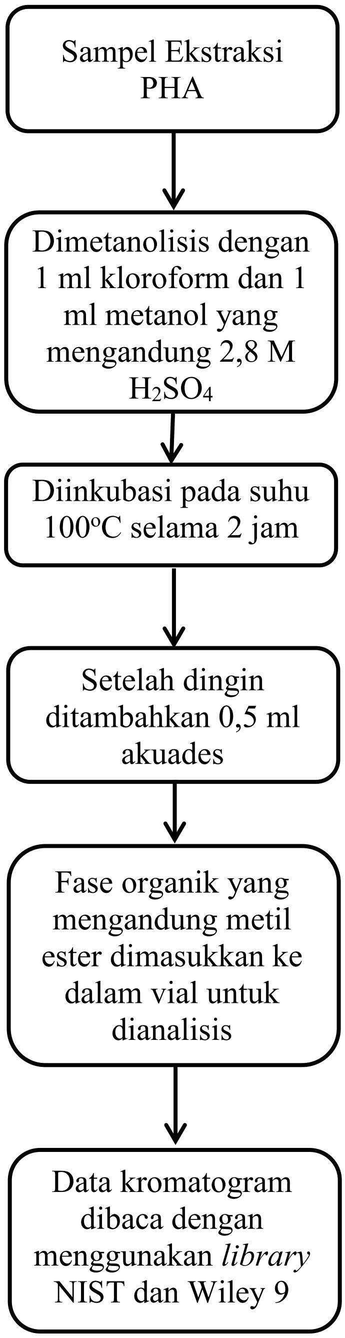
Lampiran 6. Skema Kerja Analisis *Polyhydroxyalkanoate* (PHA) Menggunakan Spektrofotometer UV-Vis



Lampiran 7. Skema Kerja Ekstraksi *Polyhydroxyalkanoate* (PHA)



Lampiran 8. Skema Kerja Analisis Jenis *Polyhydroxyalkanoate* (PHA)



Lampiran 9. Pertumbuhan Total Bakteri *Bacillus* sp. Strain CL33 pada Konsentrasi Minyak 0,5%, 1%, dan 2% dengan Standard Plate Count (SPC)

1. Bakteri *Bacillus* sp. Strain CL33

Konsentrasi Minyak	**Pertumbuhan Total Bakteri (CFU/ml)**		
	48 jam	**72 jam**	**96 jam**
0,5%	$6,2 \times 10^{8}$	$2,5 \times 10^{10}$	$1,6 \times 10^{14}$
1%	$6,3 \times 10^{8}$	$2,9 \times 10^{11}$	$1,9 \times 10^{14}$
2%	$7,1 \times 10^{8}$	$3,4 \times 10^{10}$	$2,7 \times 10^{15}$

2. Bakteri *Bacillus flexus* Strain S5a

Konsentrasi Minyak	**Pertumbuhan Total Bakteri (CFU/ml)**		
	48 jam	**72 jam**	**96 jam**
0,5%	$1,6 \times 10^{8}$	$2,1 \times 10^{11}$	$1,4 \times 10^{14}$
1%	$3,0 \times 10^{8}$	$2,4 \times 10^{10}$	$1,9 \times 10^{14}$
2%	$3,4 \times 10^{8}$	$2,8 \times 10^{11}$	$2,2 \times 10^{15}$

Lampiran 10. Perbandingan Berat Kering Sel *Bacillus* sp. Strain CL33 pada Konsentrasi Minyak 0,5%, 1%, dan 2%

1. Bakteri *Bacillus* sp. Strain CL33

Konsentrasi Minyak	**Berat Kering Sel (g/ml)**		
	48 jam	**72 jam**	**96 jam**
0,5%	0.051	0.057	0.060
1%	0.057	0.065	0.090
2%	0.065	0.067	0.097

2. Bakteri *Bacillus flexus* Strain S5a

Konsentrasi Minyak	**Berat Kering Sel (g/ml)**		
	48 jam	**72 jam**	**96 jam**
0,5%	0.043	0.050	0.064
1%	0.049	0.059	0.067
2%	0.047	0.060	0.079

Lampiran 11. Perbandingan Nilai Absorbansi (*Optical Density*) *Bacillus* sp. Strain CL33 pada Konsentrasi Minyak 0,5%, 1%, dan 2%

1. Bakteri *Bacillus* sp. Strain CL33

Konsentrasi Minyak	**Nilai Absorbansi**		
	48 jam	**72 jam**	**96 jam**
0,5%	3,030	3,111	1,018 x 10^1
1%	3,177	3,908	1,095 x 10^1
2%	3,670	4,130	1,236 x 10^1

2. Bakteri *Bacillus flexus* Strain S5a

Konsentrasi Minyak	**Nilai Absorbansi**		
	48 jam	**72 jam**	**96 jam**
0,5%	3,070	3,563	4,112
1%	3,308	3,667	4,384
2%	3,635	4,384	5,236

Lampiran 12. Hasil Perhitungan Ekstraksi *Polyhydroxyalkanoate* (PHA)

No	Isolat Bakteri	Berat Kering Sel (g/L)	Berat Kering PHA (g/L)	Konsentrasi PHA
1.	*Bacillus* sp. Strain CL33 (2% - 96 jam)	0,927	0,855	92,23%
2.	*Bacillus flexus* Strain S5a (2% - 96 jam)	0,512	0,440	85,93%

Lampiran 13. Hasil Perhitungan Konsentrasi *Polyhydroxyalkanoate* (PHA)

Konsentrasi PHA dihitung dengan rumus (Bhuwal *et al*., 2013):

$$\text{Akumulasi PHA (\%)} = \frac{\text{Berat Kering Ekstrak PHA (g/L)}}{\text{Berat Kering Sel (g/L)}} \times 100\%$$

1. Isolat *Bacillus* sp. Strain CL33 (% - jam)

$$\text{Akumulasi PHA (\%)} = \frac{0{,}855\ (\text{g/L})}{0{,}927\ (\text{g/L})} \times 100\%$$

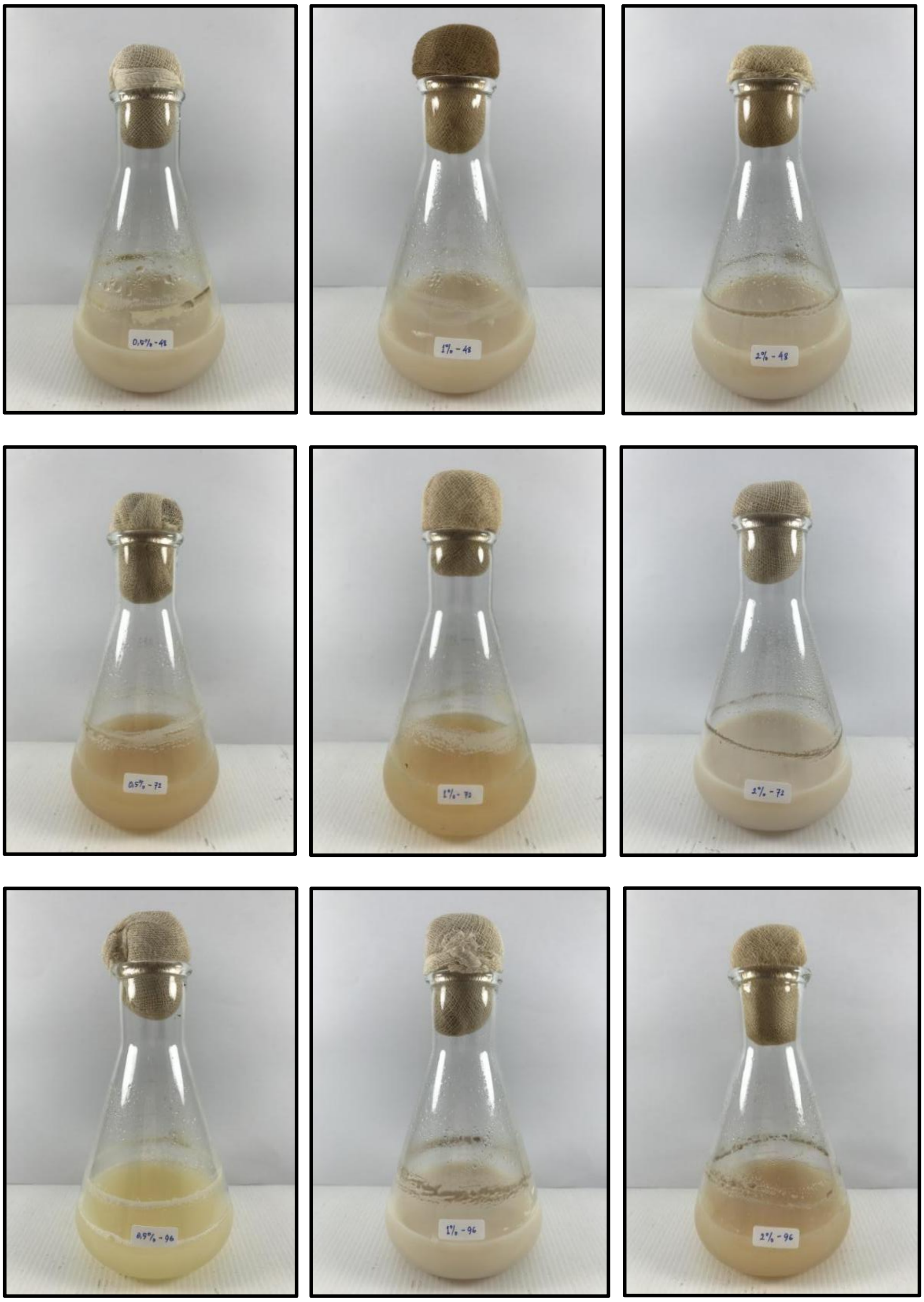
$$\text{Akumulasi PHA (\%)} = 92{,}23\%$$

2. Isolat *Bacillus flexus* Strain S5a (0,5% - 72 jam)

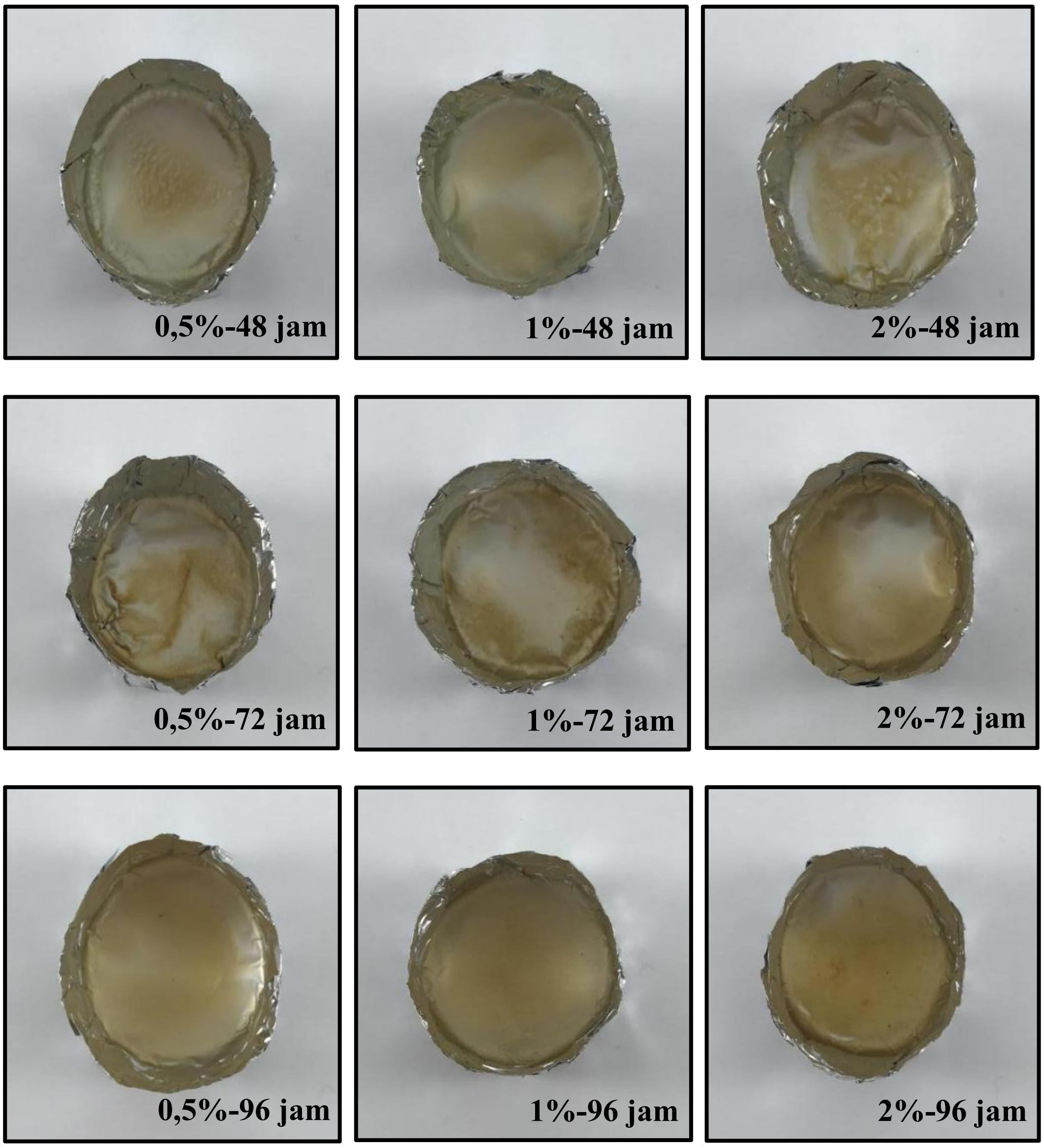
$$\text{Akumulasi PHA (\%)} = \frac{0{,}440\ (\text{g/L})}{0{,}512\ (\text{g/L})} \times 100\%$$

$$\text{Akumulasi PHA (\%)} = 85{,}93\%$$

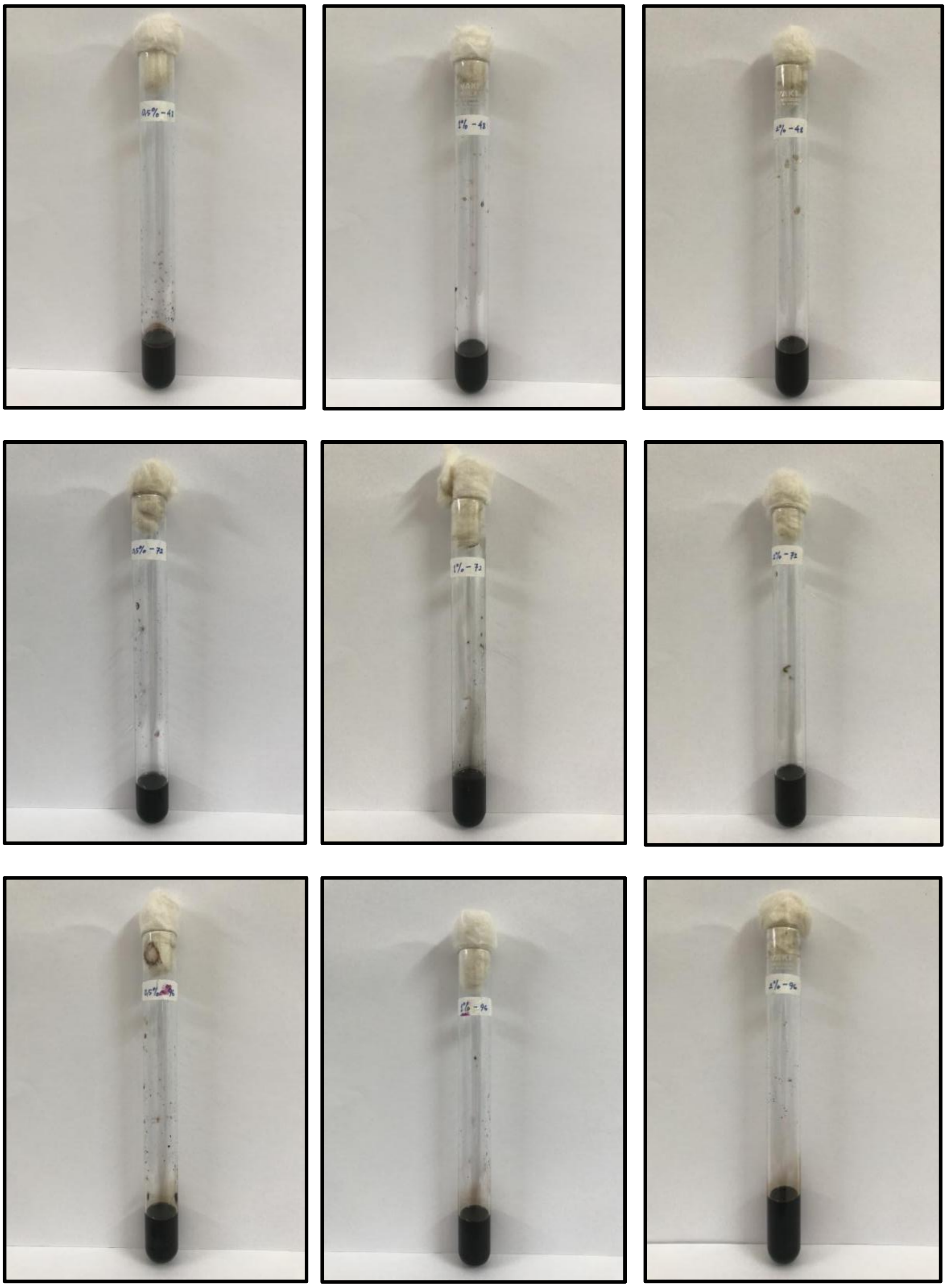
Lampiran 14. Uji Variasi Konsentrasi Sumber Karbon dalam Menghasilkan *Polyhydroxyalkanoate* (PHA)



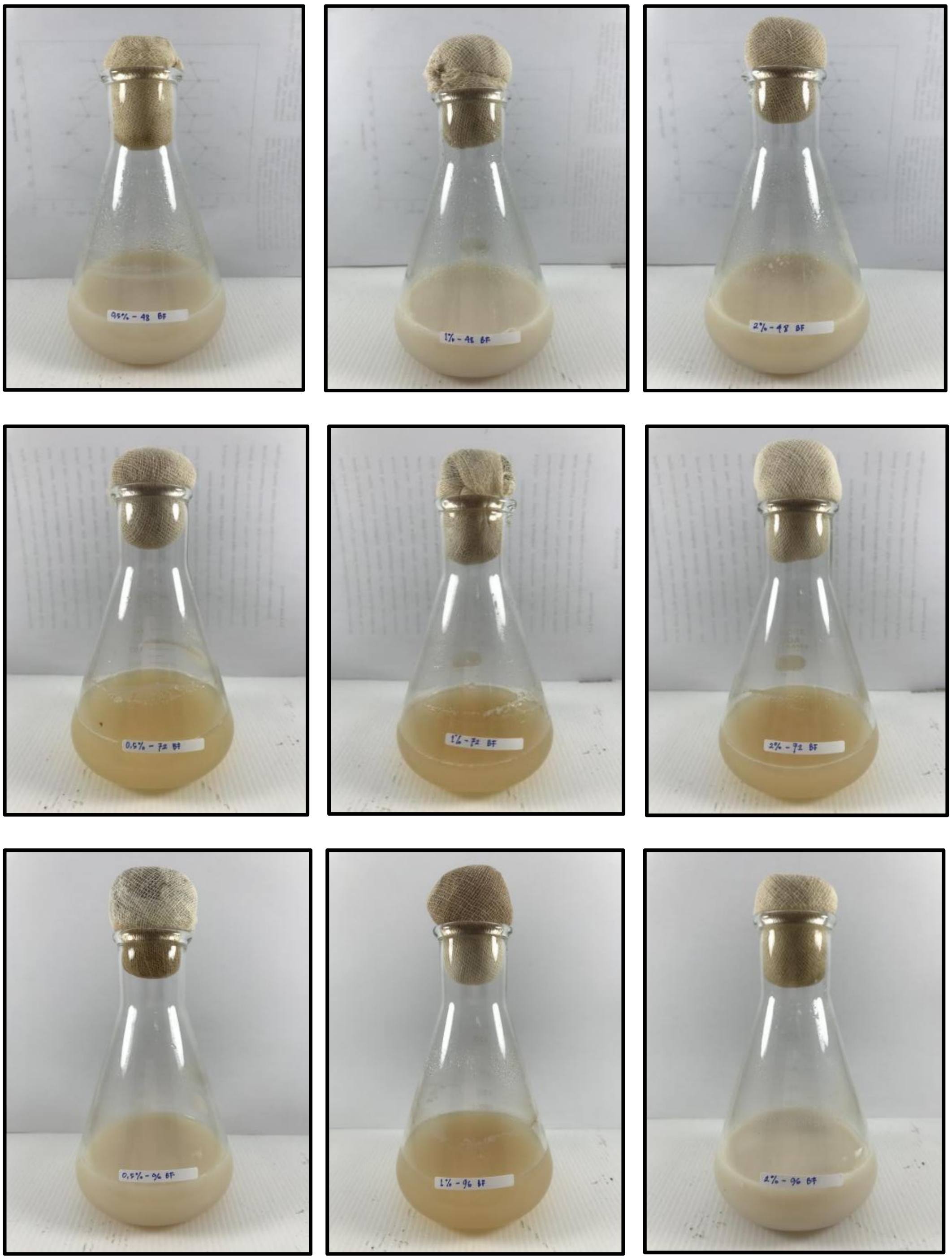
Kultur Isolat Bakteri *Bacillus* sp. Strain CL33 pada Media Minimal Ramsay yang ditambahkan Glukosa 1% dan Minyak Sawit yang divariasikan Konsentrasinya



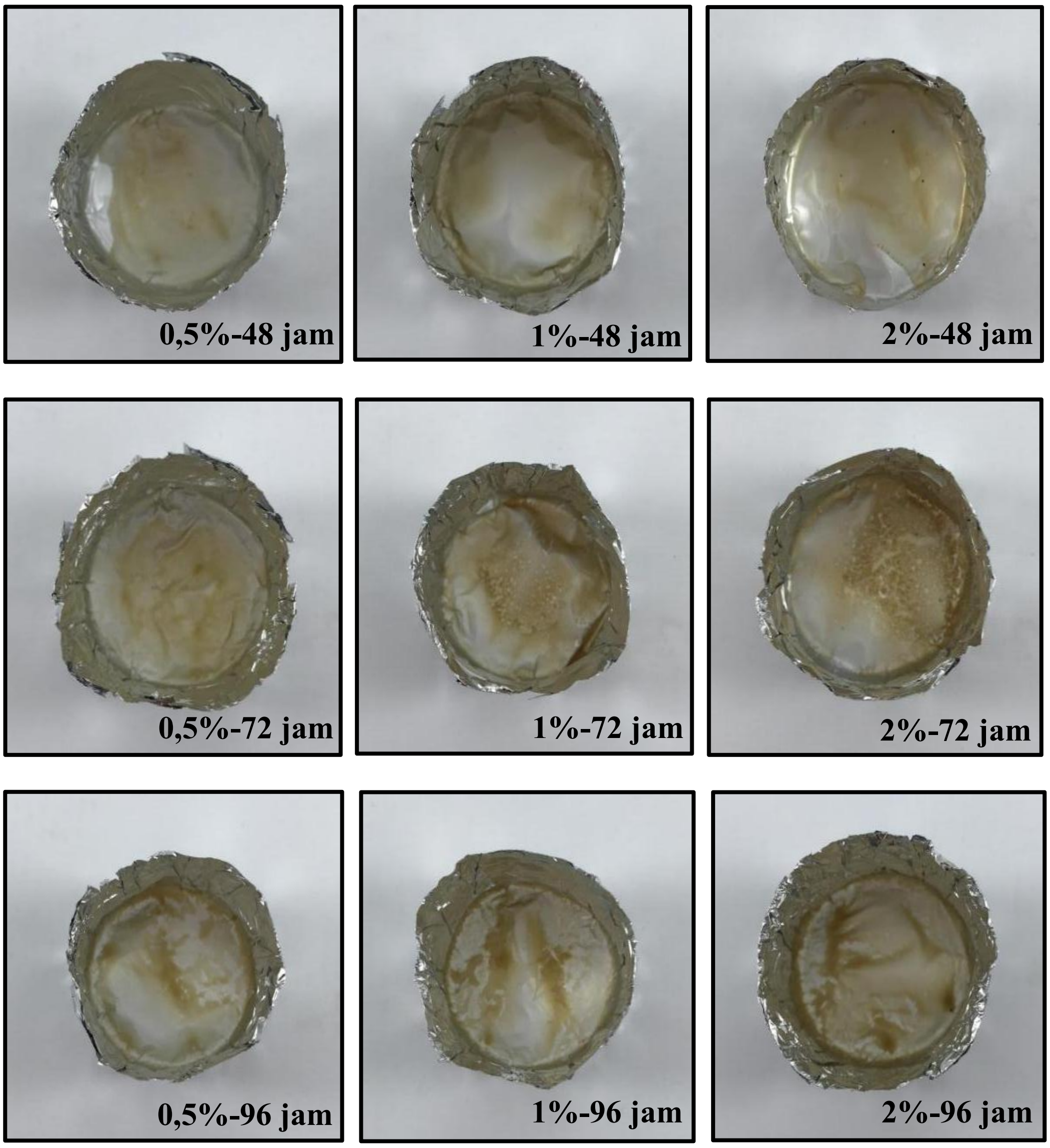
Berat Kering Sel Isolat *Bacillus* sp. Strain CL33



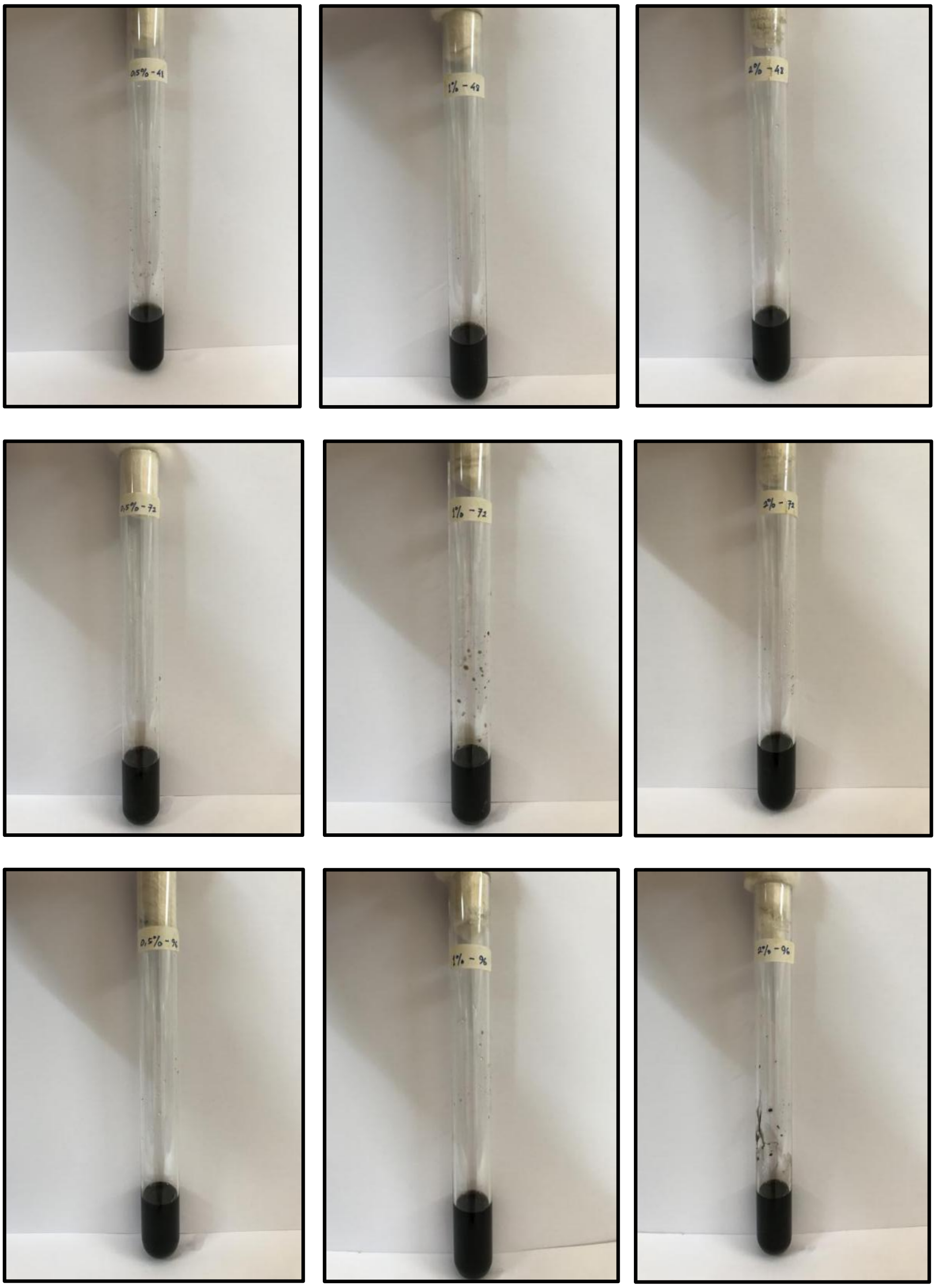
Hasil Asam Krotonoat Isolat *Bacllus* sp. Strain CL33 Setelah Penambahan H_2SO_4



Kultur Isolat Bakteri *Bacillus flexus* Strain S5a pada Media Minimal Ramsay yang ditambahkan Glukosa 1% dan Minyak Sawit yang divariasikan Konsentrasinya

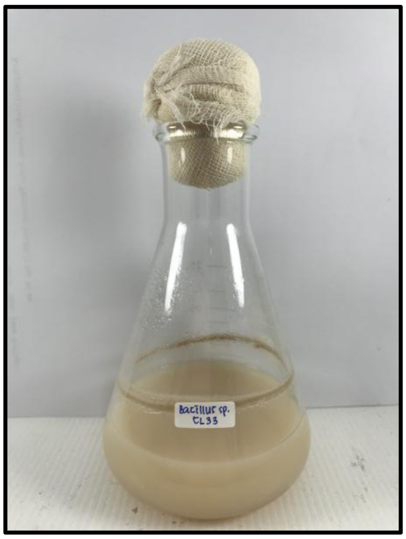


Berat Kering Sel Isolat *Bacillus flexus* Strain S5a



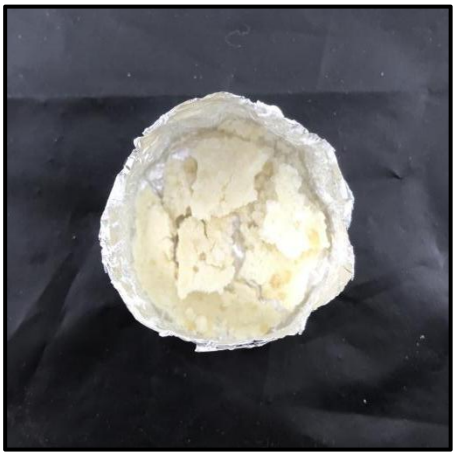
Hasil Asam Krotonoat Isolat *Bacllus flexus* Strain S5a Setelah Penambahan H_2SO_4

Lampiran 15. Ekstraksi *Polyhydroxyalkanoate* (PHA)



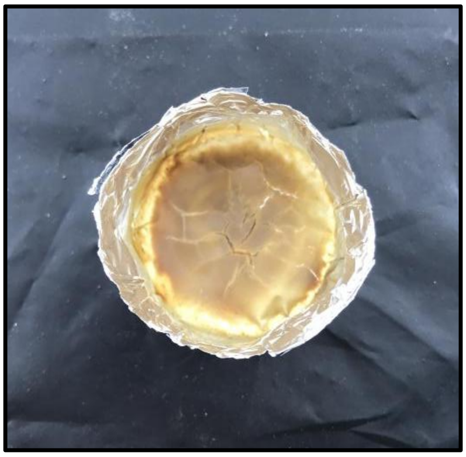
Kultur *Bacillus* sp. Strain CL33 pada Media Minimal Ramsay yang ditambahkan Glukosa 1% dan Minyak Sawit 2% pada waktu inkubasi 96 jam

Berat Kering Sel *Bacillus* sp. Strain CL33

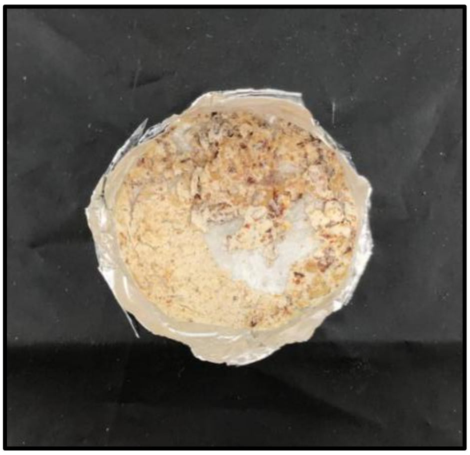


Berat Kering Ekstrak PHA *Bacillus* sp. Strain CL33

Kultur *Bacillus flexus* Strain S5a pada Media Minimal Ramsay yang ditambahkan Glukosa 1% dan Minyak Sawit 2% pada waktu inkubasi 96 jam



Berat Kering Sel *Bacillus flexus* Strain S5a



Berat Kering Ekstrak PHA *Bacillus flexus* Strain S5a

Lampiran 16. Analisis Jenis *Polyhydroxyalkanoate* (PHA)

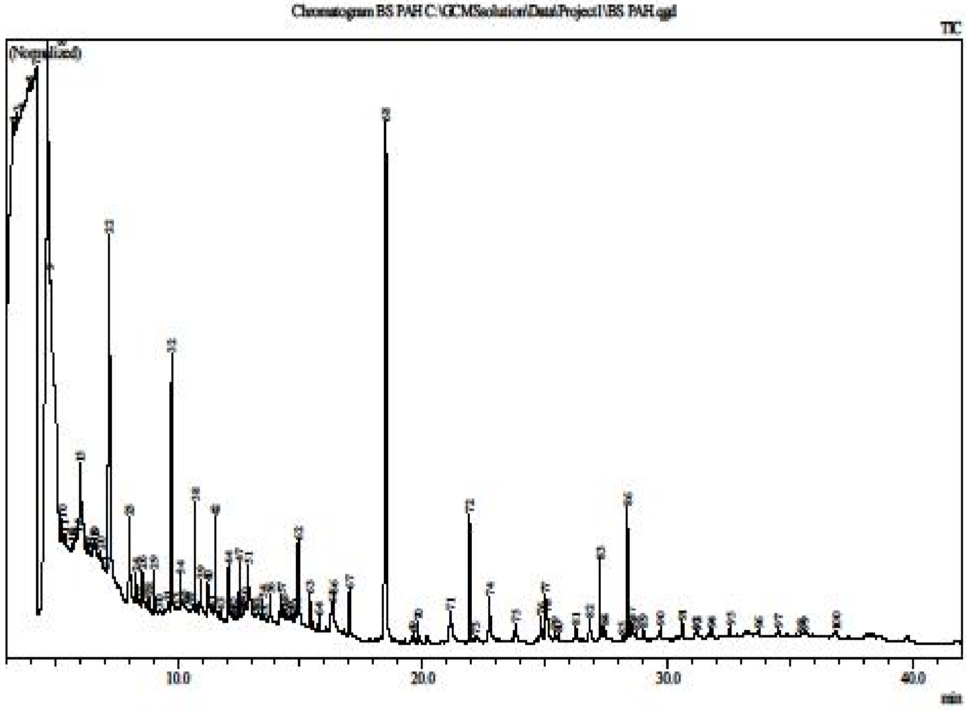
1. *Bacillus* sp. strain CL33

DATA REPORT GCMS-QP2010 ULTRA SHIMADZU

Sample Information

Analyzed by	: Admin
Analyzed	: 21/06/2022 6:08:02 PM
Sample Type	: Unknown
Level #	: 1
Sample Name	: BS PAH
Sample ID	:
IS Amount	: [1]=1
Sample Amount	: 1

Chromatogram BS PAH C:\GCMSsolution\Data\Project1\BS PAH.qgd



Peak Report TIC

Peak#	R.Time	Area	Area%	A/H	Name
1	3.329	604993094	11.45	17.59	Cyclotrisiloxane, hexamethyl-
2	3.400	102444885	1.94	2.98	DISULFIDE, DIMETHYL
3	3.463	140411412	2.66	3.94	ETHANESULFONIC ACID, METHYL ESTER
4	3.650	467237646	8.84	12.81	2-DEUTERO-EXO-5-NORBORNENE-2-THIOLACETATE
5	3.950	630661802	11.93	15.93	Sulfuric acid, dimethyl ester
6	4.037	217930068	4.12	5.47	1H-CYCLOPENTA[C]FURAN-1-ONE, 3,3A,6,6A-TETRAHYDRO-, CIS-(.+-.)-
7	4.254	474420490	8.98	11.32	Sulfuric acid, dimethyl ester
8	4.729	407241306	7.70	9.19	Ethylphoshonic acid, fluoroanhydride, 2-methoxyethyl ester
9	4.790	474267048	8.97	17.96	CYCLOTETRASILOXANE, OCTAMETHYL-
10	5.297	42158407	0.80	5.77	Butanoic acid, 2-hydroxy-, ethyl ester, (.+/-.)-
11	5.399	63800492	1.21	10.18	1,1-DIMETHYL-3-CHLOROPROPANOL
12	5.695	56322336	1.07	10.17	3-METHOXY-4-[(TRIMETHYLSILYL)OXY]-BENZALDEHYDE-O-METHYLOXIN
13	5.775	22147171	0.42	3.83	Butanedioic acid, dimethyl ester
14	5.935	59579756	1.13	9.47	Butanedioic acid, dimethyl ester
15	6.018	134965693	2.55	11.65	Benzoic acid, 2,4-bis(trimethylsiloxy)-, methyl ester
16	6.292	14532070	0.27	3.00	METHYL 2,3-DIDEOXY-4-O-PROPARGYL-6-O-(TERT-BUTYLDIMETHYLSILYL;
17	6.372	35992902	0.68	7.19	Butanedioic acid, methyl-, dimethyl ester
18	6.575	46364528	0.88	8.43	CYCLOTRISILOXANE, HEXAMETHYL-
19	6.633	51313532	0.97	8.91	2,2-DIMETHYL-7-METHOXY-4-CHROMANONE ETHYLENE DITHIOKETAL
20	6.849	58080583	1.10	11.85	2-BENZOYL-3-(4-CHLORO-PHENYL)-2-ETHYL-CYCLOPROPANE-1,1-DICARB(
21	7.058	20186123	0.38	5.82	3-Ethoxy-1,1,1,5,5,5-hexamethyl-3-(trimethylsiloxy)trisiloxane
22	7.196	271615433	5.14	9.29	CYCLOPENTASILOXANE, DECAMETHYL-
23	8.021	51219460	0.97	6.85	4B,5A-DIHYDRO-5H-DIBENZ[3,4 : 5,6]ANTHRA[1,2-B]AZIRINE
24	8.305	14760564	0.28	4.42	2-(4'-Trimethylsilyloxyphenyl)-2-(3'-methyl-4'- trimethylsilyloxyphenyl)propane
25	8.417	8043397	0.15	7.09	CYCLOTETRASILOXANE, OCTAMETHYL-
26	8.568	16140714	0.31	4.63	3,3,5-Triethoxy-1,1,1,7,7,7-hexamethyl-5-(trimethylsilyloxy)tetrasiloxane

Peak#	R.Time	Area	Area%	A/H	Name
27	8.692	5517756	0.10	5.44	Cyclohexasiloxane, dodecamethyl-
28	8.882	3718317	0.07	2.78	3,5-Diisopropoxy-1,1,1,7,7,7-hexamethyl-3,5-bis(trimethylsiloxy)tetrasiloxane
29	9.080	10759538	0.20	3.15	3,5-Diisopropoxy-1,1,1,7,7,7-hexamethyl-3,5-bis(trimethylsiloxy)tetrasiloxane
30	9.271	2013694	0.04	4.44	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
31	9.611	5360807	0.10	5.63	Benzenepropanoic acid, methyl ester
32	9.759	52697462	1.00	2.62	CYCLOHEXASILOXANE, DODECAMETHYL-
33	9.958	3189959	0.06	5.13	CYCLOTRISILOXANE, HEXAMETHYL-
34	10.127	13424927	0.25	4.25	1-(P-NITROPHENYL)-4-(2-IMIDAZOLINYL)-5-(P-CHLOROPHENYL)-1,2,3-TRIA
35	10.250	4713075	0.09	5.52	2,2,4,4,6,6,8,8,10,10-DECAMETHYL-1,3,5,7,9,2,4,6,8,10-PENTAOXAPENTASILEC
36	10.358	3443583	0.07	5.73	CYCLOTRISILOXANE, HEXAMETHYL-
37	10.592	4334517	0.08	5.54	BIS(TRIMETHYLSILYL)-2-(HYDROXY-(ETHOXY)PHENYL)-2-HYDROXYPHEN
38	10.717	19414263	0.37	2.23	BIS(TRIMETHYLSILYL)-2-(HYDROXY-(ETHOXY)PHENYL)-2-HYDROXYPHEN
39	10.935	10773496	0.20	4.08	BENZENESULFONIC ACID, METHYL ESTER
40	11.239	14337988	0.27	5.73	2-Propenoic acid, 3-phenyl-, methyl ester
41	11.423	2008453	0.04	3.16	ISOPROPYL TRIS(TRIMETHYLSILYL)ORTHOSILICATE #
42	11.548	17942642	0.34	2.34	HEPTAMETHYL-PHENYL-CYCLOTETRASILOXANE
43	11.780	1803095	0.03	3.51	1-Propene-1,2,3-tricarboxylic acid, trimethyl ester, (E)-
44	12.085	10982780	0.21	2.55	Cycloheptasiloxane, tetradecamethyl-
45	12.233	3859820	0.07	5.21	Citric acid, trimethyl ester
46	12.317	2069946	0.04	4.11	2,4,6-CYCLOHEPTATRIEN-1-ON, 3,5-BIS-TRIMETHYLSILYL-
47	12.512	9896832	0.19	2.19	Bis(heptamethylcyclotetrasiloxy)siloxane
48	12.608	3329127	0.06	5.50	2-t-Butyl-5-(dimethoxy-phosphoryl)-3-methyl-4-oxoimidazolidine-1-carboxylic acid, t-bu
49	12.692	2292863	0.04	3.11	Bis(heptamethylcyclotetrasiloxy)siloxane
50	12.776	8497902	0.16	5.18	1,4-Benzenedicarboxylic acid, dimethyl ester
51	12.883	29382301	0.56	6.70	2,2,4,4,6,6,8,8-OCTAMETHYL-1,3,5,7,2,4,6,8-TETRAOXATETRASILOCANE
52	13.167	2336349	0.04	4.13	2,2,4,4,6,6,8,8-OCTAMETHYL-1,3,5,7,2,4,6,8-TETRAOXATETRASILOCANE
53	13.278	6227407	0.12	7.39	NONANEDIOIC ACID, DIMETHYL ESTER
54	13.465	4608689	0.09	2.68	NONAMETHYL, PHENYL-, CYCLOPENTASILOXANE
55	13.633	2199127	0.04	9.24	1,3-Benzenedicarboxylic acid, 4-methyl-, dimethyl ester
56	13.787	7384611	0.14	3.61	NONAMETHYL, PHENYL-, CYCLOPENTASILOXANE
57	14.228	9029543	0.17	4.35	1,1,3,3,5,5,7,7,9,9,11,11-DODECAMETHYL-HEXASILOXANE
58	14.354	3680023	0.07	3.73	2-(1,1,3,3,5,5-HEXAMETHYL-5-[(2,4,4,6,6-PENTAMETHYL-1,3,5,2,4,6-TRIOXAT
59	14.493	3279864	0.06	4.55	2-(1,1,3,3,5,5-HEXAMETHYL-5-[(2,4,4,6,6-PENTAMETHYL-1,3,5,2,4,6-TRIOXAT
60	14.616	1998913	0.04	4.41	METHYL 1-(N-ISOPROPYLAMINO)-2,2-DIETHYLCYCLOPROPANECARBOXYL
61	14.840	2462865	0.05	2.76	CYCLOPENTASILOXANE, DECAMETHYL-
62	14.927	28352179	0.54	4.41	1,3-Diphenyltetramethyldisiloxane
63	15.413	5907084	0.11	2.36	TETRADECANOIC ACID, METHYL ESTER
64	15.777	3397555	0.06	3.10	PENTAMETHYL PHENYL-DISILANE
65	16.307	11427067	0.22	5.08	Tetrasiloxane, decamethyl-
66	16.776	13890806	0.26	4.84	OCTADECANOIC ACID, METHYL ESTER
67	17.012	11615310	0.22	3.21	1,1,3,3,5,5-Hexamethyl-1,5-diphenyltrisiloxane
68	18.506	179813163	3.40	4.48	HEXADECANOIC ACID, METHYL ESTER
69	19.600	2607674	0.05	3.77	HEXADECANOIC ACID, ETHYL ESTER
70	19.826	6081169	0.11	3.78	1,2-Diphenyltetramethyldisilane
71	21.142	17029056	0.32	7.59	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
72	21.683	28259314	0.53	2.88	Octadecanoic acid, methyl ester
73	22.168	2050481	0.04	4.59	7,15-Dihydroxydehydroabietic acid, methyl ester, di(trimethylsilyl) ether
74	22.758	22564074	0.43	6.60	7,15-Dihydroxydehydroabietic acid, methyl ester, di(trimethylsilyl) ether
75	23.803	6748885	0.13	5.18	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
76	24.635	10675361	0.20	5.51	Tetrasiloxane, 1,1,3,3,5,5,7,7-octamethyl-
77	25.015	14459168	0.27	4.05	HEPTADECANOIC ACID, 8-OXO-, METHYL ESTER
78	25.092	11100291	0.21	5.15	1,1,3,3,5,5,7,7-OCTAMETHYL-TETRASILOXANE
79	25.401	3456924	0.07	4.28	EICOSANOIC ACID, METHYL ESTER
80	25.537	1980225	0.04	3.40	NONAMETHYL, PHENYL-, CYCLOPENTASILOXANE
81	26.260	5879004	0.11	5.15	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
82	26.820	7202360	0.14	4.37	HEPTASILOXANE, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-TETRADECAMETHYL-
83	27.267	20472703	0.39	3.26	2-Methoxydecanoic acid
84	27.421	5679261	0.11	5.58	HEXASILOXANE, 1,1,3,3,5,5,7,7,9,9,11,11-DODECAMETHYL-
85	28.163	2115089	0.04	4.92	PENTAMETHYL PHENYL-DISILANE
86	28.250	34756754	0.66	3.38	OCTADECANOIC ACID, 9,10-DICHLORO-, METHYL ESTER
87	28.517	9210876	0.17	5.97	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
88	28.716	3310963	0.06	4.87	Hexacosanoic acid, methyl ester
89	29.016	5346279	0.10	6.47	1,1,3,3,5,5,7,7,9,9,11,11,13,13-TETRADECAMETHYL-HEPTASILOXANE
90	29.722	6171084	0.12	6.39	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
91	30.608	5574869	0.11	4.52	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
92	31.136	1989820	0.04	4.01	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
93	31.224	2389390	0.05	5.09	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
94	31.791	3056784	0.06	5.02	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
95	32.558	3012550	0.06	4.14	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
96	33.719	2334518	0.04	4.66	HEXASILOXANE, 1,1,3,3,5,5,7,7,9,9,11,11-DODECAMETHYL-
97	34.520	2300087	0.04	4.88	SILIKONFETT SE30 (GRE'M LS)
98	35.442	1860900	0.04	7.31	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
99	35.594	3365304	0.06	7.96	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
100	36.864	2465972	0.05	6.49	SILICONE OIL
		5283887119	100.00		

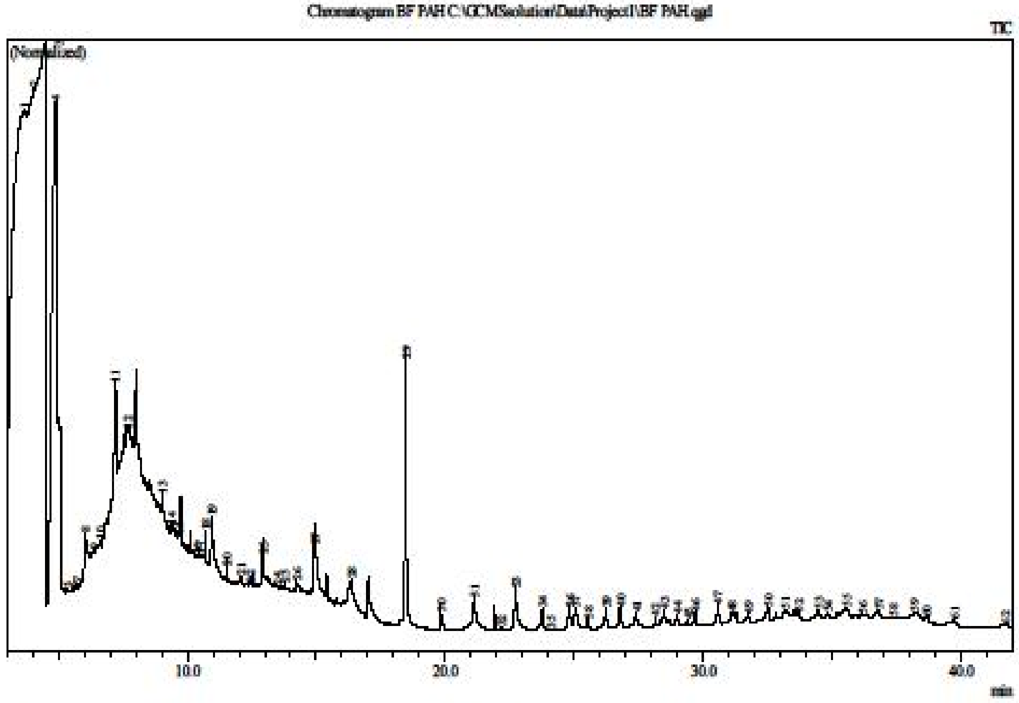
2. Bacillus flexus strain S5a

DATA REPORT GCMS-QP2010 ULTRA SHIMADZU

Sample Information

Analyzed by	: Admin
Analyzed	: 21/06/2022 6:58:01 PM
Sample Type	: Unknown
Level #	: 1
Sample Name	: BF PAH
Sample ID	:
IS Amount	: [1]=1
Sample Amount	: 1

Chromatogram BF PAH C:\GCMSsolution\Data\Project1\BF PAH.qgd



Peak Report TIC

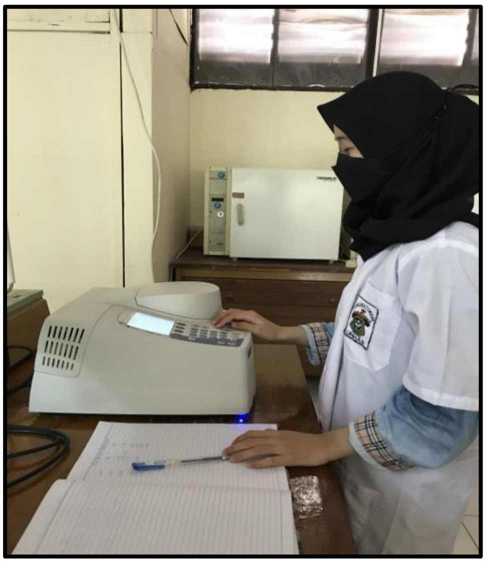
Peak#	R.Time	Area	Area%	A/H	Name
1	3.698	1305936716	16.32	34.84	SULFURIC ACID, DIMETHYL ESTER
2	4.060	745454899	9.32	18.78	3-Oxabicyclo[3.3.0]oct-6-en-2-one, 4,7-bis(methoxy)-
3	4.493	1119792053	14.00	25.50	Sulfuric acid, dimethyl ester
4	4.895	600669462	7.51	15.35	Sulfuric acid, dimethyl ester
5	5.355	9828095	0.12	7.53	1,2,4-BENZENETRICARBOXYLIC ACID, 1,2-DIMETHYL ESTER
6	5.583	13589593	0.17	10.07	BENZOIC ACID, 3-FORMYL-2,4-DIMETHOXY-6-METHYL-, 4-CARBOXY-3-HYD
7	5.732	14800085	0.18	8.42	Cyclotrisiloxane, hexamethyl-
8	6.050	81231534	1.02	14.20	PHENETHYLAMINE, 3-METHOXY-N-METHYL-.BETA.,4-BIS(TRIMETHYLSILC
9	6.400	54252524	0.68	12.06	CYCLOTRISILOXANE, HEXAMETHYL-
10	6.630	81879506	1.02	15.47	CYCLOTETRASILOXANE, OCTAMETHYL-
11	7.206	347056363	4.34	19.64	CYCLOPENTASILOXANE, DECAMETHYL-
12	7.693	1125334732	14.07	80.10	CYCLOTETRASILOXANE, OCTAMETHYL-
13	9.049	133309620	1.67	14.48	Cycloheptasiloxane, tetradecamethyl-
14	9.409	127885196	1.60	19.00	Cyclotetrasiloxane, octamethyl-
15	9.655	239190357	2.99	38.98	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
16	10.383	17930713	0.22	3.97	7H-Dibenzo[b,g]carbazole, 7a,8-dihydro-7a-methyl-
17	10.480	72367963	0.90	15.54	SILICONE GREASE, SILICONFETT
18	10.717	44863914	0.56	7.80	Dodecanedioic acid, bis(tert-butyldimethylsilyl) ester
19	10.950	158940436	1.99	21.64	Benzenesulfonic acid, methyl ester
20	11.549	39356466	0.49	9.81	HEPTAMETHYL-PHENYL-CYCLOTETRASILOXANE
21	12.079	73099846	0.91	23.72	CYCLOHEPTASILOXANE, TETRADECAMETHYL-
22	12.441	62264923	0.78	23.92	ARSENOUS ACID, TRIS(TRIMETHYLSILYL) ESTER
23	12.946	141032046	1.76	24.88	DODECANOIC ACID, METHYL ESTER
24	13.483	34997677	0.44	13.57	1,3-DIPHENYL-1-HEPTENYL TRIMETHYLSILYL ETHER
25	13.790	58229260	0.73	20.82	NONAMETHYL, PHENYL-, CYCLOPENTASILOXANE
26	14.243	98288355	1.23	32.06	Cycloheptasiloxane, tetradecamethyl-

Peak#	R.Time	Area	Area%	A/H	Name
27	14.955	191120062	2.39	27.02	1,3-Diphenyltetramethyldisiloxane
28	16.372	136105420	1.70	41.04	1,1,1,3,5,5,5-HEPTAMETHYLTRISILOXANE
29	18.485	101789970	1.27	5.14	HEXADECANOIC ACID, METHYL ESTER
30	19.848	11217999	0.14	6.11	1,2-Diphenyltetramethyldisilane
31	21.140	36147303	0.45	13.95	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
32	22.186	1530184	0.02	9.04	7,15-Dihydroxydehydroabietic acid, methyl ester,di(trimethylsilyl)ether
33	22.748	33818613	0.42	10.07	1,1,3,3,5,5,7,7,9,9,11,11-DODECAMETHYL-HEXASILOXANE
34	23.795	15414791	0.19	10.06	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
35	24.117	406491	0.01	5.09	TETRASILOXANE, 1,1,3,3,5,5,7,7-OCTAMETHYL-
36	24.830	16148228	0.20	9.07	TETRASILOXANE, 1,1,3,3,5,5,7,7-OCTAMETHYL-
37	25.080	17320062	0.22	9.81	1-ETHOXY-3,3,3-TRIMETHYL-1-[(TRIMETHYLSILYL)OXY]DISILOXANYL TRI
38	25.542	7355325	0.09	7.86	PENTAMETHYL PHENYL-DISILANE
39	26.246	19014109	0.24	11.56	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
40	26.813	18229681	0.23	9.74	HEPTASILOXANE, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-TETRADECAMETHYL-
41	27.412	19329848	0.24	15.64	1,1,3,3,5,5,7,7,9,9,11,11-DODECAMETHYL-HEXASILOXANE
42	28.157	9007823	0.11	9.73	PENTAMETHYL PHENYL-DISILANE
43	28.504	24363398	0.30	16.69	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
44	29.006	12857045	0.16	11.42	1,1,1,3,5,7,9,11,11,11-DECAMETHYL-5-[(TRIMETHYLSILYL)OXY]HEXASILOX
45	29.415	7575044	0.09	10.19	1-(DIMETHOXYMETHYL)-4-(1-METHOXY-1-METHYLETHYL)BENZENE
46	29.709	18140812	0.23	13.55	1,1,1,3,5,7,9,11,11,11-DECAMETHYL-5-[(TRIMETHYLSILYL)OXY]HEXASILOX
47	30.589	27434402	0.34	14.39	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
48	31.123	30810090	0.39	25.26	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
49	31.763	26264340	0.33	23.22	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
50	32.539	39383254	0.49	22.70	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
51	33.191	38957717	0.49	27.10	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl-
52	33.707	39287153	0.49	29.30	2-PHENYL-1,2-PROPANEDIOL 2TMS
53	34.488	38490659	0.48	26.20	SILICONE OIL
54	34.845	20945594	0.26	17.80	1,1,3,3,5,5,7,7,9,9,11,11-DODECAMETHYL-HEXASILOXANE
55	35.578	51066953	0.64	31.22	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
56	36.183	44702586	0.56	40.61	[Dimethyl-(3-trimethylsilanyloxy-propyl)-silanyl]-benzene
57	36.832	35396801	0.44	26.50	SILIKONFETT SE30 (GREVELS)
58	37.383	19100723	0.24	22.26	1,1,3,3,5,5,7,7-OCTAMETHYL-TETRASILOXANE
59	38.200	55923112	0.70	47.23	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYLOCTASILOXANE #
60	38.683	16276213	0.20	21.79	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
61	39.752	16889828	0.21	28.78	2,2,4,4,6,6,8,8,10,10,12,12,14,14,16,16,18,18,20,20-ICOSAMETHYLCYCLODECA:
62	41.795	1542786	0.02	20.59	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-
		8000946753	100.00		

Lampiran 17. Foto Prosedur Penelitian

Perhitungan Pertumbuhan Total Bakteri dengan Metode SPC

Pengukuran Berat Kering Sel



Pengukuran Absorbansi Asam Krotonat


Ekstraksi *Polyhydroxyalkanoate* (PHA)


Analisis PHA Menggunakan GC-MS