DAFTAR PUSTAKA

Abdel-Rahman, M. A., Hassan, S. E., El-Din, M. N., Azab, M. S., El-Belely, E. F., Alrefaey, H. M., & Elsakhawy, T. 2020. One-factor-at-a-time and response surface statistical designs for improved lactic acid production from beet molasses by *Enterococcus hirae* ds10. *SN Applied Sciences*, *2*(4), 573.

Akita, H., Nakashima, N., & Hoshino, T. 2017. Production of d-lactate using a pyruvate-producing *Escherichia coli* strain. *Bioscience, Biotechnology, and Biochemistry*, *81*(7), 1452-1455.

Alami, E. N. A., Sulistyaningsih, E., & Kusuma, I. F. 2022. Optimasi Purifikasi Protein Rekombinan Cidrα-Pfemp1 *Plasmodium Falciparum* Dengan Kromatogafi Afinitas. *Jurnal Ilmu Dasar*, *23*(2), 97-104.

Ali, M., Alim, S., & Amin, M. 2023. Enhancing Solubility of Recombinant *Plasmodium* Lactate Dehydrogenase (*Pldh*) Using Combination of Cold-Inducible Expression System and Cold-Stirred Bioreactor. *HAYATI Journal of Biosciences*, *30*(3), 561-566.

Alinaghi, M., Beyramysoltan, S., & Sardari, S. 2019. Importance of the catalytic site neighbouring residues on the functionality of the enzymes.

Alqarni, M. H., Foudah, A. I., Muharram, M. M., Budurian, H., & Labrou, N. E. 2021. Probing the role of the conserved Arg174 in formate dehydrogenase by chemical modification and site-directed mutagenesis. *Molecules*, *26*(5), 1222.

Amer, B., & Baidoo, E. E. K. 2021. Omics-Driven Biotechnology for Industrial Applications. *Frontiers In Bioengineering and Biotechnology*, *9*, 613307.

Aslantas, Y., & Surmeli, N. B. 2019. Effects of N-terminal and C-terminal polyhistidine tag on the stability and function of the thermophilic P450 CYP119. *Bioinorganic chemistry and applications*, 2019(1), 8080697.

Behravan, A., & Hashemi, A. 2021. Statistical Optimization Of Culture Conditions for Expression of Recombinant Humanized Anti-Epcam Single-Chain Antibody Using Response Surface Methodology. *Research In Pharmaceutical Sciences*, *16*(2), 153-164.

Ben Chorin, A., Masrati, G., Kessel, A., Narunsky, A., Sprinzak, J., Lahav, S., ... & Ben-Tal, N. 2020. ConSurf-DB: an accessible repository for the evolutionary conservation patterns of the majority of PDB proteins. *Protein Science*, *29*(1), 258-267.

Ben-Nissan, G., Vimer, S., Warszawski, S., Katz, A., Yona, M., Unger, T., ... & Sharon, M. 2018. Rapid characterization of secreted recombinant proteins by native mass spectrometry. *Communications Biology*, *1*(1), 213.

Bhaturiwala, R., Bagban, M., Mansuri, A., & Modi, H. 2022. Successive Approach Of Medium Optimization Using *One Factor At A Time* And Response Surface Methodology For Improved B-Mannanase Production From *Streptomyces* Sp. *Bioresource Technology Reports*, *18*, 101087.

Bhatwa, A., Wang, W., Hassan, Y. I., Abraham, N., Li, X. Z., & Zhou, T. 2021. Challenges associated with the formation of recombinant protein inclusion bodies in *Escherichia coli* and strategies to address them for industrial applications. *Frontiers in bioengineering and biotechnology*, *9*, 630551.

Bhogale, P. M., Sorg, R. A., Veening, J. W., & Berg, J. 2022. Switching off: The phenotypic transition to the uninduced state of the lactose uptake pathway. *Biophysical journal*, *121*(2), 183–192.

Bintsis, T. 2018. Lactic Acid Bacteria as Starter Cultures: An Update in TheirMetabolism and Genetics. AIMS microbiology, 4(4), 665

Botthoulath, V., Dalmacio, I. F., Elegado, F. B., Uy, L. Y., & Lin, H. C. 2025. Genomic Analysis For The Safety Assessment Of A Potential Probiotic Strain *Pediococcus Pentosaceus* BBS1 Isolated From Lao Fermented Bamboo Shoots (Nor Mai Som). *Microbiologyopen*, *14*(5), E70048.

Cabadaj, P., Illeová, V., Dobiašová, H., Bučko, M., & Polakovič, M. 2025. Optimization of growth and induction conditions for the production of recombinant whole cell cyclohexanone monooxygenase in *Escherichia coli. Scientific Reports*, *15*(1), 14447.

Castiglione, H., Madrange, L., Lemonnier, T., Deslys, J. P., Yates, F., & Vigneron, P. A. 2024. Development And Optimization Of A Lactate Dehydrogenase Assay Adapted To 3D Cell Cultures. *Organoids*, *3*(2), 113-125.

Chaichana, N., Boonsan, J., Dechathai, T., Suwannasin, S., Singkhamanan, K., Wonglapsuwan, M., ... & Surachat, K. (2025). Comparative genomic analysis of the Pediococcus genus reveals functional diversity for fermentation and probiotic applications. *Computational and Structural Biotechnology Journal*.

Chamchoy, K., Pakotiprapha, D., Pumirat, P., Leartsakulpanich, U., & Boonyuen, U. 2019. Application of WST-8 based colorimetric NAD (P) H detection for quantitative dehydrogenase assays. *BMC biochemistry*, *20*(1), 4.

Chatterjee, Y., Pareek, A., & Singla-Pareek, S. L. 2024. Osldh7, A Rice Lactate Dehydrogenase, Confers Stress Resilience In Rice Under Cadmium Stress Through NAD+/NADH Regulation. *Plant Physiology And Biochemistry*, *215*, 109009.

Chen, X., Li, C., & Liu, H. 2021. Enhanced Recombinant Protein Production Under Special Environmental Stress. *Frontiers In Microbiology*, *12*, 630814.

Cheng, Y. Y., Park, T. H., Seong, H., Kim, T. J., & Han, N. S. 2022. Biological Characterization Of D-Lactate Dehydrogenase Responsible For High-*Yield*

Production Of D-Phenyllactic Acid In Sporolactobacillus Inulinus. *Microbial Biotechnology*, *15*(11), 2717–2729.

Choi, T. J., & Geletu, T. T. 2018. High Level Expression And Purification Of Recombinant Flounder Gowth Hormone In *E. Coli*. *Journal Of Genetic Engineering And Biotechnology*, *16*(2), 347-355.

Chu, I. T., Speer, S. L., & Pielak, G. J. 2020. Rheostatic Control Of Protein Expression Using Tuner Cells. *Biochemistry*, *59*(6), 733-735.

Chu, J. J. K., Poh, W. H., Hasnuddin, N. T. B., Hew, E. Y., Dam, L. C., Sahili, A. E., Rice, S. A., & Goh, B. C. 2022. Novel Phage Lysin Abp013 Against *Acinetobacter Baumannii*. *Antibiotics*, *11*(2), 169.

Cortés-Ríos, J., Zárate, A. M., Figueroa, J. D., Medina, J., Fuentes-Lemus, E., Rodríguez-Fernández, M., ... & López-Alarcón, C. 2020. Protein Quantification By Bicinchoninic Acid (BCA) Assay Follows Complex Kinetics And Can Be Performed At Short Incubation Times. *Analytical Biochemistry*, *608*, 113904.

Costa, A., Encarnação, T., Tavares, R., Todo Bom, T., & Mateus, A. 2023. Bioplastics: innovation for green transition. *Polymers*, *15*(3), 517.

Crowley, E. L., & Rafferty, S. P. 2019. Review of lactose-driven auto-induction expression of isotope-labelled proteins. *Protein Expression and Purification*, *157*, 70-85.

De Marco, A. 2025. Recent advances in recombinant production of soluble proteins in E. coli. *Microbial cell factories*, *24*(1), 21.

Dennler, O., & Ryan, C. J. (2025). Evaluating sequence and structural similarity metrics for predicting shared paralog functions. *NAR Genomics and Bioinformatics*, *7*(2), lqaf051.

Díaz-Orozco, L., Moscosa Santillán, M., Delgado Portales, R. E., Rosales-Colunga, L. M., Leyva-Porras, C., & Saavedra-Leos, Z. 2025. Advances In L-Lactic Acid Production From Lignocellulose Using Genetically Modified Microbial Systems. *Polymers*, *17*(3), 322.

Djarkasi, G. S., Raharjo, S., & Noor, Z. 2017. Isolasi dan aktivitas spesifik enzim lipase indigenous biji kenari. *Jurnal Teknologi Pertanian*, *8*(1), 28-35.

Du, F., Liu, Y. Q., Xu, Y. S., Li, Z. J., Wang, Y. Z., Zhang, Z. X., & Sun, X. M. 2021. Regulating the T7 RNA polymerase expression in E. coli BL21 (DE3) to provide more host options for recombinant protein production. *Microbial cell factories*, *20*(1), 189.

Dvorak, P., Chrast, L., Nikel, P. I., Fedr, R., Soucek, K., Sedlackova, M., ... & Damborsky, J. (2015). Exacerbation Of Substrate Toxicity By IPTG In *Escherichia Coli* BL21 (DE3) Carrying A Synthetic Metabolic Pathway. *Microbial Cell Factories*, *14*(1), 201.

Dzakah, E. E., & Kang, K. 2019. Lactate Dehydrogenase: A Biomarker For Disease Diagnosis And Prognosis. In *Lactate Dehydrogenase (LDH): Biochemistry, Function And Clinical Significance* (Pp. 167-189). Nova Science Publishers.

Esa, S. S., El-Sayed, A. F., El-Khonezy, M. I., & Zhang, S. 2023. Recombinant Production, Purification, And Biochemical Characterization Of A Novel L-Lactate Dehydrogenase From *Bacillus Cereus* NRC1 And Inhibition Study Of Mangiferin. *Frontiers In Bioengineering And Biotechnology*, *11*, 1165465.

Fang, S., Song, X., Cui, L., Bai, J., Lu, H., & Wang, S. 2023. The lactate dehydrogenase gene is involved in the growth and metabolism of Lacticaseibacillus paracasei and the production of fermented milk flavor substances. *Frontiers in Microbiology*, *14*, 1195360.

Farhan, M., Hasani, I. W., Khafaga, D. S., Ragab, W. M., Ahmed Kazi, R. N., Aatif, M., ... & Fahim, Y. A. 2025. Enzymes As Catalysts In Industrial Biocatalysis: Advances In Engineering, Applications, And Sustainable Integation. *Catalysts*, *15*(9), 891.

Farshdari, F., Ahmadzadeh, M., Nematollahi, L., & Mohit, E. 2020. The Improvement Of Anti-HER2 Scfv Soluble Expression In *Escherichia Coli*. *Brazilian Journal Of Pharmaceutical Sciences*, *56*, E17861.

Fowler, B. D., Kose, N., Reidy, J. X., Handal, L. S., Skaar, E. P., & Crowe Jr, J. E. 2022. Human Monoclonal Antibodies To *Escherichia Coli* Outer Membrane Protein a Porin Domain Cause Aggegation But Do Not Alter In Vivo Bacterial Burdens In a Murine Sepsis Model. *Infection And Immunity*, *90*(6), E00176-22.

Furukawa, N., Miyanaga, A., Nakajima, M., & Taguchi, H. 2018. Structural basis of sequential allosteric transitions in tetrameric d-lactate dehydrogenases from three Gram-negative bacteria. *Biochemistry*, *57*(37), 5388-5406.

Ganjave, S. D., Srivastava, M., Nakrani, P., Mishra, V., & Wangikar, P. P. 2026. Effect of thioredoxin tag, oxidizing environment, and temperature on the global metabolome of E. coli strains. *Applied Biochemistry and Biotechnology*, *198*(1), 111-128.

George, F., Daniel, C., Thomas, M., Singer, E., Guilbaud, A., Tessier, F., ... & Foligné, B. 2018. Occurrence And Dynamism Of Lactic Acid Bacteria In Distinct Ecological Niches: A Multifaceted Functional Health Perspective. *Frontiers In Microbiology*, *9*, 2899.

Girardo, B., Schopfer, L. M., Yue, Y., Lockridge, O., & Larson, M. A. 2024. Polyaminated, acetylated and stop codon readthrough of recombinant Francisella tularensis universal stress protein in Escherichia coli. *Plos one*, *19*(4), e0299701.

Glauche, F., Pilarek, M., Bournazou, M. N. C., Grunzel, P., & Neubauer, P. 2017. *Design of experiments-based high-throughput strategy for development and optimization of efficient cell disruption protocols* (Vol. 17, No. 11, pp. 1166-1172).

Głowacka, J., Wiśniewska, A., Koncki, R., & Strzelak, K. (2023). Photometric flow system for the determination of serum lactate dehydrogenase activity. *Talanta*, *265*, 124817.

Goto, S., Motomura, A., Kawahara, A., Shiratsuchi, H., Tanaka, K., & Matsusaki, H. 2018. Cloning and heterologous expression of lactate dehydrogenase genes from acid-tolerant Lactobacillus acetotolerans HT. *Food Science and Technology Research*, *24*(5), 861-868.

Grima, R., & Leier, A. 2017. Exact product formation rates for stochastic enzyme kinetics. *The Journal of Physical Chemistry B*, *121*(1), 13-23.

Gudeta, B. 2025. Comparative Study of Rhodanese Specific Activity Assay Techniques for Plants and Bacterial Species.

Gupta, M. N., Tripathi, T., & Uversky, V. N. 2025. Binding Of A Substrate ("Lock And Key") And Conformational Adaption ("Induced Fit") Are Different Stages Of Enzyme Action. In *The Three Functional States Of Proteins* (Pp. 31-43). Academic Press.

Gusti, A. G., Pertiwi, A. A., & Pangestu, R. 2026. Structural diversity and functional versatility of bacterial lactate dehydrogenases: Guideline for designing robust industrial enzyme. *Enzyme and Microbial Technology*, 110871.

Gutmann, S., Tauer, C., Wagenknecht, M., Striedner, G., Grabherr, R., & Cserjan-Puschmann, M. 2026. Leaky recombinant expression reveals design constraints of bicistronic synthetic operons in Escherichia coli. *Scientific Reports*.

Ha, M. S., Han, C. W., Jeong, M. S., *Et Al*. 2024. Structural Basis of Lactate Dehydrogenase A-Gossypol Complex. *Biochemical And Biophysical Research Communications*, *733*, 150721.

Hajba, L., Jeong, S., Chung, S. D., & Guttman, A. 2023. Capillary Gel Electrophoresis Of Proteins: Historical Overview and Recent Advances. *Analytical Chemistry*.

Han, J. H., Lee, E. J., Park, W., Ha, K. T., & Chung, H. S. (2023). Natural compounds as lactate dehydrogenase inhibitors: Potential therapeutics for lactate dehydrogenase inhibitors-related diseases. *Frontiers in pharmacology*, *14*, 1275000.

Han, X., Huang, K., Tang, H., Ni, J., Liu, J., Xu, P. et al. 2019 Steps toward high-performance PLA: economical production of d- lactate enabled by a newly

isolated *Sporolactobacillus terrae* strain. *Biotechnology Journal*, *14*, e1800656.

Hanapiah, R. M. A., Samah, R. A., Rodzri, N. A. M., Zahari, M. A. K. M., & Zain, W. S. W. M. 2019. Effects Of Culture Conditions on Gowth and Production of Xylonic Acid Using Recombinant *E. Coli* BL21 (DE3). *Materials Today: Proceedings*, *19*, 1467-1472.

Hayat, S. M., Farahani, N., Golichenari, B., & Sahebkar, A. 2018. Recombinant Protein Expression In *Escherichia Coli* (*E. Coli*): What We Need To Know. *Current Pharmaceutical Design*, *24*(6), 718-725.

Hemamalini, N., Ezhilmathi, S., & Mercy, A. A. 2020. Recombinant Protein Expression Optimization In *Escherichia Coli*: A Review. *Indian Journal Of Animal Research*, *54*(6), 653-660.

Hever, E., Santhanam, V., Alberi, S., Dhara, A., Bols, M., Nasheuer, H. P., & Murphy, P. V. 2024. Synthesis of C-glycoside analogues of Isopropil β-D-1-tiogalaktopiranosida (IPTG) (IPTG) and 1-β-D-galactopyranosyl-2-methylpropane. Conformational analysis and evaluation as inhibitors of the lac repressor in E. coli and as galactosidase inhibitors. *Organic & Biomolecular Chemistry*, *22*(36), 7460-7477.

Heyde, S. A. H., & Nørholm, M. H. H. 2021. Tailoring The Evolution Of BL21(DE3) Uncovers A Key Role For RNA Stability In Gene Expression Toxicity. *Communications Biology*, *4*(1), 963.Huang, Y., You, C., & Liu, Z. 2017. Cloning of D-lactate dehydrogenase genes of Lactobacillus delbrueckii subsp. bulgaricus and their roles in D-lactic acid production. *3 Biotech*, *7*(3), 194.

Huang, Y., Benni, S., Yadav, U. P., Babu, M. A., Verma, A., Singh, T. G., ... & Zhang, Y. 2026. Deploying the high-throughput virtual screening (HTVS) approach for the identification of new lactate dehydrogenase (LDH) inhibitors with anticancer assets. *Scientific Reports*.

Huang, Y., You, C., & Liu, Z. 2017. Cloning of D-lactate dehydrogenase genes of Lactobacillus delbrueckii subsp. bulgaricus and their roles in D-lactic acid production. *3 Biotech*, *7*(3), 194.

Huijbers, E. J., van Beijnum, J. R., Koetsier, J., Wachholz, G. E., Kemper, P. C., Myburgh, L., ... & Griffioen, A. W. 2026. Protocol for recombinant expression in E. coli and purification of iBoost vaccine proteins using immobilized metal affinity chromatography. *STAR protocols*, *7*(2).

Igwe, C. L., Pauk, J. N., Müller, D. F., Jaeger, M., Deuschitz, D., Hartmann, T., & Spadiut, O. 2024. Comprehensive Evaluation Of Recombinant Lactate Dehydrogenase Production From Inclusion Bodies. *Journal Of Biotechnology*, *379*, 65-77.

Jiang, T., Zhang, C., He, Q., Zheng, Z., & Ouyang, J. 2018. Metabolic engineering of Escherichia coli K12 for homofermentative production of l-lactate from xylose. *Applied Biochemistry and Biotechnology*, *184*(2), 703-715.

Jin, X. X., Fang, M. D., Hu, L. L., Zhu, S. D., & Yu, W. S. 2022. Elevated Lactate Dehydrogenase Predicts Poor Prognosis Of Acute Ischemic Stroke. *PLOS ONE*, *17*(10), E0275651.

Jumper, J., Evans, R., Pritzel, A., Green, T., Figurnov, M., Ronneberger, O., ... & Hassabis, D. (2021). Highly accurate protein structure prediction with AlphaFold. *nature*, *596*(7873), 583-589.

Jung, S., Hwang, H., & Lee, J. H. 2019. Effect of lactic acid bacteria on phenyllactic acid production in kimchi. *Food Control*, *106*, 106701.

Kaur, J., & Kumar, A., 2018. Strategies for Optimization of Heterologous Protein Expression in *E. coli*: Roadblocks and reinforcements. *International journal of biological macromolecules*, *106*, 803-822.

Kaur, P., Sharma, J., Bhardwaj, N. K., Bhardwaj, S., Kaur, D., Singh, A., & Kumar, A. 2024. Prospects of crude enzymes in replacing pure enzymes for dissolving pulp production. *3 Biotech*, *14*(10), 228.

Kilic, P., Karabudak, S., Cosar, B., Savran, B. N., & Yalcin, M. 2024. Residual protein analysis by SDS–PAGE in clinically manufactured BM-MSC products. *Electrophoresis*, *45*(17-18), 1606-1617.

Kim H.J, Jeong H and Lee S.J 2020 Short-Term Adaptation Modulates Anaerobic Metabolic Flux to Succinate by Activating ExuT, a Novel D-Glucose Transporter in Escherichia coli. Front. Microbiol. 11:27. doi: 10.3389/fmicb.2020.00027

Kim, H. J., Jeong, H., & Lee, S. J. (2021). Visualization and quantification of genetically adapted microbial cells during preculture. *Frontiers in Microbiology*, *12*, 693464.

Klein, R., Nagy, O., Tóthová, C., & Chovanová, F. 2020. Clinical And Diagnostic Significance Of Lactate Dehydrogenase and Its Isoenzymes In Animals. *Veterinary Medicine International*, *2020*, 5346483.

Kunwar, B., Cheng, H. N., Chandrashekaran, S. R., & Sharma, B. K. 2016. Plastics to fuel: a review. *Renewable and sustainable energy reviews*, *54*, 421-428.

Lankatillake, C., Luo, S., Flavel, M., Lenon, G. B., Gill, H., Huynh, T., & Dias, D. A. 2021. Screening natural product extracts for potential enzyme inhibitors: protocols, and the standardisation of the usage of blanks in α-amylase, α-glucosidase and lipase assays. *Plant Methods*, *17*(1), 3.

Leskovac, V. 2020. Substrate Concentration And Reaction Velocity: Reaching The Maximum Velocity (Vmax). In *Enzyme Kinetics: Catalysis And Control* (Pp. 95–118). Springer Nature.

Li, L., Li, H., Tian, Q., Ge, B., Xu, X., Chi, Y., ... & Zhou, Y. 2022. Expression and purification of soluble recombinant β-lactamases using Escherichia coli as expression host and pET-28a as cloning vector. *Microbial Cell Factories*, *21*(1), 244.

Li, Z.-P., & Rinas, U. 2020. Recombinant protein production associated growth inhibition results mainly from transcription and not from translation. *Microbial Cell Factories, 19*.

Liu, M., Huo, M., Liu, C., Guo, L., Ding, Y., Ma, Q., ... & Zhao, G. 2022. Lysine acetylation of Escherichia coli lactate dehydrogenase regulates enzyme activity and lactate synthesis. Frontiers in Bioengineering and Biotechnology, 10, 966062.

Liu, M., Huo, M., Liu, C., Guo, L., Ding, Y., Ma, Q., Qi, Q., Xian, M. and Zhao, G., 2022. Lysine acetylation of Escherichia coli lactate dehydrogenase regulates enzyme activity and lactate synthesis. *Frontiers in Bioengineering and Biotechnology*, *10*, p.966062.

Long, P. T., Viet, L. Q., Quan, L. V., Rin, D. H., Hoa, N. X., Thao, L. D., ... & Lan, D. T. B. 2019. Cloning And Optimizing The Culture Parameters For Expression Of R1 And R2 Repeat Regions Of P97 Adhesin From *Mycoplasma Hyopneumoniae* In *Escherichia Coli*. *Advances In Animal And Veterinary Sciences*, *7*(12), 1067-1075.

Longsaward, R., Sanguankiattichai, N., Viboonjun, U., & van der Hoorn, R. A. 2023. Cautionary note on ribonuclease activity of recombinant PR-10 proteins. *Plant and Cell Physiology*, *64*(8), 847-849.

Loughran, S. T., Bree, R. T., & Walls, D. 2023. Poly-histidine-tagged protein purification using immobilized metal affinity chromatography (IMAC). In *Protein Chromatography: Methods and Protocols* (pp. 193-223). New York, NY: Springer US.

Lozano-Terol, G., Gallego-Jara, J., Sola Martínez, R. A., Martínez Vivancos, A., Cánovas Díaz, M., & De Diego Puente, T. 2021. Impact Of The Expression System On Recombinant Protein Production In *Escherichia Coli* BL21. *Frontiers In Microbiology*, *12*, 682001.

Luo, Q., Ding, N., Liu, Y., Zhang, H., Fang, Y., & Yin, L. 2023. Metabolic engineering of microorganisms to produce pyruvate and derived compounds. *Molecules*, *28*(3), 1418.

Luo, X., Wang, Y., Zheng, W., Sun, X., Hu, G., Yin, L., ... & Fu, Y. 2022. Simultaneous Improvement Of The Thermostability And Activity Of Lactic Dehydrogenase From *Lactobacillus Rossiae* Through Rational Design. *RSC Advances*, *12*(51), 33251-33259.

Maharsi, D. A., Ta'dung, J. C., Jannoke, L., & Budi, I. S. 2022. Sensitivity Analysis Using *One Factor At A Time* And Response Surface Method In Liquid-

Dominated Geothermal Reservoir. *PETRO: Jurnal Ilmiah Teknik Perminyakan*, *11*(3), 246-269.

Mahran, R., Vello, N., Komulainen, A., Malakoutikhah, M., Härmä, H., & Kopra, K. 2023. Isothermal chemical denaturation assay for monitoring protein stability and inhibitor interactions. *Scientific Reports*, *13*(1), 20066.

Maksum, I. P., Latifah, F. P. U., Nabiel, A., Sriwidodo, S., Lestari, N. F., Azizah, M. I., & Utami, D. F. 2023. An Overview Of Culture Conditions For Recombinant Protein Expression In *Escherichia Coli*. *Journal Of Applied Biotechnology Reports*, *10*(1), 864-875.

Malik, A. 2016. Protein fusion tags for efficient expression and purification of recombinant proteins in the periplasmic space of E. coli. *3 Biotech*, *6*(1), 44.applications. *Biotechnology and applied biochemistry*, *67*(4), 586-601.

Mani, S., Arab, B., Akbari, V. and Chou, C.P., 2024. Integrated bioprocessing and genetic strategies to enhance soluble expression of anti-HER2 immunotoxin in E. Coli. *Amb Express*, *14*(1), p.107.Meghwanshi, G. K., Kaur, N., Verma, S., Dabi, N. K., Vashishtha, A., Charan, P. D., ... & Kumar, R. 2020. Enzymes for pharmaceutical and therapeutic

Mani, S., Arab, B., Akbari, V., & Chou, C. P. 2024. Integrated bioprocessing and genetic strategies to enhance soluble expression of anti-HER2 immunotoxin in E. Coli. *Amb Express*, *14*(1), 107.

March, D., Bianco, V., & Franzese, G. 2021. Protein unfolding and aggregation near a hydrophobic interface. *Polymers*, *13*(1), 156.

Marques-Da-Silva, D., Mal, S. S., Aureliano, M., & Lagoa, R. 2022. The Gowth Curve Method To Rapidly Derive The Antibacterial Potential Of Polyoxovanadates. *Medical Sciences Forum*, *11*(1), 2.

Medvedev, K. E., Kinch, L. N., Schaeffer, R. D., & Grishin, N. V. 2019. Functional analysis of Rossmann-like domains reveals convergent evolution of topology and reaction pathways. *PLoS computational biology*, *15*(12), e1007569.

Mira, P., Yeh, P., & Hall, B. G. 2022. Estimating microbial population data from optical density. *Plos one*, *17*(10), e0276040.

Mital, S., Christie, G., & Dikicioglu, D. 2021. Recombinant Expression Of Insoluble Enzymes In *Escherichia Coli*: A Systematic Review Of Experimental Design And Its Manufacturing Implications. *Microbial Cell Factories*, *20*(1), 208.

Mokoena, M. 2017. Lactic Acid Bacteria And Their Bacteriocins: Classification, Biosynthesis And Applications Against Uropathogens: A Mini-Review. *Molecules*, *22*(8), 1255.

Morbioli, G. G., Mazzu-Nascimento, T., Aquino, A., Cervantes, C., & Carrilho, E. 2016. Recombinant Drugs-On-A-Chip: The Usage Of Capillary Electrophoresis And Trends In Miniaturized Systems–A Review. *Analytica Chimica Acta*, *935*, 44-57.

Muenwongtham, S., Jaturapiree, P., & Pimviriyakul, P. 2022. Effect Of Supplemented Sugar In Lysogeny Broth Medium On Gowth Of *Escherichia Coli* BL21 (DE3) And Recombinant Protein Production. *Agiculture And Natural Resources*, *56*(3), 537-546.

Mumtazah, Y. 2025. *Produksi asam laktat dan asam fenil laktat oleh bakteri asam laktat sebagai bahan pembuatan plastik biodegadable* (Undergaduate thesis, Universitas Diponegoro). Fakultas Sains dan Matematika.

Muttaqin, B. I. A. 2019. Telaah Kajian Dan Literature Review Design Of Experiment (Doe). *Journal Of Advances In Information And Industrial Technology*, *1*(1), 33-40.

Nadaf, R. D., Nadaf, P. D., Toragall, M. M., & C. T., S. 2024. Response Surface Methodology For Optimization Of Media Components For Production Of Lipase From *Bacillus Subtilis* KUBT4. *Archives Of Razi Institute*, *79*(3), 659-670.

Nakamura, M., & Akada, R. 2024. Blending of selected yeast extract and peptone for inducible and constitutive protein production in Escherichia coli using the pET system. *Journal of bioscience and bioengineering*, *138*(6), 548-556.

National Center for Biotechnology Information 2026. PubChem Compound Summary for CID 656894, isopropyl beta-D-thiogalactopyranoside.

National Center for Biotechnology Information 20266. PubChem Compound Summary for CID 440995, (+)-Lactose.

Nielsen, T. D., Hasselbalch, J., Holmberg, K., & Stripple, J. 2020. Politics and the plastic crisis: A review throughout the plastic life cycle. *Wiley Interdisciplinary Reviews: Energy and Environment*, *9*(1), e360.

Ojo, A. O., & De Smidt, O. 2023. Lactic Acid: A Comprehensive Review Of Production To Purification. *Processes*, *11*(3), 688.

Oktaviani, E., & Ekaningtias, M. 2019. Analisis Protein Isolat Bakteri *Escherichia Coli* BL21 Menggunakan Sodium Dodecyl Sulphate – Polyacrylamide Gel Elektrophoresis (SDS-PAGE). *Jurnal Pendidikan Biologi Dan Sains (PENBIOS)*, *4*(1), 30-34.

Othman, M., Ariff, A. B., Rios-Solis, L., & Halim, M. (2017). Extractive fermentation of lactic acid in lactic acid bacteria cultivation: A review. *Frontiers in Microbiology*, *8*, 2285.

Pan, P., Yang, Y., Shi, R., Kang, Y., Xu, H., Cheng, X., ... & Hu, H. 2025. Construction of Recombinant *Escherichia coli* Expressing Ammonia Assimilation Genes and Evaluation of Its Effect on Removing Ammonium Nitrogen (NH4+-N). *Microorganisms*, *13*(12), 2646.

Pangestu, R., Kahar, P., Ogino, C., & Kondo, A. 2024. Comparative responses of flocculating and nonflocculating yeasts to cell density and chemical stress in lactic acid fermentation. *Yeast*, *41*(4), 192-206.

Ping, Y., Kim, J. Y., Dinh, M. A. L., Luu, E., Cui, Y., King, E., ... & Li, H. 2025. Reprogramming the Rossmann Fold Signature Motif Creates Orthogonal Redox Biocatalysts. *bioRxiv*, 2025-12.

Pohanka, M. 2020. D-Lactic Acid As A Metabolite: Toxicology, Diagnosis, And Detection. *Biomed Research International*, *2020*, 3419034.

Poothong, J., Jang, I., & Kaufman, R. J. 2021. Defects in protein folding and/or quality control cause protein aggregation in the endoplasmic reticulum. In *Cellular biology of the endoplasmic reticulum* (pp. 115-143). Cham: Springer International Publishing.

Popova-Krumova, P., Danova, S., Atanasova, N., & Yankov, D. (2024). Lactic acid production by Lactiplantibacillus plantarum AC 11S—kinetics and modeling. *Microorganisms*, *12*(4), 739.

Rajacharya, G. H., Sharma, A., & Yazdani, S. S. 2024. Proteomics and metabolic burden analysis to understand the impact of recombinant protein production in E. coli. *Scientific reports*, *14*(1), 12271.

Rajan, R., Ahmed, S., Sharma, N., Kumar, N., Debas, A., & Matsumura, K. 2021. Review of the current state of protein aggregation inhibition from a materials chemistry perspective: special focus on polymeric materials. *Materials Advances*, *2*(4), 1139-1176.

Ramsay, R. R., & Tipton, K. F. 2017. Assessment of enzyme inhibition: a review with examples from the development of monoamine oxidase and cholinesterase inhibitory drugs. *Molecules*, *22*(7), 1192.

Rasooli, F., & Hashemi, A. 2019. Efficient expression of EpEX in the cytoplasm of Escherichia coli using thioredoxin fusion protein. *Research in pharmaceutical sciences*, *14*(6), 554-565.

Ravitchandirane, G., Bandhu, S., & Chaudhuri, T. K. 2022. Multimodal approaches for the improvement of the cellular folding of a recombinant iron regulatory protein in E. coli. *Microbial Cell Factories*, *21*(1), 20.

Reier, K., Liiv, A., & Remme, J. 2023. Ribosome Protein Composition Mediates Translation during the *Escherichia coli* Stationary Phase. *International journal of molecular sciences*, *24*(4), 3128. https://doi.org/10.3390/ijms24043128

Rezaei, L., Shojaosadati, S.A., Farahmand, L. and Moradi-Kalbolandi, S., 2020. Enhancement of extracellular bispecific anti-MUC1 nanobody expression in E. coli BL21 (DE3) by optimization of temperature and carbon sources through an autoinduction condition. *Engineering in life sciences*, *20*(8), pp.338-349.

Ribeiro, V. T., Asevedo, E. A., de Paiva Vasconcelos, L. T. C., Filho, M. A. O., de Araújo, J. S., de Macedo, G. R., ... & Dos Santos, E. S. 2019. Evaluation of induction conditions for plasmid pQE-30 stability and 503 antigen of Leishmania i. chagasi expression in E. coli M15. *Applied microbiology and biotechnology*, *103*(16), 6495-6504.

Rosano, G. L., Morales, E. S., & Ceccarelli, E. A. 2019. New tools for recombinant protein production in Escherichia coli: A 5-year update. Protein science, 28(8), 1412-1422.

Sadri, F., Safarpour, H., Ansari, Z., Ebrahimpour, Y., & Feriedouni, M. 2024. Enhanced Expression And Bioactivity Assessment Of Recombinant SUMO-Protease-1 In *E. Coli* BL21 (DE3) Via Cleavage Of His6-SMT3-SDF-1 Fusion Protein. *Interdisciplinary Perspectives On Infectious Diseases*, *2024*(1), 3080719.

Schuster, L. A., & Reisch, C. R. 2022. Plasmids for controlled and tunable high-level expression in E. coli. *Applied and environmental microbiology*, *88*(22), e00939-22.

Sellés Vidal, L., Murray, J. W., & Heap, J. T. 2021. Versatile selective evolutionary pressure using synthetic defect in universal metabolism. *Nature Communications*, *12*(1), 6859.

Shang, F., Wang, H., Zhang, D., Wang, W., Yu, J., & Xue, T. 2021. Construction of an AI-2 quorum sensing induced heterologous protein expression system in Escherichia coli. *PeerJ*, *9*, e12497.

Siddikey, F., Jahan, M. I., Hormoni, Hasan, M. T., Nishi, N. J., Hasan, S. K., ... & Hossain, M. A. 2025. Enzyme technology in the food industry: molecular Mechanisms, Applications, and sustainable innovations. *Food science & nutrition*, *13*(9), e70927.

Simas, R. G., Pessoa Junior, A., & Long, P. F. 2023. Mechanistic aspects of IPTG (isopropylthio-β-galactoside) transport across the cytoplasmic membrane of Escherichia coli—a rate limiting step in the induction of recombinant protein expression. *Journal of Industrial Microbiology and Biotechnology*, *50*(1), kuad034.

Singh, N., Ogunseitan, O. A., Wong, M. H., & Tang, Y. 2022. Sustainable materials alternative to petrochemical plastics pollution: A review analysis. *Sustainable horizons*, *2*, 100016.

Singh, V., Haque, S., Niwas, R., Srivastava, A., Pasupuleti, M., & Tripathi, C. K. M. 2017. Strategies For Fermentation Medium Optimization: An In-Depth Review. *Frontiers In Microbiology*, *7*, 2087.

Sisca, E. P., Hartanti, M. D., & Tjahyadi, D. 2024. Measurement Of Temperature, Ph And Substrate Levels On The Activity Of The Galactose-1-Phosphate Uridyltransferase Enzyme. *Journal Of Indonesian Social Sciences*, *5*(7), 1681-1692.

Siu, S. S., Langden, A. B. W., & Wong, W. K. 2017. Transformasi Dan Kloning Plasmid Pj804:77539 Pada *E. Coli* TOP'10. *Jurnal Biologi*, *6*, 65–70.

Smith, D. L., Lemieux, E. N., & Barua, S. 2018. Correction In Bicinchoninic Acid (BCA) Absorbance Assay To Analyze Protein Concentration. *Nano Life*, *8*(1), 1850002.

Snoeck, S., Guidi, C., & De Mey, M. 2024. "Metabolic burden" explained: stress symptoms and its related responses induced by (over) expression of (heterologous) proteins in Escherichia coli. *Microbial Cell Factories*, *23*(1), 96.

So, K. K., Le, N. M. T., Nguyen, N. L., & Kim, D. H. 2023. Improving expression and assembly of difficult-to-express heterologous proteins in Saccharomyces cerevisiae by culturing at a sub-physiological temperature. *Microbial cell factories*, *22*(1), 55.

Soleymani, B., & Mostafaie, A. 2019. Analysis Of Methods To Improve The Solubility Of Recombinant Bovine Sex Determining Region Y Protein. *Reports Of Biochemistry And Molecular Biology*, *8*(3), 227–235.

Spassov, D. S. 2024. Binding affinity determination in drug design: insights from lock and key, induced fit, conformational selection, and inhibitor trapping models. *International Journal of Molecular Sciences*, *25*(13), 7124.

Stetz, M. A., Carter, M. V., & Wand, A. J. 2016. Optimized expression and purification of biophysical quantities of Lac repressor and Lac repressor regulatory domain. *Protein expression and purification*, *123*, 75-82.

Sun, D., Li, H., Song, D., Zhang, L., Zhao, X., & Xu, X. 2019. Genome, transcriptome and fermentation analyses of Lactobacillus plantarum LY-78 provide new insights into the mechanism of phenyllactate biosynthesis in lactic acid bacteria. *Biochemical and Biophysical Research Communications*, *519*(2), 351-357.

Sun, X., Hu, J., Wang, Y., Luo, X., Huang, H., & Fu, Y. 2023. One-Pot Encapsulation Of Lactate Dehydrogenase And Fe3O4 Nanoparticles Into A Metal–Organic Framework: A Novel Magnetic Recyclable Biocatalyst For The Synthesis Of D-Phenyllactic Acid. *Frontiers In Bioengineering And Biotechnology*, *10*, 1124450.

Sun, Y., Gao, G., & Cai, T. 2021. Enzymatic Characterization Of D-Lactate Dehydrogenase And Application In Alanine Aminotransferase Activity Assay Kit. *Bioengineered*, *12*(1), 6459-6471.

Swetha, T. A., Ananthi, V., Bora, A., Sengottuvelan, N., Ponnuchamy, K., Muthusamy, G., & Arun, A. 2023. A review on biodegradable polylactic acid (PLA) production from fermentative food waste-Its applications and degradation. *International Journal of Biological Macromolecules*, *234*, 123703.

Sylvere, N., Mustopa, A. Z., Budiarti, S., Meilina, L., Hertati, A., & Handayani, I. 2023. Whole-genome sequence analysis and probiotic characteristics of Lactococcus lactis Subsp. lactis strain Lac3 isolated from traditional fermented buffalo milk (Dadih). *Journal of Genetic Engineering and Biotechnology*, *21*(1), 49.

Taguchi H. The Simple and Unique Allosteric Machinery of Thermus caldophilus Lactate Dehydrogenase, 2016, p. 117–145. https://doi.org/10.1007/5584_2016_171.

Tey, S. K., Lam, H., Wong, S. W. K., Zhao, H., To, K. K. W., & Yam, J. W. P. 2022. ACE2-Enriched Extracellular Vesicles Enhance Infectivity Of Live SARS-Cov-2 Virus. *Journal Of Extracellular Vesicles*, *11*(5), E12231.

Thomas, P.D., Ebert, D., Muruganujan, A., Mushayahama, T., Albou, L.P. and Mi, H., 2022. PANTHER: Making genome-scale phylogenetics accessible to all. *Protein Science*, *31*(1), pp.8-22.

Toledo-Patiño, S., Pascarelli, S., Uechi, G. I., & Laurino, P. 2022. Insertions and deletions mediated functional divergence of Rossmann fold enzymes. *Proceedings of the National Academy of Sciences*, *119*(48), e2207965119.

Tuttle, A. R., Trahan, N. D., & Son, M. S. 2021. Growth and maintenance of Escherichia coli laboratory strains. *Current protocols*, *1*(1), e20.

Ughy, B., Nagyapati, S., Lajko, D. B., Letoha, T., Prohaszka, A., Deeb, D., ... & Szilak, L. 2023. Reconsidering dogmas about the growth of bacterial populations. *Cells*, *12*(10), 1430.

Uhoraningoga, A., Kinsella, G. K., Henehan, G. T., & Ryan, B. J. 2018. The Goldilocks Approach: A Review Of Employing Design Of Experiments In Prokaryotic Recombinant Protein Production. *Bioengineering*, *5*(4), 89.

Velázquez-Libera, J. L., Durán-Verdugo, F., Valdés-Jiménez, A., Núñez-Vivanco, G., & Caballero, J. (2020). LigRMSD: A web server for automatic structure matching and RMSD calculations among identical and similar compounds in protein-ligand docking. *Bioinformatics*, *36*(9), 2912-2914.

Villela, S. M., Kraiem, H., Bouhaouala-Zahar, B., Bideaux, C., Aceves Lara, C. A., & Fillaudeau, L. 2020. A protocol for recombinant protein quantification by densitometry. *Microbiologyopen*, *9*(6), 1175-1182.

Vitolo, M. 2020 Brief Review on Enzyme Activity. World Journal of Pharmaceutical Research, 9, 60-76.

Wan, S., Liu, X., Sun, W., Lv, B., & Li, C. 2023. Current advances for omics-guided process optimization of microbial manufacturing. *Bioresources and Bioprocessing*, *10*(1), 30.

Wanandy, T., Handley, S. A., Mulcahy, E., & Wiese, M. 2024. Comparative Study Of The Commonly Used Protein Quantitation Assays On Different Hymenoptera Venoms: A Fundamental Aspect Of Hymenoptera Venom Proteome Analysis. *Toxicon*, *241*, 107685.

Wandrey, G., Bier, C., Binder, D., Hoffmann, K., Jaeger, K. E., Pietruszka, J., ... & Büchs, J. 2016. Light-induced gene expression with photocaged IPTG for induction profiling in a high-throughput screening system. *Microbial cell factories*, *15*(1), 63.

Wang, T., Xue, H., Liu, H., Yuan, H., Huang, D., & Jiang, Y. 2025. Advancements in metabolic engineering: unlocking the potential of key organic acids for sustainable industrial applications. *Frontiers in Bioengineering and Biotechnology*, *13*, 1556516.

Wang, Y., Wu, J., Lv, M., Shao, Z., Hungwe, M., Wang, J., ... & Geng, W. 2021. Metabolism characteristics of lactic acid bacteria and the expanding applications in food industry. *Frontiers in bioengineering and biotechnology*, *9*, 612285.

Wei, P., Gao, J. X., Zheng, G. W., Wu, H., Zong, M. H., & Lou, W. Y. 2016. Engineering of a novel carbonyl reductase with coenzyme regeneration in E. coli for efficient biosynthesis of enantiopure chiral alcohols. *Journal of biotechnology*, *230*, 54-62.

Wu, B., Yu, Q., Zheng, S., Pedroso, M. M., Guddat, L. W., He, B., & Schenk, G. 2019. Relative catalytic efficiencies and transcript levels of three d-and two l-lactate dehydrogenases for optically pure d-lactate production in Sporolactobacillus inulinus. *MicrobiologyOpen*, *8*(5), e00704.

Yang, Q., Wei, C., Guo, S., Liu, J., & Tao, Y. 2020. Cloning and characterization of a L-lactate dehydrogenase gene from Ruminococcaceae bacterium CPB6. *World journal of microbiology & biotechnology*, *36*(12), 182.

Zahurancik, W. J., Szkoda, B. E., Lai, L. B., & Gopalan, V. 2020. Ramping recombinant protein expression in bacteria. *Biochemistry*, *59*(23), 2122-2124.

Zhang, W., Lu, J., Zhang, S., Liu, L., Pang, X., & Lv, J. 2018. Development An Effective System To Expression Recombinant Protein In *E. Coli* Via Comparison And Optimization Of Signal Peptides: Expression Of *Pseudomonas Fluorescens* BJ-10 Thermostable Lipase As Case Study. *Microbial Cell Factories*, *17*(1), 50.

Zhang, Y., Kaushik, N., Park, P., Liu, R., & Liu, Y. 2025. *Pediococcus Pentosaceus* In Fermented Foods: Probiotic Properties And A Multi-Omics Framework For Applications. *Trends In Food Science & Technology*, 105187.

Zhang, Z. X., Nong, F. T., Wang, Y. Z., Yan, C. X., Gu, Y., Song, P., & Sun, X. M. 2022. Strategies for Efficient Production of Recombinant Proteins in *Escherichia coli*: Alleviating the Host Burden and Enhancing Protein Activity. *Microbial cell factories*, *21*(1), 191.

Zhang, Z., Nong, F.-T., Wang, Y.-Z., Yan, C., Gu, Y., Song, P., & Sun, X. 2022. Strategies for efficient production of recombinant proteins in *Escherichia coli* : alleviating the host burden and enhancing protein activity. *Microbial Cell Factories, 21*.

Zhou, X., Xiang, Q., Wu, Y., Li, Y., Peng, T., Xu, X., ... & Wang, W. 2024. A low-cost and eco-friendly recombinant protein expression system using copper-containing industrial wastewater. *Frontiers in Microbiology*, *15*, 1367583.

Zhou, Y., & Hua, J. (2025). Regulation and mechanisms of L-lactic acid and D-lactic acid production in baijiu brewing: insights for flavor optimization and industrial application. *Fermentation*, *11*(4), 213.

Zhou, Y., Qi, M., & Yang, M. 2022. Current Status And Future Perspectives Of Lactate Dehydrogenase Detection And Medical Implications: A Review. *Biosensors*, *12*(12), 1145.

Zhu, L., Xu, X., Wang, L., Dong, H., Yu, B., & Ma, Y. (2015). NADP+-Preferring D-Lactate Dehydrogenase From *Sporolactobacillus Inulinus*. *Applied And Environmental Microbiology*, *81*(18), 6294-6301.