

DAFTAR PUSTAKA

- Aanniz, T., M. Ouadghiri, M. Melloul, J. Swings, E. Elfahime, J. Ibijbijen, M. Ismaili & M. Amar. 2015. Thermophilic Bacteria in Moroccan Hot Springs, Salt Arshes and Desert Soils. *Braz. J. Microbiol.* 46(2): 443-453.
- Aanniz, T., M. Ouadghiri, M. Melloul, J. Swings, E. Elfahime, J. Ibijbijen, M. Ismaili & M. Amar. 2015. Thermophilic Bacteria in Moroccan Hot Springs, Salt Arshes and Desert Soils. *Braz. J. Microbiol.* 46(2): 443-453.
- Adelere, I. & A. Lateef. 2019. Degradation of Keratin Biomass by Different Microorganisms. *Keratin as a Protein Biopolymer* 123-162.
- Agustien, A. 2010. *Protease Bakteri Termofilik*. UNPAD PRESS. Bandung.
- Agustien, A., M. Muqarramah, and F. Alamsjah, "Optimization and Molecular Identification of Protease-Producing Thermophilic Bacterial Isolate TUA-26," *Online J Biol Sci*, vol. 24, no. 3, pp. 321–329, 2024, doi: 10.3844/ojbsci.2024.321.329.
- Agustien, A., W. Cahyati, and Y. Rilda, "Exploration and Characterization of Thermophilic Bacteria from the Kerinci-Jambi Geothermal Source for Alcohol Production," *Online J Biol Sci*, vol. 24, no. 3, pp. 313–320, 2024, doi: 10.3844/ojbsci.2024.313.320.
- Agustien, A., Y. Rilda, Arzita & Yunofrizal. 2015. Catalytic Activity and Conditions of Extracellular Protease Alkaline Thermostable *Bacillus* sp. SR-09. *Journal of Chemical and Pharmaceutical Research* 7(11): 417-421.
- Adelere, I. A., & Lateef, A. (2019). Degradation of keratin biomass by different microorganisms. *Keratin as a Protein Biopolymer: Extraction from Waste Biomass and Applications*, 123-162.
- Alrumman, S., Y.S.M. Mostafa, S. Al-Qahtani & T.H.T. Taha. 2018. Hydrolytic Enzyme Production by Thermophilic Bacteria Isolated from Saudi Hot Springs. *De Gruyter* 13: 470-480.
- Ahmad, W., M. Tayyab, M.N. Aftab, A.S. Hahmi, M.D. Ahmad, S. Firyal, M. Wasim & A.R. Awan. 2020. Optimization of Conditions for the Higher Level Production of Protease: Characterization of Protease from *Geobacillus* SBS-4S. *Waste and Biomass Valorization*. Akihary, C.V. & B.J. Kolondam. 2020. Pemanfaatan gen 16S RNA sebagai perangkat identifikasi bakteri untuk penelitian-penelitian di Indonesia. *Pharmacon* 9(1): 16-22.

- Arzita & A. Agustien. 2013. Potensi *Bacillus* sp. PA-05 Termofilik Obligat Untuk Produksi Amilase. Prosiding Semirata FMIPA Universitas Lampung.
- Arzita, Syamsuardi, A. Agustien & Y. Rilda. 2019. Isolation and Identification of *Bacillus* spp. Thermophilic Obligate Producing Serine Alkaline Protease from Hot Spring in Sungai Abu, Kerinci, Jambi, Indonesia. *Ecology, Environment and Conservation Journal* 25(1): 450-455.
- Aydar, A.Y. 2018. Utilization of Response Surface Methodology in Optimization of Extraction of Plant Materials. *INTECH* 10: 157-169.
- Aznia, A., A. Agustien & N. Nasir. 2014. Optimasi Parsial Isolat Termofilik M5-24 dalam Produksi Protease. *Jurnal Biologi Universitas Andalas (J. Bio. UA.)* 3(3): 238-243
- Baltaci, M.O., B. Genc, S. Arslan, G. Adiguzel & A. Adiguzel. 2017. Isolation and Characterization of the Thermophilic Bacteria from Geothermal Areas in Turkey and Preliminary Research on Biotechnological Enzyme Potentials. *Geomicrobiology Journal* 34: 1.
- Bakti, C.P. 2012. Optimasi Produksi Enzim Selulase dari *Bacillus* sp. BPPT CC RK2 dengan Variasi pH dan Suhu menggunakan Response Surface Methodology. *Skripsi*. Universitas Indonesia. Depok.
- Baykara, S.G., Y. Surmeli & G. Sanli-Mohamed. 2021. Purification and Biochemical Characterization of a Novel Thermostable Serine Protease from *Geobacillus* sp. GS53. *Applied Biochemistry and Biotechnology* 193: 1574-1584.
- Baweja, M., P.K. Singh, A. Sadaf, R. Tiwari, L. Nain, S. K. Khare & P. Shukla. 2017. Cost Effective Characterization Process and Molecular Dynamic Simulation Of Detergent Compatible Alkaline Protease from *Bacillus pumilus* strain MP27. *Process Biochem* 58:199-203.
- Bisswanger, H. 2014. Enzyme assays. *Perspectives in Science* 1(1): 41-55.
- Bouacem, K., A. Bouanane-Darenfed, N.Z. Jaouadi, M. Joseph, H. Hacene, B. Ollivier, M.L. Fardeau, S. Bejar & B. Jaouadi. 2016. Novel Serine Keratinase from *Caldicoprobacter algeriensis* Exhibiting Outstanding Hide Dehairing Abilities. *Int J Biol Macromol* 86:321-328.
- Bhunia, B., Basak, B., & Dey, A. (2012). A review on production of serine alkaline protease by *Bacillus* spp. *Journal of Biochemical Technology*, 3(4), 448-457.
- Cahyani, L. 2013. Pemanfaatan Tepung Cangkang Udang Sebagai Media Produksi Kitinase Oleh Bakteri Kitinolitik Isolat 26. *Skripsi*. Jurusan

Biologi Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Jember.

Cappuccino, J.G., N. Sherman. (2005). *Microbiology: A Laboratory Manual* 11th Ed. Pearson Education, Inc. Edinburgh Gate Harlow. England.

Cappucino, J.G. & N. Sherman. 2013. *Microbiology A Laboratory Manual Tenth edition*. Pearson Education. San Fransisco.

Carmen, P. & J. Baranyi. 2008. Single-cell and Population Lag Times As A Function of Cell Age. *Appl Env. Microb* 74: 2534-2536.

Carriere, J., N. Vaughn, J. Kraber, P. Sobczyk, P. Bronikowski & J.M. Mazur. 2019. Design-Expert. 1300 Godward Street Northeast, Suite 6400 Minneapolis, MN 55413: Statease, Inc.

Chalamaiah, M., W. Yu & J. Wu. 2018. Immunomodulatory and Anticancerprotein Hydrolysates (Peptides) from Food Proteins: A Review. *FoodChem* 245: 205-222.

Chasanah, E. (2018). Identifikasi fenotip bakteri amilolitik dan selulolitik dari isolat bekatul dengan metode profile matching berdasarkan Bergey's manual of determinative bacteriology (Doctoral dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).

Che, J., B. Liu, C. Ruan, J. Tang & D. Huang. 2015. Biocontrol of Lasiodiplodia Theobromae, which Causes Black Spot Disease of Harvested Wax Apple Fruit, using a Strain of Brevibacillus brevis FJAT-0809-GLX. *Crop Prot* 67: 178-183.

Chen, G.Q. & X.R. Jiang. 2018. Next Generation Industrial Biotechnology Based on Extremophilic Bacteria. *Current Opinion in Biotechnology* 50: 94-100.

Chun, J., Lee, J. H., Jung, Y., Kim, M., Kim, S., Kim, B. K., & Lim, Y. W. (2007). EzTaxon: a web-based tool for the identification of prokaryotes based on 16S ribosomal RNA gene sequences. *International journal of systematic and evolutionary microbiology*, 57(10), 2259-2261.

Clarridge III, J. E. (2004). Impact of 16S rRNA gene sequence analysis for identification of bacteria on clinical microbiology and infectious diseases. *Clinical microbiology reviews*, 17(4), 840-862.

Coorevits, A; Dinsdale, AE; Halket, G; Lebbe, L; De Vos, P; Van Landschoot, A; Logan, NA (July 2012). "Taxonomic revision of the genus Geobacillus: emendation of Geobacillus, G. stearothermophilus, G. jurassicus, G. toebii, G. thermodenitrificans and G. thermoglucosidans (nom. corrig., formerly 'thermoglucosidasius'); transfer of Bacillus thermantarcticus to the genus as G. thermantarcticus comb. nov.; proposal of Caldibacillus debilis gen.

- nov., comb. nov.; transfer of *G. tepidamans* to *Anoxybacillus* as *A. tepidamans* comb. nov.; and proposal of *Anoxybacillus caldiproteolyticus* sp. nov". *International Journal of Systematic and Evolutionary Microbiology*. 62 (Pt 7): 1470–85. doi:10.1099/ijs.0.030346-0.
- Dalal, R. 2015. Screening and Isolation of Protease Producing Bacteria from Soil Collected from Different Areas of Burhanpur Region (MP). India. *Int. J. Curr. Microbiol. Appl. Sci.* 4: 597-606.
- Darmawati, S. 2014. Phylogenetic Relationship of Gram Negative Bacteria of Enterobacteriaceae Family in the Positive Widal Blood Cultures based on 16S rRNA Gene Sequences. *Indonesian Journal of Biotechnology* 19(1): 64-70.
- Derekova, A., Mandeva, R., & Kambourova, M. (2008). Phylogenetic diversity of thermophilic carbohydrate degrading bacilli from Bulgarian hot springs. *World Journal of Microbiology and Biotechnology*, 24, 1697-1702.
- Dewi, L.R. 2013. Pengaruh Bahan Organik dan Trace Elements terhadap Pertumbuhan dan Kandungan Gula Tanaman Stevia (*Stevia rebaudiana* bertonii M.). *Jurnal Matematika, Sains dan Teknologi* 14(1): 26-36.
- Dewi, A.K., I.W. Sumarjaya & I.G.A.M. Srinadi. 2015. Penerapan Metode Permukaan Respons dalam Masalah Optimalisasi. *E-jurnal Matematika* 2(2): 32-36.
- Dewi, N., R.S. Purbowatiningrum, L.N. Agustina & Aminin. 2017. Isolasi Bakteri Termofilik Sumber Air Panas Gedongsongo dengan Media Pengaya MB (Minimal Broth) dan TS (Taoge Sukrosa) serta Identifikasi Fenotip dan Genotip. *Jurnal Kimia Sains dan Aplikasi* 20(2): 84-91.
- Devi, S. P., & Jha, D. K. (2020). Isolation of a lipolytic and proteolytic *Bacillus licheniformis* from refinery oily sludge and optimization of culture conditions for production of the enzymes. *Microbiology and Biotechnology Letters*, 48(4), 515-524.
- Dharmayanti, N. I. (2011). Molecular phylogenetic: organism taxonomy method based on evolution history.
- Dutta, S., Y.S. Park & K. Park. 2016. Proteolytic Activity of Thermophilic *Bacillus licheniformis* strain SF5-1 for the Efficient Bioconversion of Pork Waste to Amino Acid Fertiliser. *Int. Biodeterior. Biodegrad.* 111: 31-36.
- El-Gayar, K.E., M.A. Al Abboud & A.M.M. Essa. 2017. Characterization of Thermophilic Bacteria Isolated from Two Hot Springs in Jazan, Saudi Arabia. *Journal of Pure and Applied Microbiology* 11(2): 743-752.

- Enuneku, A.A., P.I. Abhulimen, P.O. Isibor, C.O. Asemota, B. Okpara, T.O. Imoobe & L.I. Ezemonye. 2020. Interactions of Trace Metals with Bacteria and Fungi in Selected Agricultural Soils of Egbema Kingdom, Warri North, Delta state, Nigeria. *Heliyon* 6.
- Fachrial, E., V. Krisdianilo, Harmileni, I.N.E. Lister, T.T. Nugroho & Saryono. 2021. Isolation, Characterization, Activity Test and Molecular Identification of Thermophilic Bacteria Producing Proteases from Dolok Tinggi Raja Natural Hot Springs, North Sumatra, Indonesia. *Biodiversitas* 22: 1725-1732.
- Farhadian, S., Asoodeh, A., & Lagzian, M. (2015). Purification, biochemical characterization and structural modeling of a potential htrA-like serine protease from *Bacillus subtilis* DR8806. *Journal of Molecular Catalysis B: Enzymatic*, 115, 51–58. <https://doi.org/10.1016/j.molcatb.2015.02.001>
- Farinas, C. S. (2015). Developments in solid-state fermentation for the production of biomass-degrading enzymes for the bioenergy sector. *Renewable and Sustainable Energy Reviews*, 52, 179-188.
- Firliani, W., A. Agustien & F.A. Febria. 2015. Karakterisasi Bakteri Termofilik Penghasil Enzim Protease Netral. *Jurnal Biologi Universitas Andalas* 4(1): 9-14.
- Genc, B., H. Nadaroglu, A. Adiguzel, & O. Baltaci. 2015. Purification and characterization of an extracellular cellulase from *Anoxybacillus gonensis* O9 isolated from geothermal area in Turkey. *Journal Environ Biol* 36(6): 1319-1324.
- Gulmus, E.O. & A. Gormez. 2020. Identification and Characterization of Novel Thermophilic Bacteria from Hot Springs, Erzurum, Turkey. *Arch Microbiol* 77: 979-987.
- Guo, X.D., D. Chen, T.J. Papenfuss, N.B. Ananjeva, D.A. Melnikov & Y. Wang. 2011. Phylogeny and Divergence Times of some Racerunner Lizards (Lacertidae: Eremias) Inferred from Mitochondrial 16S rRNA Gene Segments. *Molecular Phylogenetics and Evolution* 61: 400-412.
- Hammami, A., Hamdi, M., Abdelhedi, O., Jridi, M., Nasri, M., & Bayouhdh, A. (2017). Surfactant-and oxidant-stable alkaline proteases from *Bacillus invictae*: characterization and potential applications in chitin extraction and as a detergent additive. *International journal of biological macromolecules*, 96, 272-281.
- Harley, J. P. and Prescott, L. M. (2002). *Laboratory Exercises in Microbiology 5th Edition*. New York: Mc Graw Hill Company.

- Hatayama, K., H. Shoun, Y. Ueda & A. Nakamura. 2014. *Brevibacillus fulvus* sp. nov., Isolated from a Compost Pile. *Int J Syst Evol Microbiol* 64:506-512.
- Hnatush, S., Peretyatko, T., Maslovska, O., Moroz, O., Komplikevych, S., & Kondratiuk, T. (2020). Morphological, physiological and biochemical properties of heavy metal resistant isolates of bacteria obtained from different Antarctic substrates. *Ukrainian Antarctic Journal*, (1), 82-92.
- Ibrahim, A.S., Y.B. Elbadawi, A.M. El-Toni, K.S. Almaary, M.A. El-Tayeb, A.A. Elagib & D.A.F. Maany. 2021. Stabilization and Improved Properties of *Salipaludibacillus agaradhaerens* Alkaline Protease by Immobilization Onto Double Mesoporous Core-Shell Nanospheres. *International Journal of Biological Macromolecules* 166: 557-566.
- Imšenecki, A., & Solnzeva, L. (1945). The growth of aerobic thermophilic bacteria. *Journal of Bacteriology*, 49(6), 539-546.
- Irdawati, I., I.S. Putri, Syamsuardi, A. Agustien & Y. Rilda. 2018. The Thermophilic Bacterial Growth Curve. *Bioscience* 2(2): 58-64.
- Janda, J. M., & Abbott, S. L. (2007). 16S rRNA gene sequencing for bacterial identification in the diagnostic laboratory: pluses, perils, and pitfalls. *Journal of clinical microbiology*, 45(9), 2761-2764.
- Jingying, C. & G. Yan. 2023. Optimization of Fermentation Conditions for Protease Production from *Bacillus subtilis*. *BIO Web of Conferences* 59.
- Joo, H.J., H.Y. Kim, L.H. Kim, S. Lee, J.G. Ryu & T. Lee. 2015. A *Brevibacillus* sp. antagonistic to mycotoxigenic *Fusarium* spp. *Biol Control* 87:64-70.
- Khosravi, F., M. Khaleghi & H. Naghavi. 2022. Screening and Identification of Cellulose-Degrading Bacteria from Soil and Leaves at Kerman Province, Iran. *Archives of Microbiology* 204:88.
- Kortam, Y.G., W.M.A. El-Rahim, A.E-N.A. Khattab, N.Y. Rebouh, R.R. Gurina, O.S. Barakat, M. Zakaria & H. Moaward. 2023. Enhancing the Antibiotic Production by Thermophilic Bacteria Isolated from Hot Spring Waters via Ethyl Methanesulfonate Mutagenesis. *Antibiotics* 12, 1095: 2-17.
- Kosasi, C., Lolo, W. A., & Sedewi, S. (2019). Isolasi dan Uji Aktivitas Antibakteri dari Bakteri yang Berasosiasi dengan Alga *Turbinaria ornata* (Turner) J. Agardh serta Identifikasi secara Biokimia. *Jurnal Pharmacon*. 8: 351- 359. [Isolation and Antibacterial Activity Test of Bacteria Associated with Algae *Turbinaria ornata* (Turner) J. Agardh and Biochemical Identification]

- Kumar, S., G. Stecher, M. Li, C. Knyaz dan K. Tamura. 2018. MEGA X: Molecular Evolutionary Genetics Analysis across computing platforms. *Molecular Biology and Evolution* 35: 1547-1549.
- Kumar, S., A.K. Dangi, P. Shukla, D. Baishya & S.K. Khare. 2019. Thermozyms: Adaptive Strategies and Tools for their Biotechnological Applications. *Bioresour Technology* 278: 1-50.
- Kurniawan, H.M. 2017. Isolasi dan Optimasi Ekstrinsik Bakteri Termo-Proteolitik Isolat Sumber Air Panas Semurup, Kab. Kerinci, Jambi. *Scientia Journal* 6(1): 62-68.
- Kurniawan, H.M., R. Fikrinnisa & A. Adriadi. 2022. Optimasi Ekstrinsik Produksi Protease dari *Bacillus* sp. TG-50 Isolat Tanah Tempat Pembuangan Akhir Sampah (TPAS) Talang Gulo Jambi. *Jurnal Penelitian Biologi (Journal of Biological Research)* 9(1): 1-14.
- Lee, Y. J., Ganbat, D., Oh, D. K., Kim, H. W., Jeong, G. E., Cha, I. T., ... Lee, S. J. (2022). Isolation and Characterization of Thermophilic Bacteria from Hot Springs in Republic of Korea. *Microorganisms*, 10(12). <https://doi.org/10.3390/microorganisms10122375>
- Liu, Yichen., Zhang, Qian., Min, Sheng., Xiangchao, Cheng., Guan, Suixia., Li, Hongwei., Gong, Ting., Wang, Yang., Ding, Ke., Li, Xiaokang., Yinju, Li., Tingcai, Wu., Chen, Wang. (2012). Method for producing protease through one-bacterium multi-enzyme strain.
- Lowry, O. H., Rosebrough, N. J., Farr, A. L., & Randall, R. J. (1951). Protein measurement with the Folin phenol reagent. *J Biol Chem*, 193(1), 265-275.
- Madigan, M.T., J.M. Martinko, D. Stahl & Clark. 2012. *Brock Biology of Microorganisms (13th Edition)*. New York. Pearson.
- Maghraby, Y. R., El-Shabasy, R. M., Ibrahim, A. H., & Azzazy, H. M. E. S. (2023, February 14). Enzyme Immobilization Technologies and Industrial Applications. ACS Omega. *American Chemical Society*. <https://doi.org/10.1021/acsomega.2c07560>
- Mahmudah, R., M. Baharuddin & Sappewali. 2016. Identifikasi Isolat Bakteri Termofilik Dari Sumber Air Panas Lejja, Kabupaten Soppeng. *Al-Kimia* 4(1): 31-42.
- Mardalena. 2016. Fase Pertumbuhan Isolat Bakteri Asam Laktat (BAL) Tempoyak Asal Jambi yang disimpan pada Suhu Kamar. *Jurnal Sains Peternakan Indonesia* 11(1): 58-64.

- Mohammad, B. T., Al Daghistani, H. I., Jaouani, A., Abdel-Latif, S., & Kennes, C. (2017). Isolation and characterization of thermophilic bacteria from Jordanian hot springs: *Bacillus licheniformis* and *Thermomonas hydrothermalis* isolates as potential producers of thermostable enzymes. *International journal of microbiology*, 2017(1), 6943952.
- Montgomery, D.C. 2017. *Design and Analysis of Experiments 9th Edition*. Wiley.
- Moran L.A., K.G. Scrimgeour, H.R. Horton, R.S. Ochs & J.D. Rawn. 1994. *Biochemistry*. Second Edit, Prentice Hall, Inc. Upper Saddle River. *Biochemical Education* 22(4): 219.
- Motyán, J.A., F. Toth & J. Tozser. 2013. Research Applications of Proteolytic Enzymes in Molecular Biology. *Biomolecules* 3: 923-942.
- Muzzazinah. 2017. Metode Filogenetik pada Indigofera. Prosiding Seminar Nasional Pendidikan Biologi dan Biologi 25-40.
- Nadeem, M. A., Iqbal, Z., Ayub, M., Mubeen, K., & Ibrahim, M. (2009). Effect of nitrogen application on forage yield and quality of maize sown alone and in mixture with legumes. *Pak. J. Life Soc. Sci*, 7(2), 161-167.
- Nadila, P. 2019. Eksplorasi Bakteri Termofilik dari Sumber Air Panas Dikawasan Cagar Alam Tinggi Raja Kecamatan Silau Kahen Kabupaten Simalungun Sumatera Utara. *Disertasi*. Medan. Universitas Medan Area.
- Nafia, S. Z. I., Pujiyanto, S., & Budiharjo, A. Isolasi, Skrining, dan Identifikasi Molekuler Bakteri Termotoleran Proteolitik dari Sumber Air Panas Nglimit Gonoharjo Kendal. *Bioma: Berkala Ilmiah Biologi*, 24(1), 30-35.
- Nanda, P.T., S.A. Siregar, R. Kurniawan, Hairuidin, Meriyanti & Yatno. 2017. Isolasi, Karakterisasi dan Uji Potensi Bakteri Penghasil Enzim Termostabil Air Panas Kerinci. *Chempublish Journal* 2(1): 26-31.
- Naveed, M., F. Nadeem, T. Mehmood, M. Bilal, A. Zahid, A. Fazeha. 2021. Protease-A Versatile and Ecofriendly Biocatalyst with Multi-Industrial Applications: An Updated Review. *Catalysis Letter* 151: 307-323.
- Ningsih, F., D.G. Nurlaili, A. Yokota, S. Yabe & W. Sjamsuridzal. 2021. Isolation and Molecular Identification of Thermophilic Bacteria from Litter of Mount Galunggung Hot Spring, Tasikmalaya, Indonesia. *Journal of Physics: Conference Series* 1943 012097.
- Nurkhotimah, N., E. Yuliati & A. Rahmawati. 2017. Pengaruh Suhu dan pH Terhadap Aktivitas Enzim Fosfatase Bakteri Termofilik Sungai Gendol Pasca Erupsi Merapi. *Kingdom (The Journal of Biological Studies)* 6(8): 465-471.

- Novitasari, Y.E. & N. Herdyastuti. 2014. Skrining Bakteri Termofilik Penghasil Enzim Amilase dari Sumber Air Panas Singgahan Tuban, Jawa Timur. *UNESA Journal of Chemistry* 3(3): 189-193.
- Nuryati & D. Salimy. 2008. *Metode Permukaan Respon dan Aplikasinya pada Optimal Eksperimen Kimia*. Risalah Lokakarya Komputasi dalam Sains dan Teknologi Nuklir; Serpong, Indonesia. Serpong (ID): Pusat Pengembangan Energi Nuklir BATAN 373-391.
- Oktavia, Y. S.D. Lestari, S. Lestari, Herpandi & M. Jannah. 2018. Optimasi Waktu Inkubasi Produksi Protease dan Amilase Isolat Bakteri Asal Terasi Ikan Teri *Stolephorus* sp. *Jurnal Ilmu dan Teknologi Kelautan Tropis* 10(3): 719-725.
- Olajuyigbe, F. M. (2013). Optimized production and properties of thermostable alkaline protease from *Bacillus subtilis* SHS-04 grown on groundnut (*Arachis hypogaea*) meal. *Advances in Enzyme Research*, 1(04), 112.
- Pakpahan, R. 2009. Isolasi Bakteri dan Uji Aktivitas Protease Termofilik dari Sumber Air Panas Sipoholon Tapanuli Utara Sumatera Utara. *Tesis*. Sekolah Pascasarjana Universitas Sumatera Utara. Medan.
- Panda, A.K., S.S. Bisht, S. Demondal, N.S. Kumar, G. Gurusubramanian & A.K. Panigrahi. 2014. *Brevibacillus* as a biological tool: a short review. *Antonie van Leeuwenhoek. International Journal of General and Molecular Microbiology* 105: 623-639.
- Pandey, A., K. Dhakar, A. Sharma, P. Priti, P. Sati & B. Kumar. 2014. Thermophilic Bacteria that Tolerate a Wide Temperature and pH Range Colonize the Soldhar (95°C) and Ringigad (80°C) Hot Springs of Uttarakhand, India. *Annals of microbiology* 65(2): 809-816.
- Pangastuti, A. (2006). Species definition of procaryotes based on 16S rRNA and protein coding genes sequence. *Biodiversitas Journal of Biological Diversity*, 7(3).
- Pant, G., A. Prakash, J.V.P. Pavani, S. Bera, G.V.N.S. Deviram, A. Kumar, M. Panchpuri & R.G. Prasuna. 2015. Production, Optimization and Partial Purification of Protease from *Bacillus subtilis*. *JTUSCI* 9(1): 50-55.
- Poedjiadi, A. 2009. *Dasar-Dasar Biokimia*. UI Press. Jakarta. Poernomo, A.T., Isaeni, Sugianto, D.A. Purwanto, A.C. Dewi & D. Suryagama. 2017. Pengaruh Nutrisi pada Produksi dan Karakterisasi Protease dari Bakteri Termofilik Isolat LS-1 Lumpur Sidoarjo. *Jurnal Farmasi Dan Ilmu Kefarmasian Indonesia* 4(2): 52-59.

- Pramiadi, D. E. Yulianti & A. Rakhmawati. 2014. Isolasi dan Uji Aktivitas Enzim Lipase Termotabil dari Bakteri Termofilik Pasca Erupsi Merapi. *Jurnal Sains Dasar* 3(1): 9-19.
- Pujawati, S. 2012. Seleksi, Karakterisasi dan Identifikasi Bakteri Termofilik Pasca Erupsi Merapi Sebagai Penghasil Enzim Amilase. *Skripsi*. Program Studi Biologi Universitas Negeri Yogyakarta.
- Rabelo, S. C., Fonseca, N. A., Andrade, R. R., Maciel Filho, R., & Costa, A. C. (2011). Ethanol production from enzymatic hydrolysis of sugarcane bagasse pretreated with lime and alkaline hydrogen peroxide. *Biomass and bioenergy*, 35(7), 2600-2607.
- Rawat, S. 2015. Food Spoilage: Microorganisms and Their Prevention. *A sian Journal of Plant Science and Research* 5(4): 47-56. Razzaq, A., S. Shamsi, A. Ali, Q. Ali, M. Sajjad, A. Malik & M. Ashraf. 2019. Microbial Proteases Applications. *Front. Bioeng. Biotechnol* 7:110.
- Razzaq, A., Shamsi, S., Ali, A., Ali, Q., Sajjad, M., Malik, A., & Ashraf, M. (2019). Microbial proteases applications. *Frontiers in bioengineering and biotechnology*, 7, 110.
- Rehman, H. U., Aman, A., Nawaz, M. A., & Qader, S. A. U. (2015). Characterization of pectin degrading polygalacturonase produced by *Bacillus licheniformis* KIBGE-IB21. *Food Hydrocolloids*, 43, 819-824.
- Reiny, S.S. 2012. Potensi *Lactobacillus acidophilus* ATCC 4796 sebagai Biopreservatif pada Rebusan Daging Ikan Tongkol. *Jurnal IJAS* 2(2): 604-613.
- Respati, N.Y., E. Yulianti & A. Rakhmawati. 2017. Optimasi Suhu dan pH Media Pertumbuhan Bakteri Pelarut Fosfat dari Isolat Bakteri Termofilik. *Jurnal Prodi Biologi* 6(7): 423-430.
- Rezakhani, N., A.M. Rad, K. Parivar, M. Khayati & S. Etemadzade. 2014. Immobilization of Protease in Biopolymers (Mixture of Alginate Chitosan). *Journal of Paramedical Sciences (JPS)* 5(4): 108-113.
- Rojas, J. A., Cruz, C., Mikán, J. F., Villalba, L. S., Cepero de García, M. C., & Restrepo, S. (2009). Isoenzyme characterization of proteases and amylases and partial purification of proteases from filamentous fungi causing biodeterioration of industrial paper. *International Biodeterioration and Biodegradation*, 63(2), 169–175.
- Rolfe, M.D., J.C.J. Rice, S. Lucchini, C. Pin, A. Thompson, A.D.S. Cameron, M. Alston, M.F. Stringer, R.P. Betts, J. Baranyi, M.W. Peck & J.C.D. Hinton. 2012. Lag Phase is a Distinct Growth Phase that Prepares

- Bacteria for Exponential Growth and Involves Transient Metal Accumulation. *Journal of Bacteriology* 194(3): 686-701.
- Rosselló-Mora, R., & Amann, R. (2001). The species concept for prokaryotes. *FEMS microbiology reviews*, 25(1), 39-67.
- Rosnawita, M., A. Agustien & N. Nasir. 2015. Pengaruh Faktor Abiotik terhadap Produksi Protease dari Isolat Bakteri M1-23. *Jurnal Biologi Universitas Andalas (J. Bio. UA.)* 4(1): 45-49.
- Sabbathini, G.C., Wijanarka, S. Pujiyanto & P. Lisdiyanti. 2017. Isolasi dan Identifikasi Bakteri Genus Sphingomonas dari Daun Padi (*Oryza Sativa*) di Area Persawahan Cibinong. *Jurnal Biologi* 6(1): 59-64.
- Sari, U.M., A. Agustien & Nurmiati. 2012. Penapisan dan Karakterisasi Bakteri Selulolitik Termofilik Sumber Air Panas Sungai Medang, Kerinci, Jambi. *Jurnal Biologi Universitas Andalas (J. Bio UA)* 1(2): 166-171.
- Sawant, R. & S. Nagendran. 2014. Protease: an Enzyme with Multiple Industrial Applications. *World Journal of Pharmacy and Pharmaceutical Sciences* 3(6): 568-579.
- Setyawan, F. (2015). Pengaruh Aplikasi Inokulum Rhizobium dan Pupuk Organik Terhadap Pertumbuhan dan Produksi Kacang Tanah (*Arachis hypogaea* L.) (Doctoral dissertation, Universitas Brawijaya).
- Shaikh, I.A., B. Turakani, J. Malpani, S.V. Goudar, M.H. Mahnashi, R.H. Al-Serwi, M.M. Ghoneim, M. El-Sherbiny, B.A. Mannasaheb, F. Alsaikhan, V. Sindagimath, A.A. Khan, U.M. Muddapur, S. Azzouz, T. Mohammed & S.M.S Iqbal. 2023. Extracellular Protease Production, Optimization, and Partial Purification from *Bacillus nakamurai* PL4 and its Applications. *Journal of King Saud University* 35: 1-11.
- Shanmugavel, M., Vasantharaj, S., Saathiyavimal, S., & Gnanamani, A. (2016). Application of an alkaline protease in biological waste processing: An eco-friendly approach. *Int. J. Biosci. Nanosci*, 3, 19-24.
- Shajahan, S., I. G. Moorthy, N. Sivakumar & G. Selvakumar. 2017. Statistical Modeling and Optimization of Cellulase Production by *Bacillus licheniformis* NCIM 5556 Isolated from The Hot Spring, Maharashtra, India. *Journal of King Saud University – Science* 29(3): 302-310.
- Sharif, S., A.H. Shah, A. Fariq, S. Jannat, S. Rasheed & A. Yasmin. 2023. Optimization of Amylase Production using Response Surface Methodology from Newly Isolated Thermophilic Bacteria. *Heliyon* 9:1-12.

- Sharma, K.M., R. Kumar, S. Panwar & A. Kumar. 2017. Microbial Alkaline Proteases: Optimization of Production Parameters and Their Properties. *Journal of Genetic Engineering & Biotechnology* 15: 115-126.
- Si, J.B., E.J. Jang, D. Charalampopoulos & Y.J. Wee. 2018. Purification and Characterization of Microbial Protease Produced Extracellularly from *Bacillus subtilis* FBL-1. *Biotechnology and Bioprocess Engineering* 23:176-182.
- Singh, R., A. Mittal, M. Kumar & P.K. Mehta. 2016. Microbial Proteases in Commercial Applications. *Journal of Pharmaceutical, Chemical and Biological Sciences* 4(3): 365-374.
- Soeka, Y.S. 2015. Kemampuan *Bacillus licheniformis* dalam Menghasilkan Enzim α -amilase. *Prosiding Semnas Biodiv Indonesia* 1(5):1162-1166.
- Sopandi, T. & Wardah. 2014. *Mikrobiologi Pangan*. C.V Andi Offset. Yogyakarta.
- Souza, P.M., M.L. de Assis Bittencourt, C.C. Caprara, M. de Freitas, R.P.C. de Almeida, D. Silveira, Y.M. Fonseca, E.X.F. Filho, A.P. Junior & P.O. Magalhães. 2015. A Biotechnology Perspective of Fungal Proteases. *Brazilian Journal of Microbiology* 46(2): 337-346.
- Srividya, S., & Mala, M. (2011). Influence of process parameters on the production of detergent compatible alkaline protease by a newly isolated *Bacillus* sp. Y. *Turkish Journal of Biology*, 35(2), 177-182.
- Stülke, J., & Hillen, W. (1999). Carbon catabolite repression in bacteria. *Current opinion in microbiology*, 2(2), 195-201.
- Suberu, Y., I. Akande, T. Samuel. A. Lawal & A. Olaniran. 2019. Optimization of Protease Production in Indigenous *Bacillus* sp. Isolated from Soil Samples in Lagos, Nigeria using Response Surface Methodology. *Biocatalysis and Agricultural Biotechnology* 18: 1-13.
- Sudha, S.U. Nandhini, V. Mathumathi, J.M.A. Nayaki. 2018. Production, Optimization and Partial Purification of Protease from Terrestrial Bacterium *Exiguobacterium profundum* sp. MM1. *Biocatalysis and Agricultural Biotechnology* 16: 347-352.
- Sudhakaran, R., Franklin, N., & Chandran, R. P. (2019). Screening and Identification of pathogenic microorganisms in backwaters of Alappuzha District, Kerala State, India. *Int. J. Adv. Res. Biol. Sci*, 6(4), 62-69.
- Sudin, R. Sulistijowati & R.M. Harmain. 2020. Penapisan dan Pola Pertumbuhan Bakteri Kitinolitik dari Cangkrang Rajungan (*Portunus pelagicus*). *Jambura Fish Processing Journal* 2(1): 36-45.

- Suleiman, A.D., N.A.A. Rahman, H.M. Yusof, F.M. Shariff & N.A. Yasid. 2020. Effect of Cultural Conditions on Protease Production by Thermophilic *Geobacillus thermoglucosidasius* SKF4 Isolated from Sungai Klah Hot Spring Park, Malaysia. *Molecules* 25: 2609.
- Sulistijowati, R. 2012. Potensi *Lactobacillus acidophilus* sebagai biopreservatif pada rebusan daging ikan tongkol. *Jurnal IJAS* 2(2): 604.
- Sumantha, A., C. Larroche & A. Pandey. 2006. Microbiology and Industrial of Food-Grade Proteases: A perspective. *Food Technology Biotechnology* 44 (2): 211-220.
- Sumardi, R. Agustrina, B. Irawan, & I. Selviana. 2018. Pengaruh paparan medan magnet pada ion logam Fe dan Zn dalam media pertumbuhan thdp produksi protease *Bacillus* sp. *Jurnal ilmu lingkungan – PS Ilmu Lingkungan UNDIP*, 6(2): 173-177.
- Sumardi, S. Farisi, C.N. Ekowati & M.S. Diana. 2019. Aktivitas dan Karakterisasi Enzim Protease Isolat *Bacillus* sp. (UJ132) secara Kualitatif dan Kuantitatif. *Jurnal Riset Akuakultur* 14(3): 193-199.
- Sun, F., Y. Hu, X. Yin, B. Kong & L. Qin. 2020. Production, Purification and Biochemical Characterization of The Microbial Protease Produced by *Lactobacillus fermentum* R6 Isolate from Harbin Dry Sausages. *Process Biochemistry* 89:37-45.
- Sutay-Kocabas, D. & R. Grumet. 2019. Evolving Regulatory Policies Regarding Food Enzymes Produced by Recombinant Microorganisms. *GM Crops and Food* 10(4): 191-207.
- Syah, M. A. (2022). Isolasi dan Karakterisasi Molekuler Gen 16S rRNA Bakteri Lipolitik Asal Limbah Kulit Biji Jambu Mete. *Jurnal Sumberdaya Hayati*, 8(1), 20-26.
- Takami, H., T. Akiba & K. Horikosh. 1989. Production of Extremely Thermostable Alkaline Protease from *Bacillus* sp. AH-101. *Applied Microbiol Biotechnol* 30: 120-124.
- Talhi, I., Dehimat, L., Jaouani, A., Cherfia, R., Berkani, M., Almomani, F., ... & Chaouche, N. K. (2022). Optimization of thermostable proteases production under agro-wastes solid-state fermentation by a new thermophilic *Mycothermus thermophilus* isolated from a hydrothermal spring Hammam Debagh, Algeria. *Chemosphere*, 286, 131479.
- Tamura, K., G. Stecher, D. Peterson, A. Filipiski & S. Kumar. 2013. MEGA 6: Molecular Evolutionary Genetics Analysis Version 6.0. *Molecular Biology and Evolution* 30: 2725-2729.

- Tang, R., Q. Zhang, Y. Ye, S. Yang, T. Fu, G-H. Liu & S-G. Zhou. 2021. *Brevibacillus composti* sp. nov., Isolated from Hyperthermophilic Compost. *International Journal of Systematic and Evolutionary Microbiology* 71(11). Tarik A., M. Ouadghiri, M. Melloul & J. Swings. 2015. Thermophilic bacteria in Moroccan hot springs, saltmarshes and desert soils. *Brazilian Journal of Microbiology* 46(2): 443-453.
- Toh, S. C., Lihan, S., Leong, S. S., Lahuri, A. H., Woon, W. C., & Ng, W. W. (2023). Enzymatic Screening and Genotypic Characterization of Thermophilic Bacteria from the Hot Springs of Sarawak, Malaysia. *Makara Journal of Science*, 27(4), 4.
- Tuntun, M. & M. Huda. 2014. Isolasi dan Identifikasi Bakteri Termofilik dari Sumber Air Panas Way Panas Bumi Natar Lampung Selatan. *Jurnal Analis Kesehatan* 3(1): 297-304.
- Untu, P., Rumengan, I. F., & Ginting, E. L. (2015). Identifikasi Mikroba yang Koeksis Dengan *Ascidia Lissoclinum patella* Menggunakan Sekuens Gen 16S rRNA. *Jurnal Pesisir dan Laut Tropis*, 3(2), 23-33.
- Urbietta, M.S., E.R. Donati, K.G. Chan, S. Shahar, L.L Sin & K.M. Goh. 2015. Thermophiles in The Genomic Era: Biodiversity, Science, and Applications. *Biotechnology Advances* 33(6): 633-647.
- Volk, W. A. dan M. F. Wheeler. (1993). *Mikrobiologi Dasar*. Jilid 1. Edisi ke-5. Erlangga. Jakarta.
- Wang, K-X., C. Li, Y-Q. He, L-Q. Cui, R-W. Chen, L-J. Long & X-P. Tian. 2021. *Brevibacillus marinus* sp. nov., a Thermophilic Bacterium Isolated from Deep Sea Sediment in the South China Sea. *International Journal of Systematic and Evolutionary Microbiology* 71(12).
- Warshel, A. & R.P. Bora. 2016. Perspective: Defining and Quantifying the Role of Dynamics in Enzyme Catalysis. *The Journal of Chemical Physics* 144(18): 180901- 1809017.
- Wartono, W., Suryadi, Y., & Susilowati, D. N. (2020). Keefektifan formulasi bakteri *Burkholderia cepacia* isolat E76 terhadap *Rhizoctonia solani* Kühn pada pertumbuhan tanaman padi di laboratorium. *Jurnal Agrotropika*, 17(2).
- Wartono, W., Suwignyo, R. A., Napoleon, A., & Suheryanto, S. (2021). Isolation of Indigenous Bacteria from Paddy Field for Methomyl Degradation. *Jurnal Ilmu Alam dan Lingkungan*, 12(2).

- Yang, X. & A.E. Yousef. 2018. Antimicrobial Peptides Produced by *Brevibacillus* spp.: Structure, Classification and Bioactivity: a mini review. *World J Microbiol Biotechnol* 34:57.
- Yuanita, D. N., & Wikandari, P. R. (2014). Screening Bakteri proteolitik termofilik dari sumber air panas Singgahan Tuban. *UNESA Journal of Chemistry*, 3(3), 12-13.
- Yuniati, R., Nugroho, T. T., & Puspita, F. (2015). Uji aktivitas enzim protease dari isolat bacillus sp. galur lokal riau (Doctoral dissertation, Riau University).
- Zhang, X. X., Wei, Y., Liu, L., Zhou, Y. G., & Chen, G. Q. 2013. Regulation of nitrate assimilation in bacteria and archaea. *Archives of Microbiology*, 195(6), 397-410.
- Zhang, Y., Hu, J., Zhang, Q., Cai, D., Chen, S., & Wang, Y. (2023). Enhancement of alkaline protease production in recombinant *Bacillus licheniformis* by response surface methodology. *Bioresources and Bioprocessing*, 10(1). <https://doi.org/10.1186/s40643-023-00641-8>
- Zusfahair, D. R. Ningsih, D. Kartika & A. Fatoni. 2016. Amylase from *Bacillus thuringiensis* Isolated from Tapioca Waste: Isolation, Partial Purification and Characterization. *Malaysian J. of Fundamental and Applied Sciences* 12(1):22-2

