

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

1. Profil kurva pertumbuhan isolat fungi dan kurva produksi enzim L-asparaginase dari isolat fungi endofit genus *Penicillium* yang diisolasi dari daun tanaman tomat (*Lycopersicum esculentum* Mill.) paling optimal dicapai pada waktu 72 jam setelah inokulasi ke dalam media pertumbuhan.
2. Suhu optimum enzim L-Asparaginase dari isolat fungi endofit genus *Penicillium* yang diisolasi dari daun tanaman tomat (*Lycopersicum esculentum* Mill.) berada pada suhu 40°C, sedangkan pH optimum enzim berada pada pH 7.
3. Aktivitas spesifik enzim L-Asparaginase dari isolat fungi endofit genus *Penicillium* yang diisolasi dari daun tanaman tomat (*Lycopersicum esculentum* Mill.) pada suhu 40°C dan pH 7 yaitu sebesar 0,5077 Unit/mL.

5.2 Saran

Sebaiknya dilakukan penelitian lebih lanjut untuk produksi enzim L-asparaginase dari isolat fungi endofit genus *Penicillium* yang diisolasi dari daun tanaman tomat (*Lycopersicum esculentum* Mill.), uji afinitas terhadap L-Glutamin dan dilanjutkan dengan pemurnian serta pengujian lebih lanjut dari enzim yang dihasilkan agar dapat diaplikasikan dalam ruang lingkup yang lebih luas.

DAFTAR PUSTAKA

- Andersson, C.S., 2006, ‘Structural studies of *Erwinia carotovora* L-Asparaginase X-ray crystallography’, *Thesis*, Master of Science, Physics and Measurement Technology, Linkoping University, Swedia.
- Arpintasari, A., Wuryanti dan Rahmanto, W.H., 2008, Isolasi dan Uji Potensi L-Asparaginase dari Rimpang Kunyit Putih (*Curcuma mangga* Vall) terhadap Leukemia Tipe K562, *Jurnal Kimia Sains dan Aplikasi* **11(3)**: 57-62.
- Atcc. 2018. Potato Dextrose Yeast. Diakses pada 6 September 2018, <https://www.atcc.org/~media/6869C9720D1342578E8EBCA327FA1305.ashx>
- Ayuningtyas, O., 2008, ‘Eksplorasi Enzim Selulase Dari Isolat Bakteri Selulolitik Asal Rumen Sapi’, *Skripsi*, Departemen Kimia, Fakultas Sains dan Teknologi, Airlangga, Surabaya, Halaman 27-28.
- Basha, N.S., Rekha, R., Komala, M. and Ruby, S., 2009, Production of Extracellular Anti-leukaemic Enzyme Lasparaginase from Marine Actinomycetes by Solid state and Submerged Fermentation: Purification and Characterisation, *Tropical Journal of Pharmaceutical Research*, **8(4)**: 353-360.
- BC Cancer Agency Cancer Drug Manual. 2013. Asparaginase. Diakses pada 18 November 2018, http://www.bccancer.bc.ca/drug-database-site/Drug%20Index/Asparaginase_monograph_1June2013_formatted.pdf
- Belson, M., Beverley K. and Adrienne H., 2007, Risk Factors for Acute Leukemia in Children : A Review, *Environmental Health Perspectives*, **115**: 138-145.
- Borek D. and Jaskolski, M., 2001, Sequence Analysis of Enzymes with Asparaginase Activity, *Acta Biochimica Polonica* **48(4)**: 893-902.
- Boyd, J.W. and Phillips, A.W., 1971, Purification and properties of L-Asparaginase from *Serratia marcescens*, *Journal of Bacteriology*, **106(2)**: 578-587.
- Bradford, M., 1976., A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein dye binding, *Annal. Biochem*, **72**: 248-254.

- Campbell, H.A., Mashburn, L.T., Boyse, E.A. and Old, L.J., 1967, Two L-Asparaginases from *Escherichia coli* B. Their Separation, Purification, and Antitumor activity, *Biochem*, **6**: 721-730.
- Chow, Y.Y. and Ting, A.S.Y. 2015, Endophytic L-asparaginase producing fungi from plants associated with anticancer properties, *Journal of Advanced Research*, **6**: 869-876.
- Dias, F.F.G., Ruiz, A.L.T.G., Torre, A.D. and Sato, H.H., 2016, Purification, characterization and antiproliferative activity of L-asparaginase from *Aspergillus oryzae* CCT 3940 with no glutaminase activity, *Asian Pac J Trop Biomed*, **6(9)**: 785–794.
- Egler, R.A., Ahuja, S.P. and Matloub, Y., 2016, L-asparaginase in the treatment of patients with acute lymphoblastic leukemia, *Journal of Pharmacology and Pharmacotherapyapeutics*, **7(2)**: 62-71.
- Ehrman, M., Cedar, H. and Schwartz, J.H., 1971, L-Asparaginase II of *Escherichia coli*, Study on the Enzymatic Mechanism of Action, *Journal of Biological Chemistry*, **246(1)**: 88-94.
- Ferdiaz, S., 1992, *Mikrobiologi Pangan I*, Gramedia Pustaka Utama, Jakarta.
- Guillory, J.K, 2010, CRC Handbook of Chemistry and Physics, 91st edition, *Journal of Medicinal Chemistry*, **53(24)**: 8780–8780.
- Himedia. 2018. Malt Extract Agar. Diakses pada 21 November 2018, <http://himedialabs.com/TD/M137.pdf>.
- Huerta-Zepeda, A., Ortuno, L., Pont, G.D., Duran, S., Lloret, A., Merchant-Larios, H. and Calderon, J., 1997, Isolation and Characterization of *Rhizobium etli* Mutants Altered in Degradation of Asparagine, *Journal of Bacteriology*, **179**: 2068-2072.
- Imada, A., Igarasi, S., Nakahama, K. and Isono, M., 1973, Asparaginase and Glutaminase Activities of Micro-organisms, *Journal of General Microbiology*, **76**: 85-99.
- Isselbacher, K. J, Eugene B., Jean D. W., Joseph B.M., Anthony S. F. and Dennis L.K., 1999, *Harrison Prinsip-Prinsip Ilmu Penyakit Dalam Vol. 4 Edisi 13*, EGC, Jakarta.
- Jones, B.N., Svante P. and Stanley S., 1981, Amino Acid Analysis and Enzymatic Sequence Determination of Peptides by An Improved oPhthaldialdehyde Pre-Column Labeling Procedure, *Journal of Liquid Chromatography*, **4**: 565-586.

- Kawedia, J.D. and Rytting, M.E., 2014, Asparaginase in Acute Lymphoblastic Leukemia, Clinical Lymphoma, Myeloma & Leukemia, *SOHO Supplement*, **14**: S14-S17.
- Kumala, S., 2014, *Mikroba Endofit, Pemanfaatan Mikroba Endofit dalam Bidang Farmasi*, ISFI Penerbitan, Jakarta.
- Lincoln, L. and More, S.S., 2014, Isolation and Production of Clinical and Food Grade L-Asparaginase Enzyme from Fungi, *Journal of Pharmacognosy and Phytochemistry*, **3(3)**: 177-183.
- Majeed, A.D., 2008, 'Extraction, Purification and Characterization Of LAsparaginase from *Withania Somnifera* Ripe Fruits', *Thesis*, Bachelor of Science, University of Baghdad College of Science Department of Biotechnology, Baghdad.
- Manning, G.B. and Campbell, L.L., 1957, The Asparagine Deaminase of *Bacillus Coagulans* and *Bacillus Strearothermophilus*, *Canadian Journal of Microbiology*, **3**: 1001-1009.
- Mesas, J.M., Gil, J.A. and Martin, J.F., 1990, Characterization and Partial Purification of L-Asparaginase from *Corynebacterium Glutamicum*, *Journal of general microbiology*, **136**: 515-519.
- Michalska K, Bujacz G, and Jaskolski M., 2006, Crystal Structure of Plant Asparaginase, *Journal of Molecular Biology*, **360**: 105-116.
- Morrison, C., and Charles, 2012, *Panduan untuk Penderita Leukemia*, PT. Indeks, Jakarta.
- Muksini, M.U.S., 2017, Karakteristik Molekuler L-Asparaginase *Bacillus subtilis* str. ITBCC1 Asal Indonesia Melalui Pendalaman Bioinformatika, *Skripsi*, Sarjana Teknologi Pertanian, Institut Pertanian Bogor, Bogor.
- Muttaqin, A., 2009, *Buku Ajar Asuhan Keperawatan Klien dengan Gangguan Sistem Kardiovaskular dan Hematologi*, Salemba Medika, Jakarta, hal. 415.
- Narta, U.K., Kanwar, S.S., and Azmi, W., 2007, Pharmacological and clinical evaluation of L-asparaginase in treatment of leukemia, *Critical Reviews in Oncology/Hematology*, **61(3)**: 208-221.
- Nimkande, K.D., Khan, Z.H., Mular, S.M., and Kunjwani, S.S., 2015, Isolation, Purification & Characterization of L-Asparaginase from dry seeds of *Pisum sativum* and *Vigna radiata*, *International Journal of Applied Research*, **1(7)**: 628-631.

- Novertita, Dinah, F., dan Sinaga, E., 2009, Isolasi dan Uji Aktivitas Antibakteri Jamur Endofit dari Daun dan Rimpang *Zingiber officinale* Val., *Jurnal Farmasi Indonesia*, **4(4)**: 171-176.
- Permono, B., 2010, *Buku Ajar Hematologi-Onkologi Anak*, Ikatan Dokter Anak Indonesia, Jakarta.
- Reynold, D.R., and Taylor, J.W., 1993, The Fungal Holomorph: A Consideration of Mitotic Meiotic and Pleomorphic Speciation, *CAB international*, Wallingford.
- Setiawan, A.S.R., Wuryanti., dan Aminin, A.L.N., 2013, Purifikasi L-Asparaginase Dari Bawang Bombay (*Allium cepa* L.) Menggunakan Kromatografi Filtrasi Gel Sephadex G-100, *Chem Info*, **1(1)**: 27-34.
- Setyosari, P., 2010, *Metode Penelitian Pendidikan & Pengembangan*, Kencana, Jakarta.
- Shrivastava, A.A., Sudhir K.J., Abdul A.K., and Francesco M., 2009, Biotechnological Advancement in Isolation of Anti-Neoplastic Compounds From Natural Origin : A Novel Source of L-Asparaginase, *Acta Biomedica*, **81**: 104-108.
- Siddalingeshwara, K. G. and Lingappa, K., 2011, Production and characterization of L-asparaginase a tumor inhibitor, *International Journal of PharmTech Research*, **3**: 314-319.
- Stecher, A. L., P. Morgantetti de Deus, I. Polikarpov, and J. Abrahao-Neto, 1999, Stability of L-asparaginase : an enzyme used in leukemia treatment, *Pharmaceutica Acta Helveticae* **74**: 1-9.
- Tan, R.X. and Zou W.X., 2001. Endophytes : A Rich Source of Functional Metabolites, *Natural Product Reports*, **18**: 448-459.
- Tosa, T.; Sano, R.; Yamamoto, K.; Nakamura, M.; Ando, K, and Chibata, I., 1971, L-Asparaginase from *Proteus vulgaris*, *Applied Microbiology*, **22(3)**: 387-392.
- U.S. National Library of Medicine, 2017, *PubChem*, Bethesda: U.S. National Library of Medicine.
- Verma, N. K., Kumar, G., Kaur, and Ariand, S., 2007, L-Asparaginase: A Promosing Chemotherapeutic Agent, *Critical Review Biotechnology*, **27**: 45-62.
- Winarto, W., 2017, 'Isolasi dan Skrining Fungi Endofit Penghasil Enzim L-Asparaginase dari Daun Tanaman Tomat (*Lycopersicum esculentum*

Mill.)', Skripsi, Sarjana Farmasi, Universitas Katolik Widya Mandala, Surabaya.

Yadav, N. and Supriya S., 2014, Production of L-Asparaginase By *Fusarium Oxysporum* Using Submerged Fermentation, *International Journal of Pharmaceutical Science Invention*, **3(6)**: 32-40.

Ylikangas, P., and Mononen, I., 2000, A Fluorometric Assay for L-Asparaginase Activity and Monitoring of L-Asparaginase Therapy, *Analytical Biochemistry*, **280(1)**: 42-45.

Youssef, M.M., and M. A. Al-Omair, 2008, Cloning, Purification, Characterization and Immobilization of L-Asparaginase II from *E. coli* W3110, *Asian Journal of Biochemistry*, **3(6)**: 337-350.