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DAFTAR PUSTAKA

- Akagi K., Watanabe J., Hara M., Kezuka Y., Chikaishi E., Yamaguchi T., Akutsu H., Nonaka T., Watanabe T. and Ikegami T. 2006. Identification of the substrate interaction region of the chitin-binding domain of *Streptomyces griseus* chitinase. *C. J Biochem. Tokyo.* 139:483–493.
- Baehaki, A. dan Herpandi. 2011. Karakterisasi Parsial Kitinase dari Isolat Bakteri Lumpur Rawa Indralaya Sumatra Selatan. Prosiding Seminar asional MPHPI 3: 61-68.
- Barrow, R.K.A. and Feltham R.C.W. 1993. Manual For The Identification of Medical Bacteria. Cambridge University Press. Cambridge.
- Bassler, B. L., Yu, C., Lee, Y. C. and Roseman, S. (1991). Chitin utilization by marine bacteria. Degradation and catabolism of chitin oligosaccharides by *Vibrio furnissii*. *J Biol Chem* 266: 24276–24286.
- Bintang, M. 2010. Teknik Penelitian Biokimia. Erlangga, Jakarta.
- Bitton, G. 2005. Waste Water Microbiology. John Willey & Sons, Inc. New Jersey
- Bradford, M. M. 1976. A Rapid and Sensitive Method of Microgram Quantities of Protein Utilizing the Principle of Protein- Dye Binding. *Jurnal Anal. dan Biochem.* 12: 248-254.
- Breed R.S., Murray, E.G.D. and Smith, N.R. 1957. Bergey's Manual of Determinative Bacteriology. Waverly Press. Baltimore.
- Brock, T. D. and T. M. Madigan. 1991. Biology of Microorganism. 6th ed. Prentice hall. International, Inc.
- Brzezinska, M.S. and W. Donderski. 2001. Occurrence and activity of the chitinolytic bacteria of *Aeromonas* genus. *Polish Journal of Environmental Studies.* 10: 27-31.
- Budiani, A., Santoso, D.A., Susanti, I., Mawardi S. dan Siswanto. 2004. Ekspresi β - 1,3 Glukanase dan Kitinase pada Tanaman Kopi Arabika Tahan dan Rentan Karat Daun. *Jurnal Menara Perkebunan.* 72: 57-71.



- Cabib, E. 1987. The Synthesis and Degradation of Chitin. A. Journal of Environmental Studies. 59: 59 – 101.
- Chaiharn, M., Lumyong, S., Hasan, N. and Plikomol, A. 2012. Solid-state cultivation of *Bacillus thuringiensis* R 176 with shrimp shells and rice straw as a substrate for chitinase production. Ann Microbiol. 63: 443-450
- Chasanah, E., Ilmi, M. dan Mangunwardoyo, W. 2009. Penapisan Bakteri Kitinolitik dari Limbah Pengolahan Udang. JPB. Perikanan 4: 59-68
- Chasanah, E., Fawzya, Y.N., Pratitis A. dan T. Nurhayati. 2007. Penapisan Bakteri Penghasil Enzim Kitosanase yang Berasosiasi dengan Spons Laut. Jurnal Pascapanen dan Bioteknologi Kelautan dan Perikanan. 2: 161-169.
- Chen J. P. and Lee M. S. 1994. Simultaneous production and Partition of Chitinase During Growth of *Serratia marcescens* In An Aqueous Two Phase System. Jurnal Biotech. Techniq. 8: 783-788.
- Chernin, L.S., Ismailov, Z., Haran, S. and Chet, I. 1995. Chitinolytic *Enterobacter agglomerans* antagonistic to fungal plant pathogens. Applied and Environmental Microbiology 61: 1720–1726.
- Countino. 2005. Enzymatic Hydrolysis of Chitin In The Production of Oligosaccharides Using *Lecanicillium Fungicola* Chitinases. Elsevier Ltd. Cambrigde
- Darsono, V. 1994. Pengantar Ilmu Lingkungan. Penerbit Universitas Atma Jaya. Yogyakarta
- Dian, V. 2001. Studi Mengenai Karakteristik Limbah Cair di PT Indomaguro Tunas Unggul. Fakultas Perikanan dan Kelautan. Intitut Pertanian Bogor. Bogor. Skripsi
- Donderski, W. and M. Trzebiatowska. 1999. Chitinase activity production by planktonic, benthic and epiphytic bacteria inhabiting the moty bay of the Jeziork Lake (Poland). Jurnal Environ. Studi. 8: 215 – 220.
- Essghaier B., Hedi A., Bejji M., Jijakli H., Boudabous A. and Sadfi-Zouaoui N. 2012. Characterization of a novel chitinase from a moderately halophilic bacterium, *Virgibacillus marismortui* strain M3-23. Ann Microbiol. 62:835–841.



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GADJAH MADA

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- Felse, L., and Panda, A. 1999. Regulation and cloning of microbial chitinase genes. *Journal Applied Microbiology and Biotechnology*. 51: 141-151.
- Fitri, L. dan Yasmin, Y. 2011. Isolasi Dan Pengamatan Morfologi Koloni Bakteri Kitinolitik. *Jurnal Ilmiah Pendidikan Biologi*. 3: 20-25
- Flach, J., Pilet, P. and Jolles, P. 1992. What's new in chitinase research ?. *Experientia* 48: 701-716.
- Fukamizo T. 2000. Chitinolityc enzymes: catalysis, substrate binding, and their application. *Curr Prot Peptide Sci* 1: 105-124.
- Johnson, D.E. 1931. Some observation on chitin destroying bacteria. *Journal Series of the Minnesota Agricultural Experiment Station*. 1053: 335–340
- Gillett, R. 2008. Global study of shrimp fisheries. Food and Agriculture Organization of the United Nations. Rome
- Gooday, G. W. 1990. Physiology of Microbial Degradation of Chitin and Chitosan. Kluwer Academic Publisher, Netherlands. *Jurnal Biodeg*. 1: 177-190.
- Gooday, G. W. 1990. The ecology of chitin degradation. *Adv. Microb. Ecol.* 11: 387–430.
- Gohel, V., Singh, A., Vimal, M., Ashwini, P. and Chhatpar, H.S. 2006. Bio prospecting and antifungal potential of chitinolytic microorganisms. *African Journal of Biotechnology*. 5: 54–72.
- Gonzales, J.F. 1996. Waste water treatment in the fishery industry. Food and Agriculture Organization. Amerika
- Haliza, W. dan Suhartono, M. T. 2012. Karakteristik Kitinase dari Mikrobia. *Buletin Teknologi Pasca Panen Pertanian*. 8: 1-14
- Harper, H. A., Rodwel, V. W. and Mayer, P. A. 1984. Review of Physiological Chemistry. Lange Medical Publication, California.
- Hayati, M. 1998. Mempelajari Proses Produksi Udang Beku dan Pengolahan Limbah di PT. Kalimantan Fisher. Jurusan TIN-FATETA. IPB. Bogor. Laporan Praktek Lapangan
- Hirano, S. 1997. Application of Chitin and Chitosan in the ecological and enviromental fields. Technomic Publishing Compani, Inc. Lancaster.



- Herdyastuti, N. 2009. Chitinase and Chitinolytic Microorganism : Isolation, Characterization and Potential. *Indo. J. Chem.* 9: 37-47.
- Huang, C.J., Wang, T., Chung, S. and Chen, C. 2005. Identification of an antifungal chitinase from a potential biocontrol agent, *Bacillus cereus* 28-9. *Journal of Biochemistry and Molecular Biology.* 38: 82–88.
- Hunter-Cevera, J.C., Fonda, M.E., and Belt, A. 1986. Isolation of cultures. In Demain, A.L. and Solomon, N.A. (eds.). *Manual of Industrial Microbiology and Biotechnology*. American Society of Microbiology, Washington, D.C. 1:3-23
- Ilankovan, P. 2005. Production of Nacetyl Chitobiose from Various Chitin Substrates Using Commercial Enzymes. Elsevier Ltd.
- Jenie, B.S.L. dan Rahayu, W. P. 1990. *Penanganan Limbah Industri Pangan*. Kanisius. Yogyakarta.
- Joklik, W.F. and Smith, D.T. 1968. *Microbiology*. 15th ed. Prentice-Hall inc., New York.
- Kim, S.K. 2011. Chitin, Chitosan, Oligosaccharides and Their Derivates. CRC Press. Taylor and Francis Group. New York.
- Lehninger, A. L. 1997. *Principles of Biochemistry (Dasar-Dasar Biokimia, alih bahasa: Suhartono, M.T)*. Edisi ke-1. Erlangga, Jakarta.
- Mara, D dan Sandy, C. 1994. *Pemanfaatan Air Limbah Dan Ekstera*. Penerbit ITB. Bandung.
- Martinez, M.L., Suarez A.I., Winstanley J., Ortega M.C. and Bernard K. 1995. Phenotypic Characteristics of 31 Strains of *Corynebacterium striatum* Isolated from Clinical Samples. *Journal of Clinical Microbiology.* 33: 2458-2461.
- Matano, C., Uhde, A., Youn, J.W. and Maeda, T. 2014. Engineering of *Corynebacterium glutamicum* for growth and L-lysine and lycopene production from N-acetyl-glucosamine. *Application Mikrobiology Biotechnology.* 98:5633-5643.
- McFaddin, J.F. 1985. *Media For Isolation Cultivation Identification maintenance of Medical Bacteria*. Vol 1. Baltimore, MD.



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Meidina. 2005. Aktivitas Antibakteri Oligomer Kitin yang Diproduksi Menggunakan Kitin dari Isolat B. Licheniformes. IPB. Bogor.

Meins F Jr., Neuhaus J-M., Sperisen C. and Ryals J. 1992. The primary structure of plant pathogenesis-related glucanohydrolases and their genes. In T Boller, F Meins Jr, eds, Genes Involved in Plant Defense. Springer Verlag, Vienna, Austria, pp 245–282.

Moat, A. G., J. W. Foster and M. P. Spector. 2002. Microbial physiology. 4th Ed. Willey-Liss, Inc, New York.

Morrisey, M. T., Lin J. and Ismond, A. 2005. Surimi and Surimi seafood. 2nd edition. Taylor and Francis. United States of America.

Muharni. 2009. Isolasi dan Identifikasi Bakteri Penghasil Kitinase dari Sumber Air Panas Danau Ranau Sumatra Selatan. Jurnal Penelitian Sains. 09: 12-15

Muharni dan Widjajanti, H. 2011. Skrining Bakteri Kitinolitik Antagonis Terhadap Pertumbuhan Jamur Akar Putih (*Rigidoporus lignosus*) dari Rizosfir Tanaman Karet. Jurnal Penelitian Sains. 14: 98-112

Murao S., Kawada T., Itoh H., Oyama H. & Shin T. 1992. Purification and Characterization of a Novel Type of Chitinase from *Vibrio alginoliticus* TK-22. Biosci. Biotech. Biochem. 56: 368-369.

Muzzarelli, R. A. A. 1997. Chitin. U. K. Pergamon Press. Oxford.

Nasran, S., Ariyani, F., & Indriati, N. 2003. Produksi kitinase dan kitin deasetilase dari *Vibrio harveyi*. J. Penel. Perik. Indonesia. 9: 33–38.

Nurjali, 2001. Kemampuan batu gamping dan karbon aktif dari tempurung kelapa sebagai media saring dalam menurunkan kandungan Total suspended solid dan biological oxygen demand pada limbah cair industri pembekuan udang PT dharma Niaga kabupaten cirebon. Fakultas kesehatan masyarakat universitas Diponegoro. Semarang, skripsi.

Patil, R.S., Ghormade, V. and Deshpande, M.V. 2000. Chitinolytic enzymes: An exploration. Enzyme and Microbial Technology. 26: 473–483.

Poedjiadi, A. 1994. Dasar-Dasar Biokimia. Universitas Indonesia press. Jakarta.



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- Premono, H. 2013. Isolasi dan Karakterisasi Bakteri Kitinolitik Dari Petis Udang. Fakultas Pertanian. Universitas Gadjah Mada. Skripsi
- Prawiro, R.H. 1998. Ekologi lingkungan pencemaran. Satya wacana. Semarang.
- Purwani, E.Y., Suhartono, M.T., Rukayadi, Y., Jae Kwan Hwang, & Yu Ryang Pyun. 2004. Characteristics of thermostable chitinase enzymes from the Indonesian *Bacillus* sp. 13.26. Enzyme and Microbial Technology. 35: 147–153.
- Reissig J. L., Strominger J. L. and Leloir F. A. 1955. A modified colorimetric method for the estimation of N-acetylamino sugars. Jurnal Biol. dan Chem. 217: 959-966
- Rosid W. dan Deden. 2009. Demineralisasi dan Deproteinasi Kulit Udang Secara Kontinyu pada Tahapan Ekstraksi Kitin Secara Biologis. Fakultas Teknik. Universitas Indonesia. Tesis.
- Rostinawati, T. 2008. Skrining dan Identifikasi Bakteri Penghasil Enzim Kitinase dari Air Laut di Perairan Pantai Pondok Bali. Laporan. Fakultas Farmasi Universitas Padjajaran. Aporsn Penelitian Mandiri.
- Sahai , A. S. and Manocha, M. S. 1993. Chitinases of Fungi and Plants: Their Involvement in Morphogenesis and Host-Parasite Interaction. FEMS Microbiol. 11: 317 – 338.
- Sakai, K., Yokota, A., Kurokawa, H., Wakayama, M. and Moriguchi, M. 1998. Purification and characterization of three thermostable endochitinases of a noble *Bacillus* Strain, MH-1, isolated from chitincontaining compost. Applied and Environmental Microbiology. 64: 3397–3402.
- Shahidi, F., Arachchi, J.K.V. and Jeon Y.J. 1999. Food applications of chitin and chitosan. Trends in Food Science and Technology. 10: 37-51.
- Sihaloho, W.,S. 2009. Analisa Kandungan Amonia Dari Limbah Cair Inlet dan Outlet Dari Beberapa Industri Kelapa Sawit. Jurusan Kimia Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Sumatra Utara. Skripsi.
- Sjafei, A. 2002. Studi Mengenai Karakteristik Dan Proses Pengolahan Limbah Cair Industri Hasil Perikanan. Fakultas Perikanan Dan Kelautan. Institut Pertanian Bogor. Skripsi.



- Skaugrud O. and Sargent G. 1990. Chitin and Chitosan: Crustacean Biopolymers with Potensial. International By-products Conference Anchorage: Alaska. pp. 61-72.
- Souza, C. P., Burbano-Rosero, E. M. and Almeida, C. 2009. Culture Medium for Isolating chitinolytic Bacteria from Sea Water and Plankton. World J Microbiol Biotechnol. 25:2079–2082
- Souza, L., Weltzin. J.F. and Sanders, N.J. 2011 Diferential events of two dominant plant species on community structure and invasibility in an old Weld ecosystem. J Plant Ecol. 3:76-84
- Suraini, A.A. 2008. Microbial Degradation of Chitin Materials by *Trichoderma virens* UKM1. Journal of Biological Science 8: 52-59.
- Suresh P.V. 2012. Biodegradation of shrimp processing bio-waste and concomitant production of chitinase enzyme and N-acetyl-D-Glucosamine by marine bacteria: production and process optimization. Microbiol biotechnol. 28:2945-2962.
- Sørbotten, A., Horn, S.J., Eijsink, V.G.H., and Vårum, K.M. 2005. Degradation of chitosans with chitinase B from *Serratia marcescens*: Production of chito-oligosaccharides and insight into enzyme processivity. FEBS Journal. 272: 538–549.
- Tamimi, M. dan Herdyastuti, N. 2013. Analisis Gugus Fungsi Dengan Menggunakan Spektroskopi FT-IR Dari Variasi Kitin Sebagai Substrat Kitinase Bakteri *Pseudomonas sp.* TNH-54. UNESA Journal of Chemistry. 2: 47-51.
- Tanaka, T., Fujiwara, S., Nishikori, S., Fukui, T., Takagi M. and Imaka, T. 1999. A unique chitinase with dual active site and triple substrate binding sites from the hyperthermophilic archaeon *Pyrococcus kodakaraensis* KOD1. J. Applied Environ. Microbiol. 65: 5338-5344
- Thatte, M.R. 2004. Syntesis and Antibacterial Assasement of Water-Solube Hydrophobic Chitosan Derivates Bearing Quaternary Ammonium Funcionality.. Louisiana State University. Ph D. Dissertation.
- Thompson, S.E., Smith, M., Wilkinson, M.C. and Peek, K. 2001. Identification and characterization of a chitinase antigen from *Pseudomonas aeruginosa* strain 385. Appl. Environ. Microbiol. 67: 4001--4008.



UNIVERSITAS
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- Tsigos, I., Martinou A., Kafetzopoulos D. And Bouriotis V. 2000. Chitin Deacetylase: New Versatile Tools in Biotechnology. TIBTECH. 18: 3005-311.
- Uhde, A., Youn, J.W., Maeda, T., Clermont, L., Matano, C., Krämer, R., Wendisch, V.F., Seibold, G.M. and Marin, K. 2013. Glucosamine as carbon source for amino acid-producing *Corynebacterium glutamicum*. Appl Microbiol Biotechnol. 97:1679–1687.
- Untung, K. 1996. Pengantar Pengelolaan Hama Terpadu. Gajah Mada University Press. Yogyakarta
- Varum K.M., Domard A. and Smidsrød O. 2003. Advances in chitin science. 4th edition. Trondheim. Norway.
- Venkatraman A., Yacoob S. A. M., Nagarajan Y. and Mohamed P. K. P. 2014. Optimization of Culture Condition For Production of Bacterial Chitinase Isolated From Marine Crustacean Shells. Journal of Microbiology, Biotechnology and Food Sciences. 3: 319-321.
- Vogan, C.L., Costa-Ramos, C. and Rowley, A.F. 2002. Shell disease syndrome in the edible crab, *Cancer pagurus*—isolation, characterization and pathogenicity of chitinolytic bacteria. Microbiology. 148: 743–754.
- Waluyo, L. 2007. Mikrobiologi Umum. Penerbitan Universitas Muhammadiyah Malang. Malang.
- Wang S.L., Chio S.H. and Chang W.T. 1997. Production of chitinase from shellfish waste by *Pseudomonas aeruginosa* K-187. Proc. Natl Sci Counc. ROC (B). 21:71-78.
- Wang S.L., Lin T.Y., Yen Y.H., Liao F.H. and Chen Y.J. 2006. Bioconversion of shellfish chitin wastes for the production of *Bacillus subtilis* W-118 chitinase. Carbohydr Res. 341:2507–2515.
- Wang, S. L., Liang, T.W. and Yen, Y.H. 2011. Bioconversion of chitin-containing wastes for the production of enzymes and bioactive material. Jurnal Micro. 84:732-742.



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- Wibowo, S. 2010. Penelitian pmanfaatan limbah perikanan udang untuk produksi turunan kitosan dan aplikasinya untuk mendukung industri pangan. Badan Penelitian dan Pengembangan Kelautan dan Perikanan.
- Wijaya, S. 2002. Isolasi Kitinase *dari Scleroderma columnare* dan *Thricoderma harzianum*. Jurnal Ilmu Dasar. Kalimantan. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Jember.
- Yurnaliza. 2002. Senyawa Kitin dan Kajian Aktivitas Enzim Mikrobial Pendegradasinya. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Sumatera Utara. Medan.
- Zilda D.S., Fawzya Y.N. dan Chasanah E. 2006. Karakterisasi Enzim Kitonase Dari Bakteri Kitinolitik T5a1 Yang Diisolasi Dari Terasi. JPB. Perikanan. 1: 43-50.