

DAFTAR PUSTAKA

- Abma, W.R., Driessen, W., Haarhuis, R., Van Loosdrecht, M.C.M., 2010. Upgrading of sewage treatment plants by sustainable and cost-effective separate treatment of industrial wastewater. *Water Sci. Technol.* <https://doi.org/10.2166/wst.2010.977>
- Ahn, Y.H., 2006. Sustainable nitrogen elimination biotechnologies: A review. *Process Biochem.* <https://doi.org/10.1016/j.procbio.2006.03.033>
- Ali, M., Okabe, S., 2015. Anammox-based technologies for nitrogen removal: Advances in process start-up and remaining issues. *Chemosphere* 141, 144–153. <https://doi.org/10.1016/j.chemosphere.2015.06.094>
- Ali, M., Oshiki, M., Rathnayake, L., Ishii, S., Satoh, H., Okabe, S., 2015. Rapid and successful start-up of anammox process by immobilizing the minimal quantity of biomass in PVA-SA gelbeads. *WaterRes.* <https://doi.org/10.1016/j.watres.2015.04.024>
- Ali, M., Shaw, Dario Rangel., Saikaly, Pascal E. Application of an Enrichment Culture of The Marine Anammox Bacterium “Ca. Scalindua sp. AMX11” for Nitrogen Removal Under Moderate Salinity and the Presence of Organic Carbon. *Water Research* 170 (2020) 115345.
- Bagchi, S., Lamendella, R., Strutt, S., Van Loosdrecht, M.C.M., Saikaly, P.E., 2016. Metatranscriptomics reveals the molecular mechanism of large granule formation in granular anammox reactors. *Sci. Rep.* <https://doi.org/10.1038/srep28327>
- Bernhard, A., 2010. The Nitrogen Cycle: Processes, Players, and Human Impact. *Nat. Educ. Knowl.*
- Broda, E., 1977. Two kinds of lithotrophs missing in nature. *Z. Allg. Mikrobiol.* <https://doi.org/10.1002/jobm.19770170611>
- Canfield, D.E., Kristensen, E., Thamdrup, B., 2005. Aquatic geomicrobiology. *Adv. Mar. Biol.*

Chernicharo, C.A. de L., 2007. BIOLOGICAL WASTEWATER TREATMENT SERIES. Volume 4: Anaerobic Reactors, Biological wastewater treatment in warm climate regions. <https://doi.org/10.1017/CBO9781107415324.004>

Daims, H., Taylor, M.W., Wagner, M., 2006. Wastewater treatment: a model system for microbial ecology. *Trends Biotechnol.* <https://doi.org/10.1016/j.tibtech.2006.09.002>

de L.G. Solbé, J.F., Shurben, D.G., 1989. Toxicity of ammonia to early life stages of rainbow trout (*Salmo gairdneri*). *Water Res.* [https://doi.org/10.1016/0043-1354\(89\)90071-7](https://doi.org/10.1016/0043-1354(89)90071-7)

Duc, Van Luong., Song, Bongkeun., Ito, Hiroaki., Takehida, Hama., Otani, Masashi and Kawagoshi, Yasunori. High Growth Potential and Nitrogen Removal Performance of Marine Anammox Bacteria in Shrimp-Aquaculture Sediment. *Chemosphere* S0045-6535 (17) 32137-9.

Duce, R.A., LaRoche, J., Altieri, K., Arrigo, K.R., Baker, A.R., Capone, D.G., Cornell, S., Dentener, F., Galloway, J., Ganeshram, R.S., Geider, R.J., Jickells, T., Kuypers, M.M., Langlois, R., Liss, P.S., Liu, S.M., Middelburg, J.J., Moore, C.M., Nickovic, S., Oschlies, A., Pedersen, T., Prospero, J., Schlitzer, R., Seitzinger, S., Sorensen, L.L., Uematsu, M., Ulloa, O., Voss, M., Ward, B., Zamora, L., 2008. Impacts of atmospheric anthropogenic nitrogen on the open ocean. *Science* (80-.). 320, 893–897. <https://doi.org/10.1126/science.1150369>

Erisman, J.W., Bleeker, A., Galloway, J., Sutton, M.S., 2007. Reduced nitrogen in ecology and the environment. *Environ. Pollut.* <https://doi.org/10.1016/j.envpol.2007.06.033>

Fewtrell, L., 2004. Drinking-water nitrate, methemoglobinemia, and global burden of disease: A discussion. *Environ. Health Perspect.* <https://doi.org/10.1289/ehp.7216>

Galloway, J.N., Townsend, A.R., Erisman, J.W., Bekunda, M., Cai, Z., Freney, J.R., Martinelli, L.A., Seitzinger, S.P., Sutton, M.A., 2008. Transformation

of the nitrogen cycle: Recent trends, questions, and potential solutions. *Science* (80-.). 320, 889–892. <https://doi.org/10.1126/science.1136674>

Graaf, A.A. Van De, Bruijn, P. De, Robertson, L.A., Jetten, M.M., Kuenen, J.G., 1996. Autotrophic growth of anaerobic ammonium-oxidizing microorganisms in a fluidized bed reactor.

He, S., Chen, Y., Qin, M., Mao, Z., Yuan, L., Niu, Q., Tan, X., 2018. Effects of temperature on anammox performance and community structure. *Bioresour. Technol.* 260, 186–195. <https://doi.org/10.1016/j.biortech.2018.03.090>

Hooper, A.B., Vannelli, T., Bergmann, D.J., Arciero, D.M., 1997. Enzymology of the oxidation of ammonia to nitrite by bacteria, in: Antonie van Leeuwenhoek, *International Journal of General and Molecular Microbiology*. <https://doi.org/10.1023/A:1000133919203>

Hu, Z., Lotti, T., van Loosdrecht, M., Kartal, B., 2013. Nitrogen removal with the anaerobic ammonium oxidation process. *Biotechnol. Lett.* 35, 1145–1154. <https://doi.org/10.1007/s10529-013-1196-4>

Jetten, M., Schmid, M., Van De Pas-Schoonen, K., Damsté, J.S., Strous, M., 2005. Anammox organisms: Enrichment, cultivation, and environmental analysis. *Methods Enzymol.* 397, 34–57. [https://doi.org/10.1016/S0076-6879\(05\)97003-1](https://doi.org/10.1016/S0076-6879(05)97003-1)

Jetten, M.S.M., Wagner, M., Fuerst, J., Van Loosdrecht, M., Kuenen, G., Strous, M., 2001. Microbiology and application of the anaerobic ammonium oxidation ('anammox') process. *Curr. Opin. Biotechnol.* [https://doi.org/10.1016/S0958-1669\(00\)00211-1](https://doi.org/10.1016/S0958-1669(00)00211-1)

Jin, R.C., Yang, G.F., Yu, J.J., Zheng, P., 2012. The inhibition of the Anammox process: A review. *Chem. Eng. J.* 197, 67–79. <https://doi.org/10.1016/j.cej.2012.05.014>

Jin, R.C., Zheng, P., Hu, A.H., Mahmood, Q., Hu, B.L., Jilani, G., 2008. Performance comparison of two anammox reactors: SBR and UBF. *Chem.*

Eng. J. <https://doi.org/10.1016/j.cej.2007.06.038>

Kamei, Tatsuru, Sachi Shimizu, Yasuhiro Tanaka, and Fatuba Kazama. Anaerobic Ammonium Oxidation Bacterial Communities in Long-Term Cultivated Sludge: A Comparison Between Mesophilic and Psychrophilic Condition. Japanese Journal of Water Treatment Biology Vol 52 No 1 1-9 2016.

Kartal, B., Kuenen, J.G., Van Loosdrecht, M.C.M., 2010. Sewage treatment with anammox. Science (80-.). <https://doi.org/10.1126/science.1185941>

Kartal, B., Rattray, J., van Niftrik, L.A., van de Vossenberg, J., Schmid, M.C., Webb, R.I., Schouten, S., Fuerst, J.A., Damsté, J.S., Jetten, M.S.M., Strous, M., 2007. Candidatus “Anammoxoglobus propionicus” a new propionate oxidizing species of anaerobic ammonium oxidizing bacteria. Syst. Appl. Microbiol. 30, 39–49. <https://doi.org/10.1016/j.syapm.2006.03.004>

Kartal, B., Van Niftrik, L., Rattray, J., Van De Vossenberg, J.L.C.M., Schmid, M.C., Sinninghe Damsté, J., Jetten, M.S.M., Strous, M., 2008. Candidatus “Brocadia fulgida”: An autofluorescent anaerobic ammonium oxidizing bacterium. FEMS Microbiol. Ecol. 63, 46–55. <https://doi.org/10.1111/j.1574-6941.2007.00408.x>

Khin, T., Annachhatre, A.P., 2004. Novel microbial nitrogen removal processes. Biotechnol. Adv. <https://doi.org/10.1016/j.biotechadv.2004.04.003>

Kumar, M., Daverey, A., Gu, J.D., Lin, J.G., 2016. Anammox Processes, Current Developments in Biotechnology and Bioengineering: Biological Treatment of Industrial Effluents. <https://doi.org/10.1016/B978-0-444-63665-2.00015-1>

Lettinga, G., Hulshoff Pol, L.W., 1991. UASB-process design for various types of wastewaters, in: Water Science and Technology. <https://doi.org/10.2166/wst.1991.0220>

Lettinga, G., van Velsen, A.F.M., Hobma, S.W., de Zeeuw, W., Klapwijk, A., 1980. Use of the upflow sludge blanket (USB) reactor concept for biological wastewater treatment, especially for anaerobic treatment. Biotechnol.

Bioeng. <https://doi.org/10.1002/bit.260220402>

Li, X., Sung, S., 2015. Development of the combined nitrification–anammox process in an upflow anaerobic sludge blanket (UASB) reactor with anammox granules. *Chem. Eng. J.* 281, 837–843. <https://doi.org/10.1016/j.cej.2015.07.016>

Lotti, T., Kleerebezem, R., Hu, Z., Kartal, B., Jetten, M.S.M., van Loosdrecht, M.C.M., 2014a. Simultaneous partial nitrification and anammox at low temperature with granular sludge. *Water Res.* 66, 111–121. <https://doi.org/10.1016/j.watres.2014.07.047>

Ali, M., Shaw, D.R., Saikaly, P.E., 2020. Application of an enrichment culture of the marine anammox bacterium “*Ca. Scalindua* sp. AMX11” for nitrogen removal under moderate salinity and in the presence of organic carbon. *Water Res.* 170, 115345. <https://doi.org/10.1016/j.watres.2019.115345>

Liu, C., Yu, D., Wang, Y., Chen, G., Tang, P., Huang, S., 2020. A novel control strategy for the partial nitrification and anammox process (PN/A) of immobilized particles: Using salinity as a factor. *Bioresour. Technol.* 302, 122864. <https://doi.org/10.1016/j.biortech.2020.122864>

Van Duc, L., Song, B., Ito, H., Hama, T., Otani, M., Kawagoshi, Y., 2018. High growth potential and nitrogen removal performance of marine anammox bacteria in shrimp-aquaculture sediment. *Chemosphere* 196, 69–77. <https://doi.org/10.1016/j.chemosphere.2017.12.159>

Liu, Chengcheng., Yu, Deshuang., Wang, Yanyan., Chen, Guanghuai., Tang, Peng., and Huang, Shuo. A Novel Control Strategy For The Partial Nitrification and Anammox Process (PN/A) of Immobilized Particles: Using Salinity As A Factor. *Bioresource Technology* 302 (2020) 122864.

Lotti, T., Kleerebezem, R., Lubello, C., van Loosdrecht, M.C.M., 2014b. Physiological and kinetic characterization of a suspended cell anammox culture. *Water Res.* <https://doi.org/10.1016/j.watres.2014.04.017>

Lotti, T., Kleerebezem, R., van Loosdrecht, M.C.M., 2015. Effect of temperature

- change on anammox activity. *Biotechnol. Bioeng.* 112. <https://doi.org/10.1002/bit.25333>
- Ma, B., Zhang, S., Zhang, L., Yi, P., Wang, J., Wang, S., Peng, Y., 2011. The feasibility of using a two-stage autotrophic nitrogen removal process to treat sewage. *Bioresour. Technol.* <https://doi.org/10.1016/j.biortech.2011.06.017>
- Mulder, A., 2003. The quest for sustainable nitrogen removal technologies, in: *Water Science and Technology.* <https://doi.org/10.2166/wst.2003.0018>
- Mulder, A., van de Graaf, A.A., Robertson, L.A., Kuenen, J.G., 1995. Anaerobic ammonium oxidation discovered in a denitrifying fluidized bed reactor. *FEMS Microbiol. Ecol.* [https://doi.org/10.1016/0168-6496\(94\)00081-7](https://doi.org/10.1016/0168-6496(94)00081-7)
- Najib, M., Astuti, T., 2014. The Characteristic and Trend of Sea Surface Temperature Over Indonesia In 1982-2009. *Pus. Penelit. dan Pengemb. BMKG* 37–49.
- Narita, Y., Zhang, L., Kimura, Z., Ali, M., Fujii, T., Okabe, S., 2017. Enrichment and physiological characterization of an anaerobic ammonium-oxidizing bacterium ‘*Candidatus Brocadia sapporoensis*.’ *Syst. Appl. Microbiol.* 40, 448–457. <https://doi.org/10.1016/j.syapm.2017.07.004>
- Pynaert, K., Smets, B.F., Beheydt, D., Verstraete, W., 2004. Start-up of Autotrophic Nitrogen Removal Reactors via Sequential Biocatalyst Addition. *Environ. Sci. Technol.* <https://doi.org/10.1021/es030081+>
- Qi, Panqiang., Li, Jin., Dong, Huiyu., Wang, Dan., and Bo, Yuntai. Performance of Annammox Process Treating Nitrogen-Rich Saline Wastewater: Kinetics and Nitrite Inhibition. *Journal Of Cleaner Production* 199 (2018) 493-502.
- Qian, G., Wang, J., Kan, J., Zhang, Xiaodong, Xia, Z., Zhang, Xuecheng, Miao, Y., Sun, J., 2018. Diversity and distribution of anammox bacteria in the water column and sediments of the Eastern Indian Ocean. *Int. Biodeterior. Biodegrad.* 133, 52–62. <https://doi.org/10.1016/j.ibiod.2018.05.015>
- Quan, Z.X., Rhee, S.K., Zuo, J.E., Yang, Y., Bae, J.W., Park, J.R., Lee, S.T.,

- Park, Y.H., 2008. Diversity of ammonium-oxidizing bacteria in a granular sludge anaerobic ammonium-oxidizing (anammox) reactor. *Environ. Microbiol.* 10, 3130–3139. <https://doi.org/10.1111/j.1462-2920.2008.01642.x>
- Robert Hamersley, M., Woebken, D., Boehrer, B., Schultze, M., Lavik, G., Kuypers, M.M.M., 2009. Water column anammox and denitrification in a temperate permanently stratified lake (Lake Rassnitzer, Germany). *Syst. Appl. Microbiol.* 32, 571–582. <https://doi.org/10.1016/j.syapm.2009.07.009>
- Sánchez Guillén, J.A., Cuéllar Guardado, P.R., Lopez Vazquez, C.M., de Oliveira Cruz, L.M., Brdjanovic, D., van Lier, J.B., 2015. Anammox cultivation in a closed sponge-bed trickling filter. *Bioresour. Technol.* 186, 252–260. <https://doi.org/10.1016/j.biortech.2015.03.073>
- Schmid, M., Twachtmann, U., Klein, M., Strous, M., Juretschko, S., Jetten, M., Metzger, J.W., Schleifer, K.H., Wagner, M., 2000. Molecular evidence for genus level diversity of bacteria capable of catalyzing anaerobic ammonium oxidation. *Syst. Appl. Microbiol.* 23, 93–106. [https://doi.org/10.1016/S0723-2020\(00\)80050-8](https://doi.org/10.1016/S0723-2020(00)80050-8)
- Schmid, M., Walsh, K., Webb, R., Rijpstra, W.I.C., Van De Pas-Schoonen, K., Verbruggen, M.J., Hill, T., Moffett, B., Fuerst, J., Schouten, S., Damsté, J.S.S., Harris, J., Shaw, P., Jetten, M., Strous, M., 2003. Candidatus “*Scalindua brodae*”, sp. nov., Candidatus “*Scalindua wagneri*”, sp. nov., Two New Species of Anaerobic Ammonium Oxidizing Bacteria. *Syst. Appl. Microbiol.* <https://doi.org/10.1078/072320203770865837>
- Smith, V.H., Tilman, G.D., Nekola, J.C., 1999. ScienceDirect - Environmental Pollution: Eutrophication: impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. *Environ. Pollut.* 100, 179–196.
- Smith, V.H., Tilman, G.D., Nekola, J.C., 1998. Eutrophication: Impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems, in: *Environmental Pollution*. [https://doi.org/10.1016/S0269-7491\(99\)00091-3](https://doi.org/10.1016/S0269-7491(99)00091-3)
- Strous, M., Heijnen, J.J., Kuenen, J.G., Jetten, M.S.M., 1998. The sequencing

batch reactor as a powerful tool for the study of slowly growing anaerobic ammonium-oxidizing microorganisms. *Appl. Microbiol. Biotechnol.* 50, 589–596. <https://doi.org/10.1007/s002530051340>

Strous, M., Jetten, M.S.M., 2004. Anaerobic Oxidation of Methane and Ammonium. *Annu. Rev. Microbiol.* 58, 99–117. <https://doi.org/10.1146/annurev.micro.58.030603.123605>

Strous, M., Kuenen, J.G., Jetten, M.S.M., 1999. Key physiology of anaerobic ammonium oxidation. *Appl. Environ. Microbiol.*

Strous, M., Van Gerven, E., Zheng, P., Kuenen, J.G., Jetten, M.S.M., 1997. Ammonium removal from concentrated waste streams with the anaerobic ammonium oxidation (anammox) process in different reactor configurations. *Water Res.* [https://doi.org/10.1016/S0043-1354\(97\)00055-9](https://doi.org/10.1016/S0043-1354(97)00055-9)

Terada, A., Zhou, S., Hosomi, M., 2011. Presence and detection of anaerobic ammonium-oxidizing (anammox) bacteria and appraisal of anammox process for high-strength nitrogenous wastewater treatment: A review. *Clean Technol. Environ. Policy.* <https://doi.org/10.1007/s10098-011-0355-3>

Tikilili, P.V., Technology, I., 2016. Performance and Modelling of Non-granular Anammox Culture for Wastewater Treatment.

Tuyen, N. V, Ryu, J.H., Yae, J.B., Kim, H.G., Hong, S.W., Ahn, D.H., 2018. *Journal of Industrial and Engineering Chemistry* Nitrogen removal performance of anammox process with PVA – SA gel bead crosslinked with sodium sulfate as a biomass carrier. *J. Ind. Eng. Chem.* <https://doi.org/10.1016/j.jiec.2018.07.004>

Van De Vossenberg, J., Rattray, J.E., Geerts, W., Kartal, B., Van Niftrik, L., Van Donselaar, E.G., Sinninghe Damsté, J.S., Strous, M., Jetten, M.S.M., 2008. Enrichment and characterization of marine anammox bacteria associated with global nitrogen gas production. *Environ. Microbiol.* 10, 3120–3129. <https://doi.org/10.1111/j.1462-2920.2008.01643.x>

- van der Star, W.R.L., Abma, W.R., Blommers, D., Mulder, J.W., Tokutomi, T., Strous, M., Picioreanu, C., van Loosdrecht, M.C.M., 2007. Startup of reactors for anoxic ammonium oxidation: Experiences from the first full-scale anammox reactor in Rotterdam. *Water Res.* <https://doi.org/10.1016/j.watres.2007.03.044>
- Van Hulle, S.W.H., Vandeweyer, H.J.P., Meesschaert, B.D., Vanrolleghem, P.A., Dejans, P., Dumoulin, A., 2010. Engineering aspects and practical application of autotrophic nitrogen removal from nitrogen rich streams. *Chem. Eng. J.* 162, 1–20. <https://doi.org/10.1016/j.cej.2010.05.037>
- Vitousek, P.M., Aber, J.D., Howarth, R.W., Likens, G.E., Matson, P.A., Schindler, D.W., Schlesinger, W.H., Tilman, D.G., 1997. Vitousek et al. 1997. *Ecol. Appl.* [https://doi.org/10.1890/1051-0761\(1997\)007\[0737:HAOTGN\]2.0.CO;2](https://doi.org/10.1890/1051-0761(1997)007[0737:HAOTGN]2.0.CO;2)
- Wang, Haijun, Wang, Hongzhu, 2009. Mitigation of lake eutrophication: Loosen nitrogen control and focus on phosphorus abatement. *Prog. Nat. Sci.* <https://doi.org/10.1016/j.pnsc.2009.03.009>
- Wang, T., Zhang, H., Yang, F., Li, Y., Zhang, G., 2013. Start-up and long-term operation of the Anammox process in a fixed bed reactor (FBR) filled with novel non-woven ring carriers. *Chemosphere* 91, 669–675. <https://doi.org/10.1016/j.chemosphere.2013.01.026>
- Wett, B., Hell, M., Nyhuis, G., Puempel, T., Takacs, I., Murthy, S., 2010. Syntrophy of aerobic and anaerobic ammonia oxidisers. *Water Sci. Technol.* <https://doi.org/10.2166/wst.2010.969>
- Zhang, L., Liu, M., Zhang, S., Yang, Y., Peng, Y., 2015. Integrated fixed-biofilm activated sludge reactor as a powerful tool to enrich anammox biofilm and granular sludge. *Chemosphere* 140. <https://doi.org/10.1016/j.chemosphere.2015.02.001>
- Zhang, L., Narita, Y., Gao, L., Ali, M., Oshiki, M., Okabe, S., 2017. Maximum specific growth rate of anammox bacteria revisited. *Water Res.* 116, 296–

303. <https://doi.org/10.1016/j.watres.2017.03.027>

Zhang, L., Zheng, P., Tang, C. jian, Jin, R. cun, 2008. Anaerobic ammonium oxidation for treatment of ammonium-rich wastewaters. *J. Zhejiang Univ. Sci. B.* <https://doi.org/10.1631/jzus.B0710590>

Zhang, N., Liu, G., Liu, H., Wang, Y., He, Z., Wang, G., 2011. Diclofenac photodegradation under simulated sunlight: Effect of different forms of nitrogen and Kinetics. *J. Hazard. Mater.* <https://doi.org/10.1016/j.jhazmat.2011.05.038>

Zulkarnaini, 2020. Penemuan dan Aplikasi Anammox. Universitas Andalas.

Zulkarnaini, Yujie, Q., Yamamoto-Ikemoto, R., Matsuura, N., 2018a. One-stage nitritation/anammox process using a biofilm reactor with two-inflow. *J. Water Environ. Technol.* 16, 106–114. <https://doi.org/10.2965/jwet.17-050>

Zulkarnaini, Yujie, Q., Yamamoto-Ikemoto, R., Matsuura, N., 2018b. One-Stage Nitritation/Anammox Process Using a Biofilm Reactor with Two-Inflow. *J. Water Environ. Technol.* 16, 106–114. <https://doi.org/10.2965/jwet.17-050>

