



DAFTAR PUSTAKA

- Abdelbasir, S. M., dan Shalan, A. E., 2019, An overview of nanomaterials for industrial wastewater treatment, *Korean J. Chem. Eng.*, 36 (8), 1209–1225.
- Akpan, U. G. dan Hameed, B. H., 2010, The advancements in sol-gel method of doped-TiO₂ photocatalyst, *Appl. Catal. A.: Gen.*, 375, 1-11.
- Alifi, A., Kurniawan, R., dan Syoufian, A., 2020, Zinc-doped titania embedded on the surface of zirconia: A potential visible-responsive photocatalyst material, *Indones. J. Chem.*, 20 (6), 1374–1381.
- Al-Mamun, M. R., Kader, S., Islam, M. S., dan Khan, M. Z. H., 2019, Photocatalytic activity improvement and application of UV-TiO₂ photocatalysis in textile wastewater treatment: A review. *J. Environ. Chem. Eng.*, 7, (5).
- Anwar, D. I., dan Mulyadi, D., 2015. Synthesis of Fe-TiO₂ composite as a photocatalyst for degradation of methylene blue. *Procedia Chem.*, 17, 49–54.
- Balarabe, B. Y., Bowmik, S., Ghosh, A., dan Maity, P., 2022, Photocatalytic dye degradation by magnetic XFe₂O₃ (X: Co, Zn, Cr, Sr, Ni, Cu, Ba, Bi, and Mn) nanocomposites under visible light: A cost efficiency comparison. *J. Magn. Magn. Mater.*, 562.
- Barkul, R.P., Koli, V.B., Shewale, V.B., Patil, M.K, dan Delekar, S.D., 2016, Visible active nanocrystalline N-doped anatase TiO₂ particles for photocatalytic mineralization studies, *Mater. Chem. Phys.*, 173, 42–51.
- Chen, Y.F., Lee, C.Y., Yeng, M.Y., dan Chiu, H.T., 2003, The effect of calcination temperature on the crystallinity of TiO₂ nanopowders, *J. Cryst. Growth*, 247 (3-4), 363–370.
- Cheng, Q., Yang, W., Chen, Q., Zhu, J., Li, D., Fu, L., and Zhou, L., 2020, Fe-doped zirconia nanoparticles with highly negative conduction band potential for enhancing visible light photocatalytic performance, *Appl. Surf. Sci.*, 530, 147291.
- Choi, J., Park, H. dan Hoffmann, 2010, Effect of single metal ion doping on the visible-light photoreactivity of TiO₂, *J. Phys. Chem. C.*, 114, 783-792.
- Dibowski, G., dan Esser, K., 2017, Hazards caused by UV rays of xenon light based high performance solar simulators. *Safety and Health at Work*, 8 (3), 237–245.
- Di, K., Zhu, Y., Yang., dan Li, C., 2006, Electrorheological behavior of urea-doped mesoporous TiO₂ suspensions. *Colloids Surf. A Physicochem. Eng.*, 280 (1–3), 71–75.
- Doni, N., Aziz, H., dan Syukti, 2013, Studi fotodegradasi biru metilen di bawah sinar matahari oleh ZnO-SnO₂ yang dibuat dengan metoda *solid state reaction*. Prosoding Semirata FMIPA Universitas Lampung.



- Doufar, N., Benamira, M., Lahmar, H., Trari, M., Avramova, I. dan Caldes, M.T., 2020, Structural and photochemical properties of N-doped ZrO₂ and their application as photocatalysts with TiO₂ for chromate reduction, *J. Photochem. Photobiol. A Chem.*, 386, 112105.
- Dutta, H., Nandy, A. dan Pradhan, S. K., 2016, Microstructure and optical characterizations of mechanosynthesized nanocrystalline semiconducting ZrTiO₄ compound, *J. Phys. Chem. Solids*, 95, 56-64.
- Elaziouti, Laouedj, N., dan Ahmed, B., 2011, ZnO-assisted photocatalytic degradation of congo red and benzopurpurine 4B in aqueous solution, *J. Chem. Eng. Process Technol.*, 2 (2), 2157 -7048.
- French, R. H., Glass, S. J., Ohuchi, F. S., Xu, Y. N., dan Ching, W. Y., 1994, Experimental and theoretical determination of the electronic structure and optical properties of three phases of ZrO₂, *Phys. Rev.*, 49 (8), 5133–5142.
- Gnanaprakasam, A., Sivakumar, V. M., dan Thirumurugan, M., 2015, Influencing parameters in the photocatalytic degradation of organic effluent via nanometal oxide catalyst: A Review. *Indian J. Mater. Sci.*, 2015, 1–16.
- Hadayani, L. W., Riwayati, I., dan Ratnani, R. D., 2015, Adsorpsi pewarna metilen biru menggunakan senyawa xanthat pulpa kopi, *Momentum*, 11 (1), 19-23.
- Hamdaoui, O and Chiha, M., 2006, Removal of methylene blue from aqueous solutions by wheat bran, *Acta Chem. Scand.*, 54, 407-418.
- Hanaor, D. A. H., Triani, G. dan Sorrell, C. C., 2011, Morphology and Photocatalytic Activity of Highly Oriented Mixed Phase Titanium Dioxide Thin Films, *Surf. Coat. Technol.*, 205, 3658-3664.
- Hannink, R.H.J., Kelly, P.M., and Muddle, B.C., 2004, Transformation Toughening in Zirconia-Containing Ceramics, *J. Am. Ceram. Soc.*, 83, 461–487.
- Hayati, R., Kurniawan, R., Prasetyo, N., Sudiono, S., dan Syoufian, A., 2022, Codoping effect of nitrogen (N) to iron (Fe) doped zirconium titanate (ZrTiO₄) composite toward its visible light responsiveness as photocatalysts, *Indones. J. Chem.*, 22 (3), 692–702.
- Houas, A., Lachheb, H., Ksibi, M., Elaloui, E., Guillard, C., dan Herrmann, J. M., 2001, Photocatalytic degradation pathway of methylene blue in water, *Appl. Catal. B: Environ.*, 31 (2), 145–157.
- Hu, B. L., Ge, S. W., Han, J. Y., Hua, X. J., Li, S. L., Xing, H. R., Yuan, L. T., Zhang, X. Y., Wang, K. S., Hu, P., dan Volinsky, A. A., 2022, ZrTiO₄ secondary phase effects on ductility and toughness of molybdenum alloys. *Mater. Lett.*, 307.
- Jaiswal, R., Bharambe, J., Patel, N., Dashora, A., Kothari, D. C., dan Miotello, A., 2015, Copper and Nitrogen co-doped TiO₂ photocatalyst with enhanced optical absorption and catalytic activity. *Appl.Catal. B: Environ.*, 168–169, 333–341



- Kansal, S. K., Singh, M., dan Sud, D., 2007, Studies on photodegradation of two commercial dyes in aqueous phase using different photocatalysts, *J. Hazard. Mater.*, 141 (3), 581–590.
- Khan, S., Kim, J., Sotto, A. dan Van der Bruggen, B., 2015, Humic acid fouling in a submerged photocatalytic membrane reactor with binary TiO₂-ZrO₂ particles, *J. Ind. Eng. Chem.*, 21, 779–786.
- Kim, J.Y., Kim, C.S., Chang, H.K. dan Kim, T.O., 2010, Effects of ZrO₂ addition on phase stability and photocatalytic activity of ZrO₂/TiO₂ nanoparticles, *Adv. Powder Technol.*, 21 (2), 141–144.
- Kim, J. Y., Kim, C.S., Chang, H.K., dan Kim, T.O., 2011, Synthesis and characterization of N doped TiO₂/ZrO₂ visible light photocatalysts, *Adv. Powder Technol.*, 22 (3), 443–448.
- Kokporka, L., Onsuratoom, S., and Puangpetch, T., 2013, Materials Science in Semiconductor Processing mixed oxide nanocrystals and their photocatalytic sensitized H₂ production activity under visible light irradiation, *Mater. Sci. Semicond. Process.*, 16, 667–678.
- Kurniawan, R., Sudiono, S., Trisunaryanti, W., dan Syoufian, A., 2019, Synthesis of iron-doped zirconium titanate as a potential visible-light responsive photocatalyst. *Indones. J. Chem.*, 19 (2), 454–460.
- Lestari, Y. D., Wardhani, S., dan Khunur, M. M., 2015, Degradasi *methylene blue* menggunakan fotokatalis TiO₂-N/zeolit dengan sinar matahari, *J. Student Chem.*, 1 (1), 592–598.
- Liang, Q., Liu, X., Zeng, G., Liu, Z., Tang, L., Shao, B., Zeng, Z., Zhang, W., Liu, Y., Cheng, M., Tang, W., dan Gong, S., 2019, Surfactant-assisted synthesis of photocatalysts: Mechanism, synthesis, *Adv. Environ. Appl.*, 372, 429–451.
- Liu, B., Zhao, X., Terashima, C., Fujishima, A. dan Nakata, K., 2014, Thermodynamic and kinetic analysis of heterogeneous photocatalysis for semiconductor systems, *Phys. Chem. Chem. Phys.*, 16 (19), 8751–8760.
- Menteri Lingkungan Hidup, 1995, Keputusan Menteri Negara Lingkungan Hidup Nomor 51 tahun 1995, Tentang Baku Mutu Limbah Cair, Jakarta.
- Meetei, S.D. dan Singh, S.D., 2014, Hydrothermal synthesis and white light emission of cubic ZrO₂: Eu³⁺ nanocrystals, *J. Alloys Compd.*, 587, 143–147.
- Mogal, S.I., Mishra, M., Gandhi, V.G., dan Tayade, R.J., 2013, Metal doped titanium dioxide: Synthesis and effect of metal ions on physico-chemical and photocatalytic properties, *Mater. Sci. Forum*, 734, 364–378.
- Muslim, M. I., Kurniawan, R., Pradipta, M. F., Trisunaryanti, W., dan Syoufian, A., 2021, The effects of manganese dopant content and calcination temperature on properties of titania-zirconia composite. *Indones. J. Chem.*, 21 (4), 882–890.



- Muthukumar, C., Alam, S., Iype, E., dan Prakash, P. K., 2021, Statistical analysis of photodegradation of methylene blue dye under natural sunlight, *Opt. Mater.*, 122, 111809.
- Nugroho, M. G., 2019, Sintesis Fe₃O₄/TiO₂-S sebagai fotokatalis untuk degradasi zat warna metilen biru, *Skripsi*, Jurusan Kimia, FMIPA, Universitas Gadjah Mada, Yogyakarta.
- Polisetti, S., Deshpande, P.A., dan Madras, G., 2011, Photocatalytic activity of combustion synthesized ZrO₂ and ZrO₂-TiO₂ mixed oxides, *Ind. Eng. Chem. Res.*, 50 (23), 12915–12924.
- Radecka M., Rekas M, Trenczek-Zajac A, dan Zakrzewsk K, 2008, Importance of the band gap energi and flat band potential for application of modified TiO₂ photoanodes in water photolysis, *J. Power Sources*, 181 (1), 46-55.
- Raheb, I., dan Manlla, M. S. 2021, Kinetic and thermodynamic studies of the degradation of methylene blue by photo-Fenton reaction, *Heliyon*, 7 (6).
- Reddy, C.V., Shetti, N.P., Kim, D., Sim, J., Aminabhavi, T.M., dan Ravindranadh, K., 2020, Copper-doped ZrO₂ nanoparticles as high-performance catalysts for efficient removal of toxic organic pollutants and stable solar water oxidation, *J. Environ. Manag.*, 260, 110088.
- Sahu, M., Suttiponparnit, K., Suvachittanont, S., Charinpanitkul, T., dan Biswas, P., 2011, Characterization of doped TiO₂ nanoparticle dispersions. *Chem. Eng. Sci.*, 66 (15), 3482–3490.
- Salehifar, N., dan Nikfarjam, A., 2014, Improvement and red shift toward visible spectrum of TiO₂ nanofibers through doping by Fe₂O₃ and nitrogen. *Adv. Mater. Res.*, 829, 717–721.
- Shao, G. N., Imran, S. M., Jeon, S. J., Engole, M., Abbas, N., Salman Haider, M., Kang, S. J., dan Kim, H. T., 2014, Sol-gel synthesis of photoactive zirconia-titania from metal salts and investigation of their photocatalytic properties in the photodegradation of methylene blue. *Powder Techno.*, 258, 99–109.
- Sharotri, N., Sharma, D., and Sud, D., 2019, Experimental and theoretical investigations of Mn-N-co-doped TiO₂ photocatalyst for visible light induced degradation of organic pollutants, *J. Mater. Res. Technol.*, 8 (5), 3995–4009.
- Shen, J.H., Tang, Y.H., Jiang, Z.W., Liao, D.Q. dan Horng, J.J., 2021, Optimized preparation and characterization of Cu-N codoped TiO₂ with enhanced visible light activity: An insight into effect of dopants on surface redox reactions of photogenerated charge carriers for hydroxyl radical formation, *J. Alloys Compd.*, 862, 158697.
- Sherly, E. D., Vijaya, J. J., Selvam, N. C. S., dan Kennedy, L. J., 2014, Microwave assisted combustion synthesis of coupled ZnO-ZrO₂ nanoparticles and their role in the photocatalytic degradation of 2,4-dichlorophenol. *Ceram. Int.*, 40 (4), 5681–5691.



- Singh, H., Sunaina, Yadav, K. K., Bajpai, V. K., dan Jha, M., 2020, Tuning the bandgap of m-ZrO₂ by incorporation of copper nanoparticles into visible region for the treatment of organic pollutants. *Mater. Res. Bulletin*, 123, 110698.
- Slamet, H. W., Nasution, E., Purnama, J. dan Gunlazuardi, 2009, Effect of copper species in a photocatalytic synthesis of methanol from carbon dioxide over copper-doped titania catalysts, *World. Appl. Sci. J.*, 6, 112-122.
- Sulaikhah, E. F., 2019, Sintesis Co-doped ZrTiO₄ dengan variasi konsentrasi Co dan suhu kalsinasi menggunakan metode sol-gel sebagai model fotokatalis responsif sinar tampak, *Skripsi*, Universitas Gadjah Mada.
- Syibyan, F. L., 2021, Fotodegradasi metilen biru menggunakan fotokatalis titanium dioksida terdoping timah dan lanthanum pada paparan sinar tampak, *Skripsi*, Universitas Gadjah Mada.
- Tehubijuluw, H., Subagyo, R., Yulita, M. F., Nugraha, R. E., Kusumawati, Y., Bahruji, H., Jalil, A. A., Hartati, H., dan Prasetyoko, D., 2021, Utilization of red mud waste into mesoporous ZSM-5 for methylene blue adsorption-desorption studies. *Environ. Sci. Pollut. Res.*, 28 (28), 37354–37370.
- Wang, J., Zhao, Y. F., Wang, T., Li, H., dan Li, C, 2015, Photonic, and photocatalytic behavior of TiO₂ mediated by Fe, CO, Ni, N doping and co-doping, *Phys. B: Conden. Matter*, 478, 6–11.
- Verma, S., Rani, S., Kumar, S., dan Khan, M. A. M., 2018, Rietveld refinement, micro-structural, optical and thermal parameters of zirconium titanate composites, *Ceram. Int.*, 44 (2), 1653–1661.
- Xiao, M., Li, Y., Lu, Y., dan Ye, Z., 2015, Synthesis of ZrO₂: Cu nanostructures with visible-light driven H₂ evolution activity, *J. Mater. Chem. A.*, 3 (6), 2701– 2706.
- Zhang, J., Zhou, P., Liu, J., dan Yu, J., 2014, New understanding of the difference of photocatalytic activity among anatase, rutile and brookite TiO₂, *Phys. Chem. Chem. Phys.*, 16 (38), 20382–20386.
- Zhu, D., Dong, Z., Lv, F., Zhong, C., dan Huang, W., 2022, The development of balanced heterojunction photocatalysts. *Cell Rep. Phys. Sci.*, 3 (10).