DAFTAR PUSTAKA

Abushad, M., Arshad, M., Naseem, S., dan Khan, W., 2020, Role of Cr Doping in Turning the Optical and Dielectric Properties of TiO_2 Nanostructures, *Mater. Chem. Phys.*, 256.

Akshay, V.R., Arun, B., Mandal, G., dan Vasundhara, M., 2019, Visible range optical absorption, Urbach energy estimation and paramagnetic response in Cr-doped TiO_2 nanocrystals derived by a sol-gel method, *J. Chem. Phys.*, 21, 12991–13004.

Alatabe, M.J.A. dan Ghorbanpour, M., 2024, A performance comparison of photo-fenton decolorization of methylene blue by using bentonite/iron composites prepared by liquid phase and solid phase ion exchange method, *Desal. Water Treat.*, 317, 100027.

Alexpandi, R., Abirami, G., Murugesan, B., Durgadevi, R., Swasthikka, R.P., Cai, Y., Ragupathi, T., dan Ravi, A.V., 2023, Tocopherol-assisted magnetic Ag-Fe_3O_4-TiO_2 nanocomposite for photocatalytic bacterial-inactivation with elucidation of mechanism and its hazardous level assessment with zebrafish model, *J. Hazard Mater.*, 442, 130044.

Aqeel, M., Anjum, S., Imran, M., Ikram, M., Majeed, H., Naz, M., Ali, S., and Ahmad, M.A., 2019, TiO_2@RGO (reduced graphene oxide) doped nanoparticles demonstrated improved photocatalytic activity, *Mater. Res. Express*, 6, 086215.

Arifan, F., Nugraheni, F.S., Devara, H.R., and Lianandya, N.E., 2018, Wastewater Treatment from Batik Industries Using TiO_2 Nanoparticles, *IOP Conference Series: Earth* and *Environ. Sci*. Institute of Physics Publishing.

Choudhury, B., dan Choudhury, A., 2013, Structural, optical, and ferromagnetic properties of Cr doped TiO_2 nanoparticles, *Mater. Sci. Eng.*, 794–800.

Bansal, J., Tabassum, R., Swami, S.K., Bishnoi, S., Vashishtha, P., Gupta, G., Sharma, S.N., dan Hafiz, A.K., 2020, Performance analysis of anomalous photocatalytic activity of Cr-doped TiO_2 nanoparticles [$Cr_{(x)}TiO2_{(1-x)}$], *Appl. Phys. a Mater. Sci. Process*, 126.

Biswas, S., 2019, First-principles study of the metal-insulator transition in the Ti-substituted rutile CrO_2, *Results Phys.*, 15, 102539.

Chan, H., Pavelka, M.S., dan Baran, T.M., 2023, Methylene blue photodynamic therapy of bacterial species found in human abscesses: planktonic, biofilm, and 3D silicone models, In, Dai,T., Wu,M.X., and Popp,J. (eds), *Photonic Diagn. Monit. Prev. Treat. of Infect. Inflamm. Dis.*, 10.

Che Ramli, Z.A., Asim, N., Isahak, W.N.R.W., Emdadi, Z., Ahmad-Ludin, N., Yarmo, M.A., and Sopian, K., 2014, Photocatalytic degradation of methylene blue under UV light irradiation on prepared carbonaceous TiO_2, *Sci. World J.* 1, 415136.

Chen, A., Chen, W.F., Majidi, T., Pudadera, B., Atanacio, A., Manohar, M., Sheppard, L.R., Liu, R., Sorrell, C.C., dan Koshy, P., 2021, Mo-doped, Cr-Doped, and Mo–Cr codoped TiO_2 thin-film photocatalysts by comparative sol-gel spin coating and ion implantation, *Int. J. Hydrogen Energy*, 46, 12961–12980.

Chen, L., Ou, S.-F., Nguyen, T.-B., Chuang, Y., Chen, C.-W., dan Dong, C.-D., 2024, In-situ hydrothermal synthesis of MoS_2/TiO_2 nanocomposites for enhanced and stable photocatalytic performance: Methylene blue degradation pathway and mechanism, *J. Taiwan Inst. Chem. Eng.*, 105436.

Choi, J., Park, H., dan Hoffmann, M.R., 2010, Combinatorial doping of TiO_2 with platinum (Pt), chromium (Cr), vanadium (V), and nickel (Ni) to achieve enhanced photocatalytic activity with visible light irradiation, *J. Mater. Res.*, 25, 149–158.

Daher, E.A., Al Redda, A., Robert, C.L., dan Hamd, W., 2024, Design of a new ZnO photocatalytic Fenton-like system for enhancing the removal of methylene blue at neutral pH, *Ceram. Int.*, 50, 20843–20850.

Diantariani, N.P., 2021, Penghilangan Metilen Biru and Ion Cr(VI) Secara Simultan dan Sinergis dengan Menggunakan Fotokatalif ZnO-Ag/Zeolit Alam, *Skripsi*, Universitas Gadjah Mada, Yogyakarta.

Dubey, R.S. dan Singh, S., 2017, Results in Physics Investigation of Structural and Optical Properties of Pure and Chromium Doped TiO_2 Nanoparticles Prepared by Solvothermal Method, *Results Phys.*, 7.

Eddy, D.R., Nur Sheha, G.A., Permana, M.D., Saito, N., Takei, T., Kumada, N., Irkham, Rahayu, I., Abe, I., Sekine, Y., Oyumi, T., dan Izumi, Y., 2024, Study on triphase of polymorphs TiO_2 (anatase/rutile/brookite) for boosting photocatalytic activity of metformin degradation, *Chemosphere*, 351, 141206.

Enomoto, R. dan Murakami, Y., 2023, Solvent-free temperature gradient melt formation of efficient visible-to-UV photon upconversion organic films with subsolar threshold and over 100 h photostability in air, *J. Mater. Chem. C. Mater.*, 11, 1678–1683.

Fan, X., Chen, X., Zhu, S., Li, Z., Yu, T., Ye, J., dan Zou, Z., 2008, The structural, physical and photocatalytic properties of the mesoporous Cr-doped TiO_2, *J. Mol. Catal. a Chem.*, 284, 155–160.

Gomez-Polo, C., Larumbe, S., Gil, A., Muñoz, D., Fernández, L.R., Barquín, L.F., García-Prieto, A., Fdez-Gubieda, M.L., dan Muela, A., 2021, Improved photocatalytic and antibacterial performance of Cr doped TiO_2 nanoparticles, *Surf. Interfaces*, 22, 100867.

Hajjaji, A., 2012, Minority carrier lifetime enhancement in multicrystalline silicon by means of a dual treatment based on porous silicon and sputter-deposition of TiO_2:Cr passivation layers, *Appl. Surf. Sci.*, 258, 8046–8048.

Hajjaji, A., Trabelsi, K., Atyaoui, A., Gaidi, M., Bousselmi, L., Bessais, B., dan El Khakani, M.A., 2014, Photocatalytic activity of Cr-doped TiO_2 nanoparticles deposited on porous multicrystalline silicon films, *Nanoscale Res. Lett.*, 9, 1–6.

Hamaandian, M., Sarabi, A., Mehra, A., dan Jabbari, V., 2014, Photocatalyst Cr-doped titanium oxide nanoparticles: Fabrication, characterization, and investigation of the effect of doping on methyl orange dye degradation, *Mater. Sci. Semicond. Process*, 21, 161–166.

Hao, B., Guo, J., Zhang, L., dan Ma, H., 2022, Cr-doped TiO_2/CuO photocatalytic nanofilms prepared by magnetron sputtering for wastewater treatment, *Ceram. Int.*, 48, 7106–7116.

Huang, K., Liang, G., Sun, S., Hu, H., Peng, X., Shen, R., dan Li, X., 2024, Interface-induced charge transfer pathway switching of a Cu_2O-TiO_2

photocatalyst from p-n to S-scheme heterojunction for effective photocatalytic H_2 evolution, *J. Mater. Sci. Technol.*, 193, 98–106.

Iqbal, T., Farman, S., Afsheen, S., dan Riaz, K.N., 2022, Novel study to correlate efficient photocatalytic activity of WO_3 and Cr doped TiO_2 leading to enhance the shelf-life of the apple, *Appl. Nanosci. (Switzer*land*)*, 12, 87–99.

Jariyanorasade, A. dan Junyapoon, S., 2018, Factors Affecting the Degradation of Linear Alkylbenzene Sulfonate by TiO_2 Assisted Photocatalysis and Its Kinetics, *Environ. Asia*, 11, 45–60.

Kamatchi, T., Kumaresan, P., dan Suresh, G., 2024, Characterizing the molecules of methylene blue doped glycine magnesium chloride (MDGMC) semi-organic crystal in virtue of quantum computational and analytical approach for photonics, *J. Mater. Sci.: Mater. Electron*, 35, 213.

Katai, M., Edalati, P., Hidalgo-Jimenez, J., Shundo, Y., Akbay, T., Ishihara, T., Arita, M., Fuji, M., dan Edalati, K., 2024, Black brookite rich in oxygen vacancies as an active photocatalyst for CO_2 conversion: Experiments and first-principles calculations, *J Photochem Photobiol a Chem*, 449, 115409.

Kim, M.G., Lee, J.E., Kim, K.S., Kang, J.M., Lee, J.H., Kim, K.H., Cho, M., and Lee, S.G., 2021, Photocatalytic degradation of methylene blue under UV and visible light by brookite-rutile bi-crystalline phase of TiO_2, *New J. Chem.*, 45, 3485–3497.

Koh, P.W., Yuliati, L., and, and Lee, S.L., 2014, Effect of Transition Metal Oxide Doping (Cr, Co, V) in the Photocatalytic Activity of TiO_2 for Congo Red Degradation Under Visible Light, *J. Teknol. Sci. Eng.*, 69, 45–50.

Kuroiwa, A., Nomura, Y., Ochiai, T., Sudo, T., Nomoto, R., Hayakawa, T., Kanzaki, H., Nakamura, Y., dan Hanada, N., 2018, Antibacterial, Hydrophilic Effect and Mechanical Properties of Orthodontic Resin Coated with UV-Responsive Photocatalyst, *Mater*, 11, 889.

Lawal, I.M., Soja, U.B., Hussaini, A., Saleh, D., Aliyu, M., Noor, A., Birniwa, A.H., dan Jagaba, A.H., 2023, Sequential batch reactors for aerobic and anaerobic dye removal: A mini-review, *Chem. Environ. Eng.*, 8, 100547.

Liu, N., Ming, J., Sharma, A., Sun, X., Kawazoe, N., Chen, G., dan Yang, Y., 2021, Sustainable photocatalytic disinfection of four representative pathogenic bacteria isolated from real water environment by immobilized TiO_2-based composite and its mechanism, *Chem. Eng. J.*, 426, 131217.

Lopez, R., Gomez, R., dan Oros-Ruiz, S., 2011, Photophysical and Photocatalytic Properties of TiO_2-Cr Sol-Gel Prepared Semiconductors, *Catal. Today*, 166, 159165.

Malengreaux, C.M., Pirard, S.L., Léonard, G., Mahy, J.G., Herlitschke, M., Klobes, B., Hermann, R., Heinrichs, B., dan Bartlett, J.R., 2017, Study of the photocatalytic activity of Fe^{3+}, Cr^{3+}, La^{3+}, and Eu^{3+} single-doped and co-doped TiO_2 catalysts produced by aqueous sol-gel processing, *J. Alloys Compd.*, 691, 726–738.

Moeini, Z., Hoseini, M., Dehghani, M., Samaei, M., Jafari, S., Taghavi, M., dan Azhdarpoor, A., 2024, Synthesize of heterostructure TiO_2 by simultaneous doping of double silver and phosphate to degradation of methylene blue under visible light, *Appl. Water Sci.*, 14.

Momeni, M.M. dan Motalebian, M., 2021, Chromium-Doped Titanium Oxide Nanotubes Grown Via One-Step Anodization for Efficient Photochatodic Protection of Stainess Steel, *Surf. Coatings Technol.*, 420.

Morales, G., Sham, E., Farfán Torres, M., dan Cardozo, A., 2023, Sol-gel synthesis of TiO_2 doped with chromium, characterization, and studies of photocatalytic degradation of tartrazine under visible light, *Acad. Mater. Sci.*, 268, 121725.

Nguyen, H.H., Gyawali, G., Martinez O.A., Kshetri, Y.K., dan Lee, S.W., 2020, Physicochemical properties of Cr-doped TiO_2 nanotubes and their application in dye-sensitized solar cells, *J. Photochem. Photobiol. a Chem.*, 397.

Nguyen, T.T. dan Edalati, K., 2024, Brookite TiO_2 as an active photocatalyst for photoconversion of plastic wastes to acetic acid and simultaneous hydrogen production: Comparison with anatase and rutile, *Chemosphere*, 355, 141785.

Oladoye, P.O., Ajiboye, T.O., Omotola, E.O., dan Oyewola, O.J., 2022, Methylene blue dye: Toxicity and potential elimination technology from wastewater, *Results Eng.*, 16, 100678.

Owolabi, T.O. dan Gondal, M.A., 2017, A hybrid intelligent scheme for estimating band gap of doped titanium dioxide semiconductor using crystal lattice distortion, *Comput. Mater. Sci.*, 137, 249–256.

Pawar, M., Nimbalkar, V., Khajone, A., dan Deshmukh, S., 2021, Cr-Doped TiO_2: Synthesis and Photodegradation of Methylene Blue Dye, *IOSR J. Appl. Chem. (IOSR-JAC)*, 14, 54–62.

Pourbaba, R., Abdulkhani, A., Rashidi, A., dan Ashori, A., 2024, Lignin nanoparticles as a highly efficient adsorbent for the removal of methylene blue from aqueous media, *Sci. Rep.*, 14, 9039.

Purnomo, A.S., Asranudin, Prasetyoko, D., dan Azizah, Y.D.N., 2021, The Biotransformation and Biodecolorization of Methylene Blue by Xenobiotic Bacterium Ralstonia pickettii, *Ind. J. Chem.*, 21, 1418–1430.

Reynoso, G.A., Zeghioud, H., Benítez, R.A., Romero, N.A., Djelal, H., Chávez, T.E., dan Guillén, J.Á., 2024, Visible LED active photocatalyst based on cerium doped titania for Rhodamine B degradation: Radical's contribution, stability and response surface methodology optimization, *Mater. Sci. Semicond. Process*, 176, 108349.

Riaz, R., Bibi, I., Majid, F., Kamal, S., Huwayz, M. Al, Jilani, K., Ghafoor, A., Raza, Q., Alwadai, N., dan Iqbal, M., 2024, $NiFe_2O_4$/CuO heterostructures optical, magnetic, and photocatalytic properties: Methylene blue dye degradation under solar light irradiation, *J. Mol. Struct.*, 1309.

Roy, D., Yadav, A.K., Singh, K.B., dan Pandey, G., 2023, Green Synthesized TiO_2-SnO_2 Nanocomposite for the Photocatalytic Degradation of Methylene Blue Dye, *J. Phys.*, 16, 181–194.

Rtimi, S., Dionysiou, D.D., Pillai, S.C., dan Kiwi, J., 2019, Advances in catalytic/photocatalytic bacterial inactivation by nano Ag and Cu coated surfaces and medical devices, *Appl. Catal. B.*, 240, 291–318.

S. Zhang, Y. Chen, Y. Yu, H. Wu, S. Wang, dan B. Zhu, 2007, Synthesis, characterization of Cr-doped TiO_2 nanotubes with high photocatalytic activity, *J. Nanoparticle Res.*, 10, 871–875.

Saini, R., Pandey, M., Mishra, R.K., dan Kumar, P., 2024, Adsorption potential of hydrochar derived from hydrothermal carbonization of waste biomass towards the removal of methylene blue dye from wastewater, *Biomass Convers. Biorefin*.

Santhi, N., Subashri, K., dan Prabhakaran, B., 2018, Hierarchically structure CrO_4–TiO_2 nanocomposite material and its multi application, *J. Mater. Sci.: Mater. Electron*, 29, 15074–15085.

Saqib, N.U., Shah, I., Adnan, R., Zaman, F., Imam, S.S., Jan, H.A., Aamir, A., dan Haleem, M.A., 2024, Evaluation of the photocatalytic degradation mechanism of methylene blue using nascent and Ag^+ ions-modified TiO_2, *Photochem. Photobiol. Sci.*, 23, 245–256.

Saygi, H., Ünal, E., Çakan, A., dan Akbay, E., 2024, Tailored transition metal doped TiO_2@Fe_3O_4 nanohybrids for efficient photocatalytic dye removal: Optimization via neural networks and response surface approaches, *Mater. Today Sustain.*, 27, 100845.

Scarpelli, F., Mastropietro, T.F., Poerio, T., dan Godbert, N., 2018, Mesoporous TiO_2 Thin Films: State of the Art. Titanium Dioxide, *Mater. Sustain. Environ*. InTech.

Shaban, M., Ahmed, A.M., Shehata, N., Betiha, M.A., dan Rabie, A.M., 2019, Ni-doped and Ni/Cr Co-doped TiO_2 nanotubes for enhancement of photocatalytic degradation of methylene blue, *J. Colloid Interface Sci.*, 555, 31–41.

Sharfan, N., Shobri, A., Anindria, F.A., Mauricio, R., Tafsili, M.A.B., dan Slamet, 2018, Treatment of batik industry waste with a combination of electrocoagulation and photocatalysis, *Int. J. Tech.*, 9, 936–943.

Shen, S., Wang, Y., Dong, J., Zhang, R., Parikh, A., Chen, J.-G., dan Hu, D., 2021, Mimicking Thylakoid Membrane with Chlorophyll/TiO_2 /Lipid Co-Assembly for Light-Harvesting and Oxygen Releasing, *ACS Appl. Mater. Interfaces*, 13, 11461–11469.

Shen, T., Zeng, D., Liu, Z., Hu, Y., Tian, Y., Song, J., Yang, T., Guan, R., dan Zhou, C., 2024, S-scheme Bi/Bi_2WO_6/TiO_2 nanofiber photocatalyst for efficient degradation of sulfamethoxazole, *Sep. Purif. Technol.*, 351, 128130.

Sivaranjani, S.K., Durairaj, K., Jayalakshmi, G., Sumathi, J., Balasubramanian, B., Chelliapan, S., Kamyab, H., Hashim, H., dan Kavitha, D., 2023, Efficiency of $CuCr_2O_4$/Titanium dioxide nanoparticles composite for organic dye removal in aqueous solutions, *Environ. Res.*, 236.

Spigariol, N., Liccardo, L., Lushaj, E., Rodríguez-Castellón, E., Barroso Martin, I., Polo, F., Vomiero, A., Cattaruzza, E., dan Moretti, E., 2023, Titania nanorods array homojunction with sub-stoichiometric TiO_2 for enhanced methylene blue photodegradation, *Catal. Today*, 419, 114134.

Thakur, Nikesh dan Thakur, Naveen, 2024, Degradation of textiles dyes and scavenging activity of spherical shape obtained anatase phase of Co–Ni-doped TiO_2 nanocatalyst, *J. Mater. Sci.: Mater. Electron.*, 35, 134.

Vasiljevic, Z.Z., Dojcinovic, M.P., Vujancevic, J.D., Jankovic-Castvan, I., Ognjanovic, M., Tadic, N.B., Stojadinovic, S., Brankovic, G.O., dan Nikolic, M. V., 2020, Photocatalytic degradation of methylene blue under natural sunlight using iron titanate nanoparticles prepared by a modified sol-gel method: Methylene blue degradation with Fe_2TiO_5, *R. Soc. Open. Sci.*, 7.

Waghchaure, R.H., Adole, V.A., dan Jagdale, B.S., 2022, Photocatalytic degradation of methylene blue, rhodamine B., methyl orange and Eriochrome black T. dyes by modified ZnO nanocatalysts: A concise review, *Inorg. Chem. Commun.*, 143, 109764.

Wahyuningsih, S., Hidayatia, W.N., Sari, P.P., Hidayat, R., Munawaroh, H., dan Ramelan, A.H., 2018, The Influence of Cr(III) on TiO_2 Crystal Growth and Photoactivity Properties, *IOP Conf. Ser. Mater. Sci. Eng.*, 333.

Wang, X.Q., Han, S.F., Zhang, Q.W., Zhang, N., dan Zhao, D.D., 2018, Photocatalytic oxidation degradation mechanism study of methylene blue dye wastewater with GR/TiO_2, *MATEC. Web of Conf.*, EDP Sciences.

Wang, Y., Qi, X., Qin, Y., An, C., Guo, J., dan Wang, J., 2023, Preparation of blast furnace dust particle electrodes and their application in synergistic electrochemical degradation of saline polyvinyl alcohol wastewater, *Environ. Pollut.*, 337, 122574.

Winayu, B.N.R., Hsu, M.-R., dan Chu, H., 2024, Comparison of Cr and Sr doping into TiO_2 for photocatalytic removal of gaseous 1,2 dichloroethane, *J. Photochem. Photobiol. a Chem.*, 450, 115486.

Wu, C.H. and Chern, J.M., 2006, Kinetics of photocatalytic decomposition of methylene blue, *Ind. Eng. Chem. Res.*, 45, 6450–6457.

Wu, K., Shi, M., Pan, X., Zhang, J., Zhang, X., Shen, T., dan Tian, Y., 2022, Decolourization and biodegradation of methylene blue dye by a ligninolytic enzyme-producing Bacillus thuringiensis: Degradation products and pathway, *Enzyme Microb. Technol.*, 156, 109999.

Yadav, H.M., Kolekar, T.V., Barge, A.S., Thorat, N.D., Delekar, S.D., Kim, B.M., Kim, B.J., dan Kim, J.S., 2016, Enchanced Visible Light Photocatalytic Activity of Cr(III)-Doped Anatase TiO_2 Photocatalysis, *J. Mater. Sci. Mater. Electron.*, 27, 526534.

Yuan, J., Xia, L., Wu, Y., Liu, Z., Mishra, Y.K., He, L., dan Xiong, J., 2024, High durable TiO_2 electrochromic films by Ni doping, *J. Mater. Sci.: Mater. Electron.*, 35, 961.

Zena, Z.W., Andoshe, D.M., Tufa, L.T., Gemta, A.B., dan Dejene, F.B., 2024, High performance Co_3O_4/Sn-ZnO nanocomposite photocatalyst for removal of methylene blue dye, *Phys. Scr.*, 99.

Zhang, S., Cai, M., Wu, J., Wang, Z., Lu, X., Li, K., Lee, J.-M., dan Min, Y., 2023, photocatalytic degradation of TiO_2 via incorporating Ti_3C_2 MXene for methylene blue removal from water, *Catal. Commun.*, 174, 106594.

Zhang, W., He, H., Li, H., Duan, L., Zu, L., Zhai, Y., Li, W., Wang, L., Fu, H., dan Zhao, D., 2021, Visible-Light Responsive TiO_2-Based Materials for Efficient Solar Energy Utilization, *Adv. Energy Mater.*, 11.

Zhang, X., Yang, J., dan Wang, J., 2023, Enhanced Cr(VI) Photocatalysis Reduction by Layered N-doped TiO_2 Sheets from Template Free Solvothermal Method, *Chem. Cat. Chem.*, 15.

Zhao, H., Dong, J., Xie, Y., Meng, L., Shen, S., Chen, J.-G., Hu, D., dan Yang, G., 2024, Construction of thin-shell TiO_2 vesicles inspired by the shell-deposition of diatoms for chlorophyll-sensitized photocatalyst, *Solid. State. Sci.*, 152, 107520.

Zhou, Y., Sun, L., Wang, H., Liang, W., Yang, J., Wang, L., dan Shuang, S., 2016, Investigation on the uptake and release ability of β-cyclodextrin functionalized Fe_3O_4 magnetic nanoparticles by methylene blue, *Mater. Chem. Phys.*, 170, 83–89.