

DAFTAR PUSTAKA

- Agrawal, S. A. (2021). Simplified measurement of density of irregular shaped composite materials using Archimedes principle by mixing two fluids having different densities. *International Research Journal of Engineering and Technology (IRJET)*, 8(3), 1005–1009. <https://doi.org/10.12345/irjet.v8i3.1005>
- Agustania, A. A., 2022, Aktivitas Fotokatalis Nano TiO₂ Termobilisasi Membran Poliuretan Dalam Reaksi Fotodegradasi Zat Warna Metilen Biru, 69.
- Alaqarbeh, M. (2021). Adsorption phenomena: definition, mechanisms, and adsorption types: short review. *RHAZES: Green and Applied Chemistry*, 13, 43-51.
- Al-Degs, Y. S., El-Barghouthi, M. I., Khraisheh, M. A., Ahmad, M. N., And Allen, S. J., 2005, Effect Of Surface Area, Micropores, Secondary Micropores, And Mesopores Volumes Of Activated Carbons On Reactive Dyes Adsorption From Solution, *Separation Science And Technology*, 39(1), 97–111. <https://doi.org/10.1081/Ss-120027403>
- Alzahrani, E., 2018, Chitosan membrane embedded with ZnO/CuO nanocomposites for the photodegradation of fast green dye under artificial and solar irradiation, *Analytical chemistry insights*, 13, 1177390118763361.
- Anatoly, C., Pavel, Z., Tatiana, C., Alexei, R., And Svetlana, Z., 2020, Water Vapor Permeability Through Porous Polymeric Membranes With Various Hydrophilicity As Synthetic And Natural Barriers, *Polymers*, 12(2), 282. <https://doi.org/10.3390/Polym12020282>
- Aranaz, I., Alcántara, A. R., Civera, M. C., Arias, C., Elorza, B., Heras Caballero, A., & Acosta, N. (2021). Chitosan: An overview of its properties and applications. *Polymers*, 13(19), 3256.
- Arefi, M. R, dan Rezaei-Zarchi, S. 2012. Synthesis of Zinc Oxide Nanoparticles and Their Effect on the Compressive Strength and Setting Time of Self-Compacted Concrete Paste as Cementitious Composites. *International Journal of Molecular Sciences*, 13: 4340-4350.
- Ayu, D. G., Gea, S., Andriyani, Telaumbanua, D. J., Piliang, A. F. R., Harahap, M., & Tok, A. I. Y. (2023). Photocatalytic degradation of methylene blue using N-doped ZnO/carbon dot (N-ZnO/CD) nanocomposites derived from organic soybean. *ACS omega*, 8(17), 14965-14984.
- Baig, A., Siddique, M., & Panchal, S. (2025). A review of visible-light-active zinc oxide photocatalysts for environmental application. *Catalysts*, 15(2), 100.

- Baker, R. W., 2023, *Membrane Technologies And Applications* (6th Ed.), John Wiley & Sons Ltd.
- Bashir, S., Awan, M. S., Farrukh, M. A., Naidu, R., Khan, S. A., Rafique, N., Ali, S., Hayat, I., Hussain, I., & Khan, M. Z. (2022). In-vivo (Albino Mice) and in-vitro Assimilation and Toxicity of Zinc Oxide Nanoparticles in Food Materials. *International Journal of Nanomedicine, Volume 17*, 4073–4085. <https://doi.org/10.2147/IJN.S372343>
- Bemis, R., Nurjanah, S., dan Maghviroh, N., 2019, Sintesis dan karakterisasi fotokatalis ZnO/karbon aktif dan aplikasinya pada degradasi rhodamin B, *Chempublish Journal*, 4(2), 101–113.
- Benettayeb, A., Seihoub, F. Z., Pal, P., Ghosh, S., Usman, M., Chia, C. H., & Sillanpää, M. (2023). Chitosan nanoparticles as potential nano-sorbent for removal of toxic environmental pollutants. *Nanomaterials*, 13(3), 447.
- Benjelloun, M., Miyah, Y., Akdemir Evrendilek, G., Zerrouq, F., & Lairini, S. (2021). *Recent advances in adsorption kinetic models: their application to dye types. Arab J Chem* 14: 103031.
- Benkhaya, S., M'rabet, S., And El Harfi, A., 2020, Classifications, Properties, Recent Synthesis And Applications Of Azo Dyes, *Heliyon*, 6(1). <https://doi.org/10.1016/j.heliyon.2020.E03271>
- Bodzek, M., 2019, Membrane separation techniques – removal of inorganic and organic admixtures and impurities from water environment – review, 45(4), 4–19. <https://doi.org/10.24425/aep.2019.130237>
- Bokau, S. N. (2013). Sintesis Membran Kitosan Termodifikasi Silika Abu Sekam Padi untuk Proses Dekolorisasi. Skripsi. Semarang: Prodi Kimia FMIPA Universitas Negeri Semarang
- Bujdák, J. (2023). Controversial issues related to dye adsorption on clay minerals: a critical review. *Molecules*, 28(19), 6951.
- Changmai, M., And Purkait, M. K., 2021, Membrane Adsorption, In *Interface Science And Technology* (Vol. 33, Pp. 629–653), Elsevier B.V. <https://doi.org/10.1016/B978-0-12-818805-7.00007-2>
- Cintya Jaya, L., & Rusmalina, S. (2024). Studi literatur: Penetapan kadar BKO parasetamol pada jamu menggunakan metode KLT dan spektrofotometri UV-Vis. *Pharmacy Genius*, 3(1), 7–17. <https://doi.org/10.56359/pharmgen.v3i01.317>
- Deng, G., Nagy, C., & Yu, P. (2023). Combined molecular spectroscopic techniques (SR-FTIR, XRF, ATR-FTIR) to study physiochemical and nutrient profiles of Avena sativa grain and nutrition and structure interactive

- association properties. *Critical Reviews in Food Science and Nutrition*, 63(25), 7225–7237. <https://doi.org/10.1080/10408398.2022.2045470>
- Diaz, C., And Kim, S., 2015, *Film Performance Of Poly (Lactic Acid) Blends For Packaging Applications*, 43–51.
- Elias, M., Uddin, M. N., Saha, J. K., Hossain, M. A., Sarker, D. R., Akter, S., & Uddin, J. (2021). A highly efficient and stable photocatalyst; N-doped ZnO/CNT composite thin film synthesized via simple sol-gel drop coating method. *Molecules*, 26(5), 1470.
- Elzahar, M. M., & Bassyouni, M. (2023). Removal of direct dyes from wastewater using chitosan and polyacrylamide blends. *Scientific Reports*, 13(1), 15750.
- Epp, J. 2016. X-Ray Diffraction (XRD) Techniques for Materials Characterization. In *Materials Characterization Using Nondestructive Evaluation (NDE) Methods*. Elsevier Ltd.
- Grande-Tovar, C. D., Barba-Rosado, L. V., & Valencia-Llano, C. H. (2025). Composites of Polyvinyl Alcohol and Chitosan Reinforced with Zinc Oxide Nanoparticles for Regenerative Therapy. *Prospectiva (1692-8261)*, 23(1).
- Gundara, G., Ramadhan, A. R., & Wagiman, A. (2023). Pengaruh ukuran serbuk sabut kelapa bermatrix polyester terhadap uji bending dan uji Scanning Electron Microscopy (SEM). *Rekayasa Energi Manufaktur (REM): Jurnal*, 8(1), 25–28. <https://doi.org/10.21070/rem.v8i1.1658>
- Guo, Y., Fu, X., Xie, Y., Zhu, L., Liu, R., dan Liu, L., 2022, Synthesis of Ag/ZnO nanocomposites with enhanced visible photocatalytic performance, *Optical Materials*, 133, 112980.
- Gustian, A. R. P. (2013). Sintesis dan Karakterisasi Membran Kitosan-PEG (Poli Etilen Glikol) sebagai Alternatif Pengontrol Sistem Pelepasan Obat. Skripsi. Semarang: Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Negeri Semarang.
- Hakim, L., Dirgantara, M., and Nawir, M. (2019). Karakterisasi struktur material pasir bongkahan galian golongan c dengan menggunakan X-Ray Difrraction (X-RD) di kota Palangkaraya. *Jurnal Jejaring Matematika dan Sains*, 1(1), 44-51.
- Handoyo Sahumena, M., Ruslin, R., Asriyanti, A., & Nurrohwiinta Djuwarno, E. (2020). Identifikasi Jamu Yang Beredar Di Kota Kendari Menggunakan Metode Spektrofotometri Uv-Vis. *Journal Syifa Sciences and Clinical Research*, 2(2), 65–72. <https://doi.org/10.37311/jsscr.v2i2.6977>

- Harugade, A., Sherje, A. P., & Pethe, A. (2023). Chitosan: A review on properties, biological activities and recent progress in biomedical applications. *Reactive and Functional Polymers*, 191, 105634.
- Hosseinzadeh, H. (2013). *Synthesis and swelling properties of a poly(vinyl alcohol)-based superabsorbing hydrogel*. **Current Chemistry Letters**, 2, 153–158.
- Hussain, A., Fiaz, S., Almohammed, A., dan Waqar, A., 2024, Optimizing photocatalytic performance with AG-doped ZNO nanoparticles: Synthesis and characterization, *Heliyon*, 10(15), <https://doi.org/10.1016/j.heliyon.2024.e35725>
- Ismail, A. S., Darwish, M. S. A., & Ismail, E. A. (2017). Synthesis and characterization of hydrophilic chitosan-polyvinyl acetate blends and their sorption performance in binary methanol–water mixture. *Egyptian Journal of Petroleum*, 26(1), 17–22. <https://doi.org/10.1016/J.EJPE.2016.02.006>
- Ivanova, T., Harizanova, A., Koutzarova, T., Vertruyen, B., & Closset, R. (2020). Structural and optical characterization of nitrogen and gallium co-doped ZnO thin films, deposited by sol-gel method. *Journal of Molecular Structure*, 1206, 127773.
- Jawad, A. H., Mubarak, N. S. A., & Sabar, S. (2019). Adsorption and mechanism study for reactive red 120 dye removal by cross-linked chitosan-epichlorohydrin biobeads. *Desalination and Water Treatment*, 164, 378-387.
- Jayswal, S, dan Moirangthem, R. S. 2018. Thermal Decomposition Route to Synthesize ZnO Nanoparticles for Photocatalytic Application. *American Institute of Physics*, 1-4.
- Julinawati, Marlina, Nasution, R, & Sheilatina, (2015).Applying sem-edx techniques to identifying the types of mineral of jades (giok) takengon, aceh.*Jurnal Natural* Vol.15, No.2, 2015, 1411-8513.
- Kabir, R., Saifullah, M. A. K., Ahmed, A. Z., Masum, S. M., & Molla, M. A. I. (2020). Synthesis of n-doped zno nanocomposites for sunlight photocatalytic degradation of textile dye pollutants. *Journal of Composites Science*, 4(2), 49.
- Kahar, F. (2022). *Buku Ajar Instrumen Dasar*. EUREKA MEDIA AKSARA.
- Kannan, M. (2018). Scanning electron microscopy: Principle, components and applications. A textbook on fundamentals and applications of nanotechnology, 81-92.
- Kujawski, W. (2000). Application of pervaporation and vapor permeation in environmental protection. *Polish Journal of Environmental Studies*, 9(1), 13-26.

- Kumar, S., Jain, A., Panwar, S., Sharma, I., Gupta, S., Dopita, M., & Choubey, R.K. (2023). Antibacterial studies of ZnO and silica capped manganese doped zinc sulphide nanostructures. *Applied Physics A: Materials Science & Processing*, 129. <https://doi.org/10.1007/s00339-023-06463-x>
- Kumar, S., Krishnakumar, B., Sobral, A. J., & Koh, J. (2019). Bio-based (chitosan/PVA/ZnO) nanocomposites film: Thermally stable and photoluminescence material for removal of organic dye. *Carbohydrate Polymers*, 205, 559-564.
- Kustomo, 2020, Uji karakterisasi dan mapping magnetit nanopartikel terlapisi asam humat dengan Scanning Electron Microscope – Energy Dispersive X-Ray (SEM EDX), *Indonesian Journal of Chemical Science*, 9(3), 149–153.
- Kusumawardan, C., 2009, Titanium Dioksida Terdoping Nitrogen : Kajian Tentang Sintesis , Karakterisasi Dan Aplikasinya, *Jurusan Pendidikan Kimia, Fmipa, Universitas Negeri Yogyakarta*, 124–133.
- Lavand, A. B., & Malghe, Y. S. (2015). Synthesis, characterization and visible light photocatalytic activity of nitrogen-doped zinc oxide nanospheres. *Journal of Asian Ceramic Societies*, 3(3), 305–310. <https://doi.org/10.1016/j.jascer.2015.06.002>
- Leyre, S., Coutino-Gonzalez, E., Joos, J. J., Ryckaert, J., Meuret, Y., Poelman, D., Smet, P. F., Durinck, G., Hofkens, J., Deconinck, G., & Hanselaer, P. (2014). Absolute determination of photoluminescence quantum efficiency using an integrating sphere setup. *Review of Scientific Instruments*, 85(12). <https://doi.org/10.1063/1.4903852>
- Li, G., Yi, Z., Wang, H., Jia, C., & Zhang, W. (2014). Factors impacted on anisotropic photocatalytic oxidization activity of ZnO: surface band bending, surface free energy and surface conductance. *Applied Catalysis B: Environmental*, 158–159, 280–285. <https://doi.org/10.1016/J.APCATB.2014.04.034>
- Liang, X., Zhong, H. J., Ding, H., Yu, B., Ma, X., Liu, X., & He, J. (2024). Polyvinyl alcohol (PVA)-based hydrogels: Recent progress in fabrication, properties, and multifunctional applications. *Polymers*, 16(19), 2755.
- Lubis, H., 2022, Perbandingan karakterisasi morfologi Fe₃O₄ terhadap Fe₃O₄ merck melalui metode kopresipitasi, *Juripol (Jurnal Institusi Politeknik Ganesha Medan)*, 5(2), 458–463.
- Lusiana, R. A., And Prasetya, N. B. A. W., 2020, Membran Dan Aplikasinya, In *Angewandte Chemie International Edition (Issue 6)*.
- Lusiana, R. A., Nuryanto, R., Muna, N., Dayanti, D., Gunawan, Kiswandono, A. A., Annisa, R. N., Septevani, A. A., And Sasongko, N. A., 2024, High-

Performance Sulfonated Polyether Sulfone/Chitosan Membrane On Creatinine Transport Improved By Lithium Chloride, *International Journal Of Biological Macromolecules*, 261. <https://doi.org/10.1016/j.ijbiomac.2024.129784>

Lusiana, R. A., Saputry, A. P., dan Prasetya, N. B. A., 2019, Pengaruh Sulfonasi terhadap Karakteristik Fisiko-Kimia Membran Polisulfon, *Indonesian Journal of Mathematics and Natural Sciences*, 42(1), 35–42. Mabel, M., Sundararaman, T. R., Parthasarathy, N., dan

Lv, T., Pan, L., Liu, X., & Sun, Z. (2012). Enhanced photocatalytic degradation of methylene blue by ZnO-reduced graphene oxide-carbon nanotube composites synthesized via microwave-assisted reaction. *Catalysis Science & Technology*, 2, 2297–2301. <https://doi.org/10.1039/c2cy20023f>

Makula, P., Pacia, M., & Macyk, W. (2018). How To Correctly Determine the Band Gap Energy of Modified Semiconductor Photocatalysts Based on UV-Vis Spectra. *Journal of Physical Chemistry Letters*, 9(23), 6814–6817. <https://doi.org/10.1021/acs.jpcclett.8b02892>

Malekkiani, M., Heshmati Jannat Magham, A., Ravari, F., & Dadmehr, M. (2022). Facile fabrication of ternary MWCNTs/ZnO/Chitosan nanocomposite for enhanced photocatalytic degradation of methylene blue and antibacterial activity. *Scientific Reports*, 12(1), 5927.

Marmur, A., Volpe, C. Della, Siboni, S., Amirfazli, A., And Drelich, J. W., 2017, Contact Angles And Wettability: Towards Common And Accurate Terminology, *Surface Innovations*, 5(1), 3–8. <https://doi.org/10.1680/jsuin.17.00002>

Mohammadi-Galangash, M., Mousavi, S. K., & Shirzad-Siboni, M. (2025). Photocatalytic degradation of reactive black 5 from synthetic and real wastewater under visible light with TiO₂ coated PET photocatalysts. *Scientific Reports*, 15(1), 14314.

Mohammed, A., & Abdullah, A. (2018, November). Scanning electron microscopy (SEM): A review. In *Proceedings of the 2018 international conference on hydraulics and pneumatics—HERVEX, Băile Govora, Romania (Vol. 2018, pp. 7-9)*.

Mondal, S., Ayon, S. A., Islam, M. S., Rana, M. S., & Billah, M. M. (2023). Morphological evaluation and boosted photocatalytic activity of N-doped ZnO nanoparticles prepared via Co-precipitation method. *Heliyon*, 9(10). <https://doi.org/10.1016/j.heliyon.2023.e20948>

Monshi, A., Foroughi, M. R., and Monshi, M. R. (2012). Modified Scherrer equation to estimate more accurately nano-crystallite size using XRD. *World Journal of Nano Science and Engineering*, 2(3), 154-160.

- Muinde, V. M., Onyari, J. M., Wamalwa, B., & Wabomba, J. N. (2020). Adsorption of malachite green dye from aqueous solutions using mesoporous chitosan–zinc oxide composite material. *Environmental Chemistry and Ecotoxicology*, 2, 115-125.
- Mulder, M. (2012). Basic principles of membrane technology. Springer science & business media.
- Mulder, M., 1996, Basic Principles of Membrane Technology, 2nd Ed Kluwer Academic Publishers, Boston, MA.
- Munir, N. Hanif, M., Dias, D., dan Abideen, 2., 2021, The Role of Halophytic Nanoparticles Towards The Remediation of Degraded and Saline Agricultural Lands, Pollution Research, Science Environmental <https://doi.org/10.1007/s11356-021-16139-9>
- Nathan, K. G., dan Genasan, K., 2023, Polyvinyl Alcohol-Chitosan Scaffold for Tissue Engineering and Regenerative Medicine Application : A Review, 1–18.
- Nedelkovski, V., Radovanović, M., & Antonijević, M. (2025). Advances in Photocatalytic Degradation of Crystal Violet Using ZnO-Based Nanomaterials and Optimization Possibilities: A Review. *ChemEngineering*, 9(6), 120.
- Nguyen, C. H., Tran, H. N., Fu, C. C., Lu, Y. T., dan Juang, R. S., 2020, Roles of adsorption and photocatalysis in removing organic pollutants from water by activated carbon–supported titania composites: Kinetic aspects, *Journal of the Taiwan Institute of Chemical Engineers*, 109, 51–61. <https://doi.org/10.1016/J.JTICE.2020.02.019>
- Ningsih, S. K. W., Khair, M., dan Veronita, S. 2021. Synthesis and Characterization of ZnO Nanoparticles Using Sol-Gel Method. *Indonesian Journal of Chemical Science*, 10(1): 60-67.
- Perez-Calderon, J., Marin-Silva, D. A., Zaritzky, N., dan Pinotti, A., 2023, Eco-friendly PVA-chitosan adsorbent films for the removal of azo dye Acid Orange 7: Physical cross-linking, adsorption process, and reuse of the material, *Advanced Industrial and Engineering Polymer Research*, 6(3), 239–254. <https://doi.org/10.1016/J.AIEPR.2022.12.001>
- Piras, A., Olla, C., Reekmans, G., Kelchtermans, A. S., De Sloovere, D., Elen, K., Carbonaro, C. M., Fusaro, L., Adriaensens, P., Hardy, A., Aprile, C., dan Van Bael, M. K., 2022, Photocatalytic Performance of Undoped and Al-Doped ZnO Nanoparticles in the Degradation of Rhodamine B under UV-Visible Light: The Role of Defects and Morphology, *International Journal of Molecular Sciences*, 23(24). <https://doi.org/10.3390/ijms232415459>

- Purnavita, S., Dewi, V. C., Studi, P., Kimia, T., dan Katolik, P., 2021, Kajian Ketahanan Bioplastik Pati Jagung dengan Variasi Berat dan Suhu Pelarutan Polivinil Alkohol, 2, 14–22.
- Putu Sri Ayuni, N., Wayan Yuningrat, N., Yesi Andriani, K., Analisis Kimia, J., And Matematika Dan Ilmu Pengetahuan Alam, F., 2016, *Adsorpsi-Desorpsi Zat Warna Azo Jenis Remazol Black B Menggunakan Membran Polielektrolit (Pec) Kitosan-Pektin* (Vol. 5, Issue 1).
- Qin, H., Li, W., Xia, Y., & He, T. (2011). Photocatalytic activity of heterostructures based on ZnO and N-doped ZnO. *ACS Applied Materials & Interfaces*, 3(9), 3152–3156. <https://doi.org/10.1021/am200655h>
- Raza, Z. A., Mobeen, A., Rehman, M. S. ur, & Majeed, M. I. (2023). Synthesis of copper oxide nanoparticles embedded in porous chitosan membrane for photodegradation of organic dyes. *Polymer Bulletin*, 80(10), 11031–11047. <https://doi.org/10.1007/s00289-022-04582-8>.
- Redjili, S., Ghodbane, H., Tahraoui, H., Abdelouahed, L., Chebli, D., Ola, M. S., & Lekmine, S. (2025). Green innovation: multifunctional zinc oxide nanoparticles synthesized using quercus robur for photocatalytic performance, environmental, and antimicrobial applications. *Catalysts*, 15(3), 256..
- Reza, K. M., Kurny, A. S. W., & Gulshan, F. (2017). Parameters affecting the photocatalytic degradation of dyes using TiO₂: a review. *Applied Water Science*, 7(4), 1569-1578.
- Rohmah, A. A. Z., Fajrin, A. N. A., dan Gunawan, S., 2022, Aplikasi Kitosan berbasis Kulit Udang Sebagai Alternatif Substitusi Lilin Pelapis dalam Rangka Peningkatan Umur Simpan Buah-Buahan: A Review, *Halal Research Journal*, 2(2), 120–136. <https://doi.org/10.12962/j22759970.v2i2.420>
- Sadiq, A. C., Olasupo, A., Ngah, W. S. W., Rahim, N. Y., & Suah, F. B. M. (2021). A decade development in the application of chitosan-based materials for dye adsorption: A short review. *International Journal of Biological Macromolecules*, 191, 1151-1163.
- Sanakousar, F. M., Vidyasagar, C., Jiménez-Pérez, V. M., & Prakash, K. (2022). Recent progress on visible-light-driven metal and non-metal doped ZnO nanostructures for photocatalytic degradation of organic pollutants. *Materials Science in Semiconductor Processing*, 140, 106390.
- Sanjiwani, N. M. S., & Sudiarsa, I. W. (2021). Analisis gugus fungsi obat sirup batuk dengan Fourier Transform Infrared. *Jurnal Edukasi Matematika dan Sains*, 11(2), 339–345.
- Saravanan, A., Senthil Kumar, P., Jeevanantham, S., Karishma, S., Tajsabreen, B., Yaashikaa, P. R., dan Reshma, B., 2021, Effective water/wastewater treatment

methodologies for toxic pollutants removal: Processes and applications towards sustainable development, *Chemosphere*, 280, 130595. <https://doi.org/10.1016/J.CHEMOSPHERE.2021.130595>

- Saravanan, R., Gracia, F., & Stephen, A. (2017). Basic principles, mechanism, and challenges of photocatalysis. In M. Khan, D. Pradhan, & Y. Sohn (Eds.), *Nanocomposites for visible light-induced photocatalysis* (Springer Series on Polymer and Composite Materials). Springer, Cham. https://doi.org/10.1007/978-3-319-62446-4_2
- Sekulic, T., Jovanović, V. S., And Kostić, V., 2024, *Geogebra Interactive Simulations In Analytical Chemistry Education : Example Of, September*, 190–195. <https://doi.org/10.46793/Tie24.190s>
- Senasu, T., Chankhanittha, T., Hemavibool, K., dan Nanan, S., 2021, Visible-light-responsive photocatalyst based on ZnO/CdS nanocomposite for photodegradation of reactive red azo dye and ofloxacin antibiotic, *Materials Science in Semiconductor Processing*, 123(November 2020), 105558. <https://doi.org/10.1016/j.mssp.2020.105558>
- Sharma, L.K., Mandal, D., Choubey, R.K., & Mukherjee, S. (2022). On the correlation of the effect of defects on the microstructural, optical and magnetic properties of doped ZnO. *Physica E Low Dimens Syst Nanostructures*, 144, 115370. <https://doi.org/10.1016/J.PHYSE.2022.115370>
- Soltani, A., Faramarzi, M., & Mousavi Parsa, S. A. (2021). A review on adsorbent parameters for removal of dye products from industrial wastewater. *Water Quality Research Journal*, 56(4), 181-193.
- Srivani, A., Vasanth, G., Sharma, G. S., Rao, S., Ramesh, P., Raghavendra, A., dan Kumari, G. K., 2023, SEM Imaging for Advanced Bio Materials, *Radiology Research and Diagnostic Imaging*, 2(2). <https://doi.org/10.58489/2836-5127/011>
- Stobinski, L., Lesiak, B., Malolepszy, A., Mazurkiewicz, M., Mierzwa, B., Zemek, J., and Bieloshapka, I. (2014). Graphene oxide and reduced graphene oxide studied by the XRD, TEM and electron spectroscopy methods. *Journal of Electron Spectroscopy and Related Phenomena*, 195, 145-154.
- Suhartati, T., (2017). Dasar-Dasar Spektrofotometri Uv-Vis Dan Spektrometri Massa Untuk Penentuan Struktur Senyawa Organik. In AURA CV. Anugrah Utama Rahar (Vol. 4, Issue 1). <http://dx.doi.org/10.1088/17426596/1091/1/012003>
- Sun, S., Chang, X., Li, X., & Li, Z. (2013). Synthesis of N-doped ZnO nanoparticles with improved photocatalytic activity. *Ceramics International*, 39(5), 5197–5203. <https://doi.org/10.1016/j.ceramint.2012.12.018>

- Torrent, J., Barron, V., 2008. *Methods of Soil Analysis. Part 5. Mineralogical Methods, Chapter 13 Diffuse Reflectance Spectroscopy*. SSSA Book Series, USA, pp. 367–385. No. 5.
- Tulandi, G. P. (2015). Validasi metode analisis untuk penetapan kadar parasetamol dalam sediaan tablet secara spektrofotometri ultraviolet. *Pharmacon UNSRAT*, 4(4).
- Wahyuni, A. M., Afthoni, M. H., & Rollando, R. (2022). Pengembangan dan Validasi Metode Analisis Spektrofotometri UV Vis Derivatif untuk Deteksi Kombinasi Hidrokortison Asetat dan Nipagin pada Sediaan Krim. *Sainsbertek Jurnal Ilmiah Sains & Teknologi*, 3(1), 239–247. <https://doi.org/10.33479/sb.v3i1.181>
- Wang, T., Jiang, M., Yu, X., Niu, N., & Chen, L. (2022). Application of Lignin adsorben In Wastewater Treatment: A review. *Separation and Purification Technology*, 302(1).
- Wu, S., Li, K., Shi, W., dan Cai, J., 2022a, Preparation and performance evaluation of chitosan/polyvinylpyrrolidone/polyvinyl alcohol electrospun nanofiber membrane for heavy metal ions and organic pollutants removal, *International Journal of Biological Macromolecules*, 210(May), 76–84. <https://doi.org/10.1016/j.ijbiomac.2022.05.017>
- Yanto Rahman, D., And Sulistyowati, R., 2023, *Environmental Science Journal (Esjo): Jurnal Ilmu Lingkungan Aplikasi Fotokatalis Tio2 Dan Alternatifnya Untuk Degradasi Pewarna Sintetis Dalam Limbah Cair* (Vol. 1, Issue 2). <Http://Journal.Univpgri-Palembang.Ac.Id/Index.Php/Esjo>
- Yu, Y., Xie, C., Wu, Y., Liu, P., Wan, Y., Sun, X., & Zhang, Y. (2022). Preparation of a PVA/chitosan/glass fiber composite membrane and the performance in CO₂ separation. *Membranes*, 13(1), 36.
- Yunusa, U., Usman, B., & Ibrahim, M. B. (2021). Cationic dyes removal from wastewater by adsorptive method: A systematic in-depth review. *Algerian Journal of Chemical Engineering*, 1(2), 6-40.
- Zabelin, A. A., Shkuropatova, V. A., Shkuropatov, A. Ya., & Shuvalov, V. A. (2015). Temperature dependence of light-induced absorbance changes associated with chlorophyll photooxidation in manganese-depleted core complexes of photosystem II. *Biochemistry (Moscow)*, 80(10), 1279–1287. <https://doi.org/10.1134/S0006297915100089>
- Zamboulis, A., Nanaki, S., Michailidou, G., Koumentakou, I., Lazaridou, M., Ainali, N. M., Xanthopoulou., & Bikiaris, D. N. (2020). Chitosan and its derivatives for ocular delivery formulations: Recent advances and developments. *Polymers*, 12(7), 1519.

- Zeljковиć, S., Balaban, M., Gajić, D., Vračević, S., Ivas, T., Vranković, D., & Jelić, D. (2022). Mechanochemically induced synthesis of N-ion doped ZnO: Solar photocatalytic degradation of methylene blue. *Green Chemistry Letters and Reviews*, 15(4), 869-880.
- Zhang, H., He, Q., Luo, J., Wan, Y., dan Darling, S. B., 2020, Sharpening Nanofiltration: Strategies for Enhanced Membrane Selectivity, *ACS Applied Materials & Interfaces*, 12(36), 39948–39966. <https://doi.org/10.1021/acsami.0c11136>
- Zhang, Y., Sun, Y., Li, M., Luo, S., Dorus, B., Lu, M., & Sun, Q. (2022). The application of a three-dimensional flower-like heterojunction containing zinc oxide nanoparticles and modified carbon nitride for enhanced photodegradation. *Journal of Alloys and Compounds*, 890.
- Zhou, W., Apkarian, R., Wang, Z.L., Joy, D. (2006). Fundamentals of Scanning Electron Microscopy (SEM). In: Zhou, W., Wang, Z.L. (eds) *Scanning Microscopy for Nanotechnology*. Springer, https://doi.org/10.1007/978-0-387-39620-0_1
- Zhou, X., Liu, D., Bu, H., Deng, L., Liu, H., Yuan, P., and Song, H. (2018). XRD-based quantitative analysis of clay minerals using reference intensity ratios, mineral intensity factors, Rietveld, and full pattern summation methods: A critical review. *Solid Earth Sciences*, 3(1), 16-29.
- Zhu, F. Y., Wang, Q. Q., Zhang, X. S., Hu, W., Zhao, X., & Zhang, H. X. (2014). 3D nanostructure reconstruction based on the SEM imaging principle, and applications. *Nanotechnology*, 25(18), 185705.
- Zhu, G., Hojamberdiev, M., Zhang, W., Taj Ud Din, S., Joong Kim, Y., Lee, J., And Yang, W., 2020, Enhanced Photocatalytic Activity Of Fe-Doped Bi₄O₅Br₂ Nanosheets Decorated With Au Nanoparticles For Pollutants Removal, *Applied Surface Science*, 526. <https://doi.org/10.1016/j.apsusc.2020.146760>