DAFTAR PUSTAKA

[1] Mutia Oktarina Permai Yenny, Arief Hartono, Syaiful Anwar, and Yumei Kang, "Assessment of heavy metals pollution in sediment of Citarum River, Indonesia," *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management)*, vol. 10, no. 4, pp. 584–593, Dec. 2020, doi: 10.29244/jpsl.10.4.584-593.

[2] S. Shara, S. S. Moersidik, and T. E. B. Soesilo, "Potential health risks of heavy metals pollution in the Downstream of Citarum River," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing Ltd, Jan. 2021. doi: 10.1088/1755-1315/623/1/012061.

[3] P. P. Indonesia, "Peraturan Pemerintah (PP) Nomor 22 Tahun 2021 tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup," 2021.

[4] W. Ahmad, R. D. Alharthy, M. Zubair, M. Ahmed, A. Hameed, and S. Rafique, "Toxic and heavy metals contamination assessment in soil and water to evaluate human health risk," *Sci Rep*, vol. 11, no. 1, Dec. 2021, doi: 10.1038/s41598-021-94616-4.

[5] G. Azeh Engwa, P. Udoka Ferdinand, F. Nweke Nwalo, and M. N. Unachukwu, "Mechanism and Health Effects of Heavy Metal Toxicity in Humans," *Poisoning in the Modern World - New Tricks for an Old Dog?*, Jun. 2019, doi: 10.5772/INTECHOPEN.82511.

[6] T. Hu, Q. Lai, W. Fan, Y. Zhang, and Z. Liu, "Advances in Portable Heavy Metal Ion Sensors," Apr. 01, 2023, *MDPI*. doi: 10.3390/s23084125.

[7] A. Garciá-Miranda Ferrari, P. Carrington, S. J. Rowley-Neale, and C. E. Banks, "Recent advances in portable heavy metal electrochemical sensing platforms," Oct. 01, 2020, *Royal Society of Chemistry*. doi: 10.1039/d0ew00407c.

[8] L. Yu *et al.*, "Nanomaterials-Based Ion-Imprinted Electrochemical Sensors for Heavy Metal Ions Detection: A Review," Dec. 01, 2022, *MDPI*. doi: 10.3390/bios12121096.

[9] N. B. Singh and S. Agarwal, "Nanocomposites: An overview," *Emerging Materials Research*, vol. 5, no. 1, pp. 5–43, Oct. 2015, doi: 10.1680/jemmr.15.00025.

[10] J. A. Buledi, S. Amin, & Syed, I. Haider, M. I. Bhanger, and A. R. Solangi, "Recent Developments and Innovative Strategies in Environmental Sciences in Europe A review

on detection of heavy metals from aqueous media using nanomaterial-based sensors", doi: 10.1007/s11356-020-07865-7/Published.

[11] A. Moutcine *et al.*, "Preparation, characterization and simultaneous electrochemical detection toward Cd (II) and Hg(II) of a phosphate/zinc oxide modified carbon paste electrode," *Inorg Chem Commun*, vol. 116, Jun. 2020, doi: 10.1016/j.inoche.2020.107911.

[12] J. Liu, G. Zhu, M. Chen, X. Ma, and J. Yang, "Fabrication of electrospun ZnO nanofiber-modified electrode for the determination of trace Cd(II)," *Sens Actuators B Chem*, vol. 234, pp. 84–91, Oct. 2016, doi: 10.1016/j.snb.2016.04.073.

[13] N. K. Sekar *et al.*, "Fabrication of Electrochemical Biosensor with ZnO-PVA Nanocomposite Interface for the Detection of Hydrogen Peroxide," *J Nanosci Nanotechnol*, vol. 18, no. 6, pp. 4371–4379, Dec. 2017, doi: 10.1166/jnn.2018.15259.

[14] R. Ambrosio *et al.*, "Polymeric nanocomposites membranes with high permittivity based on PVA-ZnO nanoparticles for potential applications in flexible electronics," *Polymers (Basel)*, vol. 10, no. 12, Dec. 2018, doi: 10.3390/polym10121370.

[15] S. Khan and J. K. Goh, "Development of polymer-based chemical sensor to study the impact of polymer concentration and freeze-thaw cycle on the detection of gallic acid," *Int J Electrochem Sci*, vol. 15, no. 3, pp. 2307–2325, Mar. 2020, doi: 10.20964/2020.03.40.

[16] S. A. Khan *et al.*, "Performance investigation of ZnO/PVA nanocomposite film for organic solar cell," in *Materials Today: Proceedings*, Elsevier Ltd, 2021, pp. 2615–2621. doi: 10.1016/j.matpr.2021.05.197.

[17] L. A. Malik, A. Bashir, A. Qureashi, and A. H. Pandith, "Detection and removal of heavy metal ions: a review," *Environ Chem Lett*, vol. 17, no. 4, pp. 1495–1521, Dec. 2019, doi: 10.1007/S10311-019-00891-Z/FIGURES/17.

[18] J. Zhang, Y. Yang, X. Huang, Q. Shan, and W. Wu, "Novel preparation of high-yield graphene and graphene/ZnO composite," *J Alloys Compd*, vol. 875, Sep. 2021, doi: 10.1016/j.jallcom.2021.160024.

[19] L. D. Nguyen *et al.*, "An electrochemical sensor based on polyvinyl alcohol/chitosan-thermally reduced graphene composite modified *Glassy Carbon Electrode* for sensitive

voltammetric detection of lead,” *Sens Actuators B Chem*, vol. 345, Oct. 2021, doi: 10.1016/j.snb.2021.130443.

[20] W. Hu, Z. Li, and J. Yang, “Electronic and optical properties of graphene and graphitic ZnO nanocomposite structures,” *Journal of Chemical Physics*, vol. 138, no. 12, Mar. 2013, doi: 10.1063/1.4796602.

[21] T. Hu, Q. Lai, W. Fan, Y. Zhang, and Z. Liu, “Advances in Portable Heavy Metal Ion Sensors,” Apr. 01, 2023, *MDPI*. doi: 10.3390/s23084125.

[22] L. A. Malik, A. Bashir, A. Qureashi, and A. H. Pandith, “Detection and removal of heavy metal ions: a review,” *Environ Chem Lett*, vol. 17, no. 4, pp. 1495–1521, Dec. 2019, doi: 10.1007/S10311-019-00891-Z/FIGURES/17.

[23] N. Elgrishi, K. J. Rountree, B. D. McCarthy, E. S. Rountree, T. T. Eisenhart, and J. L. Dempsey, “A Practical Beginner’s Guide to *Cyclic Voltammetry*,” *J Chem Educ*, vol. 95, no. 2, pp. 197–206, Feb. 2018, doi: 10.1021/acs.jchemed.7b00361.

[24] J. Jose *et al.*, “Principle, design, strategies, and future perspectives of heavy metal ion detection using carbon nanomaterial-based electrochemical sensors: a review,” Apr. 01, 2023, *Springer Science and Business Media Deutschland GmbH*. doi: 10.1007/s13738-022-02730-5.

[25] V. Mirceski, S. Skrzypek, and L. Stojanov, “Square-wave voltammetry,” *ChemTexts*, vol. 4, no. 4, Dec. 2018, doi: 10.1007/s40828-018-0073-0.

[26] C. Jin Mei and S. Ainliah Alang Ahmad, “A review on the determination heavy metals ions using calixarene-based electrochemical sensors,” *Arabian Journal of Chemistry*, vol. 14, no. 9, p. 103303, Sep. 2021, doi: 10.1016/J.ARABJC.2021.103303.

[27] T. Pajkossy, “Voltammetry coupled with impedance spectroscopy,” *Journal of Solid State Electrochemistry*, vol. 24, no. 9, pp. 2157–2159, Sep. 2020, doi: 10.1007/S10008-020-04689-W/FIGURES/2.

[28] D. Harvey, *Analytical Chemistry 2.1*. 2021. Accessed: Nov. 30, 2023. [Online]. Available: https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Analytical_Chemistry_2.1_(Harvey)

[29] F. Scholz, “Voltammetric techniques of analysis: the essentials,” *ChemTexts*, vol. 1, no. 4, pp. 1–24, Dec. 2015, doi: 10.1007/S40828-015-0016-Y/TABLES/1.

[30] N. Elgrishi, K. J. Rountree, B. D. McCarthy, E. S. Rountree, T. T. Eisenhart, and J. L. Dempsey, "A Practical Beginner's Guide to *Cyclic Voltammetry*," *J Chem Educ*, vol. 95, no. 2, pp. 197–206, Feb. 2018, doi: 10.1021/acs.jchemed.7b00361.

[31] F. H. Pilz and P. Kielb, "*Cyclic Voltammetry*, *Square Wave Voltammetry* or electrochemical impedance spectroscopy? Interrogating electrochemical approaches for the determination of electron transfer rates of immobilized redox proteins," *BBA Advances*, vol. 4, Jan. 2023, doi: 10.1016/j.bbadva.2023.100095.

[32] Z. Hirbodvash and P. Berini, "Surface Plasmon Electrochemistry: Tutorial and Review," Mar. 01, 2023, *MDPI*. doi: 10.3390/chemosensors11030196.

[33] Q. Zhou and H. Yao, "Recent development of carbon electrode materials for electrochemical supercapacitors," *Energy Reports*, vol. 8, pp. 656–661, Nov. 2022, doi: 10.1016/j.egyr.2022.09.167.

[34] E. Sohouli *et al.*, "A *Glassy Carbon Electrode* modified with carbon nanoonions for electrochemical determination of fentanyl," *Materials Science and Engineering: C*, vol. 110, p. 110684, May 2020, doi: 10.1016/J.MSEC.2020.110684.

[35] S. Oh, T. H. Lee, M. S. Chae, J. H. Park, and T. G. Kim, "Performance improvements of ZnO thin film transistors with reduced graphene oxide-embedded channel layers," *J Alloys Compd*, vol. 777, pp. 1367–1374, Mar. 2019, doi: 10.1016/J.JALLCOM.2018.11.004.

[36] R. Ambrosio *et al.*, "Polymeric nanocomposites membranes with high permittivity based on PVA-ZnO nanoparticles for potential applications in flexible electronics," *Polymers (Basel)*, vol. 10, no. 12, Dec. 2018, doi: 10.3390/polym10121370.

[37] L. A. Malik, A. Bashir, A. Qureashi, and A. H. Pandith, "Detection and removal of heavy metal ions: a review," Dec. 01, 2019, *Springer Verlag*. doi: 10.1007/s10311-019-00891-z.

[38] A. A. Rowe *et al.*, "Cheapstat: An open-source, 'do-it-yourself' potentiostat for analytical and educational applications," *PLoS One*, vol. 6, no. 9, Sep. 2011, doi: 10.1371/journal.pone.0023783.

[39] J. Aznar-Poveda, J. A. Lopez-Pastor, A. J. Garcia-Sanchez, J. Garcia-Haro, and T. F. Otero, "A cots-based portable system to conduct accurate substance concentration

measurements," *Sensors (Switzerland)*, vol. 18, no. 2, Feb. 2018, doi: 10.3390/s18020539.

[40] O. S. Hoilett, J. F. Walker, B. M. Balash, N. J. Jaras, S. Boppana, and J. C. Linnes, "KickStat: A Coin-Sized Potentiostat for High-Resolution Electrochemical Analysis," *Sensors 2020, Vol. 20, Page 2407*, vol. 20, no. 8, p. 2407, Apr. 2020, doi: 10.3390/S20082407.

[41] J. Aznar-Poveda, J. A. Lopez-Pastor, A. J. Garcia-Sanchez, J. Garcia-Haro, and T. F. Otero, "A cots-based portable system to conduct accurate substance concentration measurements," *Sensors (Switzerland)*, vol. 18, no. 2, Feb. 2018, doi: 10.3390/s18020539.

[42] A. Butterworth, D. K. Corrigan, and A. C. Ward, "Electrochemical detection of oxacillin resistance with SimpleStat: a low cost integrated potentiostat and sensor platform," *Analytical Methods*, vol. 11, no. 14, pp. 1958–1965, Apr. 2019, doi: 10.1039/c9ay00383e.

[43] Y. Liu *et al.*, "Label-Free and Sensitive Determination of Cadmium Ions Using a Ti-Modified Co3 O4-Based Electrochemical Aptasensor," *Biosensors (Basel)*, vol. 10, no. 12, Dec. 2020, doi: 10.3390/BIOS10120195.

[44] S. C. H. Lee and P. J. Burke, "NanoStat: An open source, fully wireless potentiostat," *Electrochim Acta*, vol. 422, Aug. 2022, doi: 10.1016/j.electacta.2022.140481.

[45] M. D. M. Dryden and A. R. Wheeler, "DStat: A versatile, open-source potentiostat for electroanalysis and integration," *PLoS One*, vol. 10, no. 10, Oct. 2015, doi: 10.1371/journal.pone.0140349.

[46] J. A. Buledi, S. Amin, & Syed, I. Haider, M. I. Bhanger, and A. R. Solangi, "RECENT DEVELOPMENTS AND INNOVATIVE STRATEGIES IN ENVIRONMENTAL SCIENCES IN EUROPE A review on detection of heavy metals from aqueous media using nanomaterial-based sensors", doi: 10.1007/s11356-020-07865-7/Published.

[47] I. Albalawi, A. Hogan, H. Alatawi, and E. Moore, "A sensitive electrochemical analysis for cadmium and lead based on Nafion-Bismuth film in a water sample," *Sens Biosensing Res*, vol. 34, Dec. 2021, doi: 10.1016/j.sbsr.2021.100454.

[48] Z. Koudelkova *et al.*, "Determination of zinc, cadmium, lead, copper and silver using a carbon paste electrode and a screen printed electrode modified with chromium(III) oxide," *Sensors (Switzerland)*, vol. 17, no. 8, Aug. 2017, doi: 10.3390/s17081832.

[49] J. Yukird, P. Kongsittikul, J. Qin, O. Chailapakul, and N. Rodthongkum, "ZnO@graphene nanocomposite modified electrode for sensitive and simultaneous detection of Cd (II) and Pb (II)," *Synth Met*, vol. 245, pp. 251–259, Nov. 2018, doi: 10.1016/j.synthmet.2018.09.012.

[50] N. Vasanthi Sridharan and B. K. Mandal, "Simultaneous Quantitation of Lead and Cadmium on an EDTA-Reduced Graphene Oxide-Modified *Glassy Carbon Electrode*," *ACS Omega*, vol. 7, no. 49, pp. 45469–45480, Dec. 2022, doi: 10.1021/acsomega.2c06080.

[51] J. Liu, G. Zhu, M. Chen, X. Ma, and J. Yang, "Fabrication of electrospun ZnO nanofiber-modified electrode for the determination of trace Cd(II)," *Sens Actuators B Chem*, vol. 234, pp. 84–91, Oct. 2016, doi: 10.1016/j.snb.2016.04.073.

[52] S. Oh, T. H. Lee, M. S. Chae, J. H. Park, and T. G. Kim, "Performance improvements of ZnO thin film transistors with reduced graphene oxide-embedded channel layers," *J Alloys Compd*, vol. 777, pp. 1367–1374, Mar. 2019, doi: 10.1016/j.jallcom.2018.11.004.

[53] R. Nagarkar and J. Patel, "Acta Scientific Pharmaceutical Sciences (ISSN: 2581-5423) Polyvinyl Alcohol: A Comprehensive Study," 2019.

[54] D. Feldman, "Poly(Vinyl alcohol) recent contributions to engineering and medicine," *Journal of Composites Science*, vol. 4, no. 4, 2020, doi: 10.3390/jcs4040175.

[55] A. Farahani and H. Sereshti, "Developing a point-of-care system for determination of dopamine, ascorbic and uric acids in biological fluids using a screen-printed electrode modified by three dimensional graphene/carbon nanotube hybrid," *Int J Electrochem Sci*, vol. 14, no. 7, pp. 6195–6208, 2019, doi: 10.20964/2019.07.47.

[56] J. Wu and M. Gong, "ZnO/graphene heterostructure nanohybrids for optoelectronics and sensors," Aug. 21, 2021, *American Institute of Physics Inc.* doi: 10.1063/5.0060255.

[57] R. Nandee, M. A. Chowdhury, A. Shahid, N. Hossain, and M. Rana, "Band gap formation of 2D materialin graphene: Future prospect and challenges," *Results in Engineering*, vol. 15, Sep. 2022, doi: 10.1016/j.rineng.2022.100474.

[58] L. D. Nguyen *et al.*, “An electrochemical sensor based on polyvinyl alcohol/chitosan-thermally reduced graphene composite modified *Glassy Carbon Electrode* for sensitive voltammetric detection of lead,” *Sens Actuators B Chem*, vol. 345, Oct. 2021, doi: 10.1016/j.snb.2021.130443.

[59] A. M. Abdel-Aziz, H. H. Hassan, and I. H. A. Badr, “*Glassy Carbon Electrode* Electromodification in the Presence of Organic Monomers: Electropolymerization versus Activation,” *Anal Chem*, vol. 92, no. 11, pp. 7947–7954, Jun. 2020, doi: 10.1021/acs.analchem.0c01337.

[60] “LMP91000 Sensor AFE System: Configurable AFE Potentiostat for Low-Power Chemical Sensing Applications,” 2011. [Online]. Available: www.ti.com

[61] A. W. Colburn, K. J. Levey, D. O’Hare, and J. V. Macpherson, “Lifting the lid on the potentiostat: a beginner’s guide to understanding electrochemical circuitry and practical operation,” Apr. 14, 2021, *Royal Society of Chemistry*. doi: 10.1039/d1cp00661d.

[62] “GitHub - LinnesLab/LMP91000: Arduino library for the LMP91000 AFE Potentiostat for Electrochemical Sensing.” Accessed: Jul. 17, 2024. [Online]. Available: https://github.com/LinnesLab/LMP91000

[63] J. Monge, O. Postolache, A. Trandabat, S. Macovei, and Ramona Burlacu, “Mobile Potentiostat IoT Compatible,” *International Conference on Sensing and Instrumentation in IoT Era (ISSI)*, 2019.

[64] A. M. Sinaga, Y. Pratama, F. O. Siburian, and K. J. F. P. S, “Comparison of Graphical User Interface Testing Tools,” *Journal of Computer Networks, Architecture and High Performance Computing*, vol. 3, no. 2, pp. 123–134, Jul. 2021, doi: 10.47709/cnahpc.v3i2.951.

[65] Y. Sineshchuk, S. Terekhin, I. Saenko, and I. Kotenko, “Evaluation of graphical user interfaces by the search time for information objects,” in *Journal of Physics: Conference Series*, IOP Publishing Ltd, Nov. 2021. doi: 10.1088/1742-6596/2096/1/012076.

[66] N. Elgrishi, K. J. Rountree, B. D. McCarthy, E. S. Rountree, T. T. Eisenhart, and J. L. Dempsey, “A Practical Beginner’s Guide to *Cyclic Voltammetry*,” *J Chem Educ*, vol. 95, no. 2, pp. 197–206, Feb. 2018, doi: 10.1021/acs.jchemed.7b00361.

[67] X. Pu *et al.*, “Understanding and Calibration of Charge Storage Mechanism in *Cyclic Voltammetry* Curves,” *Angewandte Chemie - International Edition*, vol. 60, no. 39, pp. 21310–21318, Sep. 2021, doi: 10.1002/anie.202104167.

[68] G. Wosiak, D. Coelho, E. B. Carneiro-Neto, E. C. Pereira, and M. C. Lopes, “Numerical Resolving of Net Faradaic Current in Fast-Scan *Cyclic Voltammetry* Considering Induced Charging Currents,” *Anal Chem*, vol. 92, no. 23, pp. 15412–15419, Dec. 2020, doi: 10.1021/acs.analchem.0c03026.

[69] R. H. R. Mohammed, R. Y. A. Hassan, R. Mahmoud, A. A. Farghali, and M. E. M. Hassouna, “Electrochemical determination of cadmium ions in biological and environmental samples using a newly developed sensing platform made of nickel tungstate-doped multi-walled carbon nanotubes,” *J Appl Electrochem*, vol. 54, no. 3, pp. 657–668, Mar. 2024, doi: 10.1007/s10800-023-01976-y.

[70] J. Hou, Y. Fan, X. Ma, X. Dong, and S. Yao, “Effects of modified fly ash doped carbon paste electrodes and metal film electrodes on the determination of trace cadmium(ii) by anodic stripping voltammetry,” *RSC Adv*, vol. 11, no. 28, pp. 17240–17248, Apr. 2021, doi: 10.1039/d0ra07493d.

[71] C. Raril and J. G. Manjunatha, “Sensitive Electrochemical Analysis of Resorcinol using Polymer Modified Carbon Paste Electrode: A Cyclic Voltammetric Study,” *Analytical & Bioanalytical Electrochemistry*, vol. 10, no. 4, pp. 488–498, Apr. 2018.

[72] V. H. B. Oliveira *et al.*, “A sensitive electrochemical sensor for Pb2+ ions based on ZnO nanofibers functionalized by L-cysteine,” *J Mol Liq*, vol. 309, Jul. 2020, doi: 10.1016/j.molliq.2020.113041.

[73] A. A. Oladipo, S. D. Oskouei, and M. Gazi, “Metal-organic framework-based nanomaterials as opto-electrochemical sensors for the detection of antibiotics and hormones: A review,” 2023, *Beilstein-Institut Zur Forderung der Chemischen Wissenschaften*. doi: 10.3762/bjnano.14.52.

[74] K. J. Iqbal *et al.*, “Determination of heavy metals (Pb, Cr, As, Hg, and Cd) into the body organs of selected fish, water, sediment, and soil samples from Head Punjnad and Head Taunsa, Punjab, Pakistan,” *PLoS One*, vol. 18, no. 9 September, Sep. 2023, doi: 10.1371/journal.pone.0288163.