



DAFTAR PUSTAKA

- Adamson, A.W., 1990, *Physical Chemistry of Surface*, 5th Edition, John Wiley and Sons Inc., New York.
- Agusriyadin, 2015, Ampas Kelapa sebagai Adsorben Ion Logam Cu(II), *Tesis*, Program Studi S2 Kimia FMIPA Universitas Gadjah Mada, Yogyakarta.
- Ahmad, M., Usman, A.R.A., Lee, S.S., Kim, S. and Joo, J., 2012, Eggshel and Coral Wastes as Low Cost Sorbent for Removal of Pb²⁺, Cd²⁺ and Cu²⁺ from Aqueous Solution, *J. Ind. Chem. Eng.*, 18, 198-204.
- Ahmaruzzaman, M., 2011, Industrial Waste as Low Cost Potential Adsorbent for The Treatment of Wastewater Laden with Heavy Metals, *Adv. Colloid Interf. Sci.*, 166, 36-59.
- Ali, I., and Gupta, V.K., 2007, Advances in Water Treatment by Adsorption Technology, *Nat. Protoc.*, 1, 2661-2667.
- Al-Rashdi, B., Tizaoui, C. and Hilal, N., 2012, Copper Removal from Aqueous Solution Using Nano-Scale Diboron Trioxide/Titanium Dioxide (B₂O₃/TiO₂) Adsorbent, *J. Chem. Eng.*, 183, 294-302.
- Angelis, G.D., Medeghini, L., Conte, A.M. and Mignardi, S., 2017, Recycling of Eggshell Waste into Low-Cost Adsorbent for Ni Removal from Wastewater, *J. Clean. Prod.*, 164, 1497-1506.
- Ardini, M.A., 2014, Pengaruh Cu(II) dan Ni(II) terhadap Konstanta Laju dan Energi Aktivasi Adsorpsi-Reduksi Au(III) oleh Asam Humat, *Skripsi*, Jurusan Kimia FMIPA Universitas Gadjah Mada, Yogyakarta.
- Atkins, P. W., 1999, *Physical Chemistry*, 8th Edition, W. H. Freeman and Company, New York.
- Bilal, M., Shah, J.A., Ashfaq, T., Gardazi, S.M.H., Tahir, A.A., Pervez, A., Haroon, H. and Mahmood, Q., 2013, Waste Biomass Adsorbents for Copper Removal from Industrial Wastewater, *J. Hazard. Mater.*, 263, 322-333.
- Blais, J.F., Dufresne, B. and Mercier, G., 2000, State of the Art of Technologies for Metal Remover from Industries Effluent, *Rev. Sci. Eau.*, 12(4), 687-711.
- Cahyaningrum, S.E., Herdyastuty, N., Devina, B. and Supangat, D., 2017, Synthesis and Characterization of Hydroxyapatite Powder by Wet Precipitation Method, *IOP on Chem. Mater. Sci.*, 299, 1-5.



- Canra, M., Fadli, A. dan Kumalasari, 2005, Kinetika Adsorpsi Ion Logam Cu²⁺ menggunakan *Tricalciumphosphate* sebagai Adsorben dengan Variasi Kecepatan Pengadukan dan Temperatur, *J. Fak. Tek.*, 2(2), 1-6.
- Chang, Y. C. and Chen, D. W., 2005, Preparation and Adsorption Properties of Monodisperse Chitosan-bound Fe₃O₄ Magnetic Nanoparticles for Removal of Cu(II) Ions, *J. Colloid Interf. Sci.*, 283, 446-451.
- Connel, D.W. dan Miller, G.J., 1995, *Kimia dan Eroksikologi Percernaan*, University of Indonesia Press, Jakarta.
- Cotton, F. A. dan Wulkinson, G., 1989, *Kimia Anorganik Dasar*, University of Indonesia Press, Jakarta.
- Do, D.D., 1998, *Adsorption Analysis: Equilibria and Kinetics*, Imperial College Press, London.
- Etim, U.J., Umoren, S. A. and Eduok, U.M., 2012, Coconut Coir Dust as a Low Cost Adsorbent for The Removal of Cationic Dye from Aqueous Solution, *J. Saudi Chem. Soc.*, 20, 67-76.
- Feng, N., Guo, X., Liang, S., Zhu, Y. and Liu, J., 2011, Biosorption of Heavy Metals from Aqueous Solution by Chemically Modified Orange Peel, *J. Hazard. Mater.*, 185, 49-54.
- Flores-cano, J.V., Leyva-ramos, R., Mendoza-Borron, J., Guerrero-Coronado, M., Aragon-Pina, A. and Labrada-Delgado, G., 2013, Adsorption Mechanism of Cd(II) from Water Solution onto Chikem Eggshell, *App. Surf. Sci.*, 276, 682-690.
- Foo, K.Y. and Hameed, B.H., 2012, Adsorption characteristics of Industrial Solid Waste Derived Activated Carbon Prepared by Microwave Heating for Methylene Blue, *Fuel Process. Technol.*, 99, 103-109.
- Gandhi, M. R., Kousalya, G. N. and Meenakshi, S., 2011, Removal of Copper(II) Using Chitin/Chitosan Nano Hydroxyapatite Composite, *J. Biol. Macromol.*, 48, 119-124.
- Ganiswara, S. G., 1995, *Farmakologi dan Terapi*, Edisi ke-4, Fakultas Kedokteran Universitas Indonesia, Jakarta.
- Ghosal, P. S. and Gupta, A. K., 2017, Determination of Thermodynamic Parameters from Langmuir Isotherm Constant-Revisited, *J. Mol. Liq.*, 225, 137-146.
- Ho, Y. S., 2006, Review of Pseudo Second Order Models for Adsorption System, *J. Process Biochem.*, 136, 681-689.



- Hui, P., Meena, S.L., Singh, G., Agarawal, R.D. and Prakash, S., 2010, Synthesis of Hydroxyapatite Bio-Ceramics Powder by Hydrothermal Method, *J. Miner. Mater. Char. Eng.*, 9(8), 683-692.
- Ibrahim, A., Zhou, Y., Li, X., Chen, L., Hong, Y., Su, Y., Wang, H. and Li, J., 2015, Synthesis Rod-Line Hydroxyapatite with High Surface Area and Pore Volume from Eggshell for Effective Adsorption Of Aqueous Pb(II), *Mater. Res. Bull.*, 62, 132-141.
- Iriany, Krisnawati and Jasinda, 2013, Adsorption of Heavy Metal Iron Fe(III) using Activated Powdered Duck Eggshell Adsorbent, *Environ. Concern.*, 37-40.
- Kalavathy, M. H., Karthikeyan, T., Rajgopal, S. and Miranda, R. L., 2005, Kinetic and Isotherm Studies of Cu(II) Adsorption onto H₃PO₄ Activated Rubber Wood Sawdust, *J. Colloid Interf. Sci.*, 292, 354-362.
- Kamari, A., Yusoff, S. N, M., Abdullah, F. and Putra, W. P., 2014, Biosorptive Removal of Cu(II), Ni(II), and Pb(II) Ions from Aqueous Solution using Coconut Dregs Residue: Adsorption and Characterization Studies, *J. Environ. Chem. Eng.*, 2, 1912-1919.
- Kulkarni, S.J. and Kaware, J.P., 2013, A Review on Research for Cadmium Removal from Effluent, *Int. J. Eng. Sci. Innov. Tech.*, 2(4), 465-469.
- Kumar, P.S. and Gayathri, R., 2009, Adsorption of Pb²⁺ Ions from Aqueous Solution onto Bael Thee Leaf Powder: Isotherms, Kinetics and Thermodynamics Study, *Eng. Sci. Technol.*, 4(4), 381-399.
- Laonapakul, T., 2015, Synthesis of Hydroxiapatite from Biogenic Wastes, *KKU Eng. J.*, 42(3), 269-275.
- Li, J., Hu, J., Sheng, G., Zhao, G. and Huang, Q., 2009, Effect of pH Ionic Strength, Foreign Ions and Temperature on The Adsorption of Cu²⁺ from Aqueous Solution to GMZ Bentonite, *Colloid Surf. A.*, 349, 195-201.
- Li, Y., Yue, Q. And Gao, B., 2010, Adsorption Kinetics and Desorption of Cu(II) and Zn(II) from Aqueous Solution onto Humic Acid., *J. Hazard. Mater.*, 178, 455-461.
- Liao, D, Zheng, W., Li, X., Yang, Q., Yue, X., Guo, L. and Zheng, G., 2010, Removal Of Lead(II) from Aqueous Solutions using Carbonate Hydroxyapatite Extracted from Eggshell Waste, *J. Hazard. Mater.*, 126-130.
- Lynam, M. M., Kliduf, J. E. and Weber, J., 1995, Adsorption of p-Nitrophenol from Dilute Aqueous Solution, *J. Chem. Educ.*, 72, 80-84.



- Mahreni, Sulistyowati, E., Sampe, S., dan Chandra W., 2012, Pembuatan Hidroksiapatit dari Kulit Telur, *Prosiding Seminar Nasional Teknik Kimia "Kejuangan"*, 6 Maret 2012, Yogyakarta.
- Malamis, S. and Katsoua, E., 2013, A Review on Zinc and Nickel Adsorption on Natural and Modified Zeolite, Bentonite, and Vermiculite: Examination of Process Parameters, Kinetics and Isotherms, *Hazard Mater.*, 252-253.
- Mallakpour, S. and Khadem, E., 2018, Chitosan/CaCO₃-Silan Nanocomposites: Synthesis Characterization, Invitro Bioactivity and Cu(II) Adsorption Properties, *J. Biol. Macromol.*, 114, 149-160.
- Manahan, S.E., 2001, *Environmental Science, Technology and Chemistry*, CRC Press LLC, Boca Raton.
- Marcias-Gracia, A., Corzo, M. G., Dominguez, M. A., Franco, M. A. and Naharro, J. M., 2017, Study of The Adsorption and Electroadsorption Process of Cu²⁺ Ions Within Thermally and Chemically Modified Activated Carbon, *J. Hazard. Mater.*, 328, 56-65.
- Martins, R.J.E., Pardo, R. and Boaventura, R.A.R., 2004, Cadmium (II) and Zinc (II) Adsorption by the Aquatic Moss *Fontinalis Antipyretica*: Effect of Temperature, pH and Water Hardness, *Water Res.*, 38, 693-699.
- Meski, S., Ziani, and Khireddine, H., 2010, Removal of Lead Ions by Hydroxyapatite Prepared from the Eggshell, *J. Chem. Eng. Data*, 55, 3923-3928.
- Mortada, W.L., Kenway, I.M.M., Abdelghany, A.M., Islam, A.M., Dania, A. I. and Nabieh, K.A., 2015, Determination of Cu²⁺, Zn²⁺ and Pb²⁺ in Biological and Food Samples by FAAS after Proconcentration with Hydroxyapatite Nanorods Originated from Eggshell, *Mater. Scie. Eng.*, 52, 288-296.
- Muhammad, N., Parr, J., Smith, M. D. and Wheatley, A. D., 1998, Adsorption of Heavy Metal in Slow Sand Filters, *Proceedings of the 24th WEDC International Conference on Water Supply and Sanitation*, Durban, South Africa, 346-349.
- Nandi, B. K., Goswami, A. and Purkait, M. K., 2009, Adsorption Characteristics of Brilliant Green Dye on Kaolin, *J. Hazard Mater.*, 161, 387-395.
- Narsito, Nuryono dan Suyanta, 2004, Kinetika Adsorpsi Zn²⁺ dan Cd²⁺ pada Silika Gel Termodifikasi Hasil Pengolahan Abu Sekam Padi, *Laporan Hasil Penelitian Ilmu Dasar*, Lembaga Penelitian Universitas Gadjah Mada, Yogyakarta.
- Nayak, A.K., 2010, Hydroxyapatite Synthesis Methodologies: An Overview, *Int. J. Chem. Tech. Res.*, 2, 903-907.



- Novitasari, A. I. M., Indraswary, R., dan Pratiwi, R., 2017, Pengaruh Aplikasi Gel Ekstrak Membran Kulit Telur Bebek 10% Terhadap Kepadatan Serabut Kolagen pada Proses Penyembuhan Luka Ginggiva, *J. Odonta Dental.*, 4, 13-20.
- Oscik, J., 1982, *Adsorption*, John Willey and Sons, New York.
- Osipow, L. S., 1962, *Surface Chemistry Theory and Industrial Applications*, Reinhold Publishing Cooperation, New York.
- Pavia, D.L., Lampman, G.M., Kris, G.S. and Vyvyan, J.R., 2009, *Introduction of Spectroscopy*, 4th Ed., Brook/Cole Cengage Learning, Washington.
- Powel, K. J., Brown, P. L., Byrne, R. H., Gajda, T., Hefter, G., Sjoberg, S. and Wanner, H., 2007, Chemical Specification of Environmentally Significant Metals with Inorganic Ligand, *Pure Appl. Chem.*, 5(70), 895-950.
- Rahman, M. S., and Islam, M. R., 2009, Effect of pH on Isotherms Modelling for Cu(II) ions adsorption using Maple Wood Sawdust, *J. Chem. Eng.*, 149, 273-280.
- Ramos, S. N., Do, C., Xavier, A.L. P., Teodoro, F. S., Gil, L. F. and Gurgel, L. V.A., 2016, Removal of Cobalt(II), Copper(II), and Nickel(II) Ions from Aqueous Solutions using Phtalate Functionalized Sugarcane Bagasse: Mono and Multicomponent Adsorption in Batch Mode, *Ind. Crops Prod.* 79, 116-130.
- Ribeiro, M. H. L., Lourenco, P. A. S. and Monteiro, J. P., 2005, Kinetics of Selectibe Adsorption of Impurities from A Crude Vegetable Oil in Hexane to Activated Eaths and Carbons, *Eur. Food Res. Technol.*, 213, 132-138.
- Rozaini, C. A., Jain, K., Oo, C. W., Tan, K. W., Tan, L. S., Azraa, A. and Tong, K S., 2010, Optimization of Nickel and Copper Ions Removal by Modified Mangrove Barks, *J. Chem. Eng.*, 1, 1.
- Rujitanapanich, S., Kumpapan, P. and Wanjanoi, P., 2014, Synthesis of Hydroxiapatite from Oyster Shell Via Precipitation, *Energy Procedia*, 56, 112-117.
- Saleha., 2015, Sintesis dan Karakterisasi Hidroksiapatit dari Nanopartikel Kalsium Oksida (CaO) Cangkang Telur untuk Aplikasi Dental Implan, *Prosiding Pertemuan Ilmiah XXIX HFI Jateng dan DIY*, 25 April 2015, Yogyakarta.
- Sari, M., 2017, Sintesis dan Karakterisasi Hidroksiapatit Berbahan Dasar Cangkang Kerang (*Perna viridis*) dengan Variasi Suhu Kalsinasi dan Waktu Pengadukan Menggunakan Metode Presipitasi, *Tesis*, Departemen Fisika FMIPA Universitas Gadjah Mada, Yogyakarta.



- Shen, T.F. and Chen, L., 2003, The Role of Magnesium and Calcium in Eggshell Formation in Tsaiya Ducks and Leghorn Hens, *Asian-Aust J Anim Sci.*, 16, 290.
- Stumm, W. and Morgan, J.J., 1996, *Aquatic Chemistry*, 3rd Ed, John Willey and Sons Inc., New York.
- Sud, D., Mahajan, G. and Kaur, M.P., 2008, Agricultural Waste Material as Potential Adsorbent for Sequestering Heavy Metal Ions from Aqueous Solution, *Bioresour. Technol.*, 99, 6017-6027.
- Suryadi, 2011, Sintesis dan Karakterisasi Biomaterial Hidroksiapatit dengan Proses Pengendapan Kimia Basah, *Tesis*, Fakultas Universitas Indonesia, Depok.
- Syafaat, F. Y., 2017, Sintesis dan Karakterisasi Hidroksiapatit Berbahan Dasar Cangkang Kerang Simpson dan Cangkang Telur Burung Puyuh dengan Variasi Konsentrasi Ca:P dan Suhu Sintering, *Tesis*, Program Studi S2 Kimia FMIPA Universitas Gadjah Mada, Yogyakarta.
- Tan, K. T., 1992, *Dasar-Dasar Kimia Tanah*, Gadjah Mada University Press, Yogyakarta.
- Tangboriboon, N., Kunanuruksapong, and A., Sirivat, 2012, Preparation and Properties of Calcium Oxide From Eggshell Via Calcination, *Mater. Sci. Pol.*, 30(4), 313-322.
- Tosun, I., 2012, Ammonium Removal from Aqueous Solution by Clinoptilolite: Determination of Isotherm and Thermodynamic Parameters and Comparison of Kinetics Models, *Intern. J. Environ. Res. Public Health*, 9, 970-984.
- Umaningrum, D. Santoso, U.T. Nurmasari, R., dan Yunus, R., 2010, Kinetika Adsorpsi Pb(II), Cd(II) dan Cr(III) pada Adsorben Produk Pengikatan Silang Terproteksi Asam Humat/Kitosan, *Indones. J. Chem.*, 10, 80-87.
- Vogel, 1990, *Buku Teks Analisis Anorganik Kualitatif Makro dan Semimikro*, Bagian 1, Cetakan kedua, PT Kalman Media Pustaka, Jakarta.
- Wang, J., Xu, L., Meng, Y., Cheng, C. and Li, A., 2011, Adsorption of Cu²⁺ on New Hypercrosslinked Polystyrene Adsorbent: Batch and Column Studies, *J. Chem. Eng.*, 178, 108-114.
- Weng, C.H., Lin, Y.T., Hong, D.Y., Sharma, Y.C., Chen, S.C. and Tripathi, K., 2014, Effective Removal of Copper Ions from Aqueous Solution using Base Treated Black Tea Waste., *Ecol. Eng.*, 67, 127-13.



- Wu, L., Forsling, W. and Schindler, P. W., 1991, Surface Complexation of Calcium Mineral in Aqueous Solution 1 Surface Protonation of Fluoroapatite Water Interface, *J. Colloid, Sci.*, 147, 178-185.
- Xie, X., Xiong, H., Zhang, Y., Tong, Z., Liao, A. and Qin, Z., 2017, Preparation Magnetic Cassava Residue Microspheres and Its Application for Cu(II) Adsorption, *J. Env. Chem. Eng.*, 5, 2800-2806.
- Yadav, A., Pandey, L.K., Kumar, D. and Gaur, J.P., 2014, Morphological Abnormalities in Periphytic Diatoms as A Tool for Biomonitoring of Heavy Metal Pollution in A River, *Ecol.Indic.*, 36, 272-279.
- Yahaya, N.K.E., Latiff, M.F.P.M, Abustan, I., Bello, O.S. and Ahmad, M.A., 2011, Adsorptive Removal of Cu(II) using Activated Carbon Prepared from Rice Husk by ZnCl₂ Activation and Subsequent Gasification with CO₂, *Int. J. Eng. Technol.*, 11(1), 207-211.
- Yang, B., Tong, X., Deng, Z. and Xiangwen, 2015, The Adsorption of Cu Species onto Pyrite Surface and Its Effect om Pyrite Floation, *J. Chem*, 1-7.
- Yargic, A.S., Sahin, R.Z.Y., Ozbay, N. and Onal, E., 2014, Assessment of Toxic Copper(II) Biosorption from Aqueous Solution by Chemically-Treated Tomato Waste (*Solanum lycopersium*), *J. Clean. Pro.*, 1-8.
- Yoga, I. P. S., 2016, Pemanfaatan Kulit Batang Mangrove Api-Api (*Avicenia marina*) sebagai Adsorben Ion Logam Cu(II), *Tesis*, Program Studi S2 Teknik Lingkungan Fakultas Teknik Universitas Gadjah Mada, Yogyakarta.
- Zheng, W., Li, X., Yang, Q., Zheng, G., Shen, X., Zhang, Y. and Liu, J., 2007, Adsorption of Cd(II) and Cu(II) from Aqueous Solution by Carbonate Hydroxylapatite Derived from Eggshell Waste, *J. Hazard. Mater.*, 147, 534-539.