



## DAFTAR PUSTAKA

- Abdolmohammad-Zadeh, H., Mohammad-Rezaei, R., and Salimi, A., 2019, Preconcentration of Mercury(II) Using a magnetite@carbon/dithizone Nanocomposite, and Its Quantification by Anodic Stripping Voltammetry, *Microchim. Acta.*, 187, 1–8.
- Adamson, A.W., 1990, Physical Chemistry of Surfaces, 5th ed., John Wiley & Sons, New York.
- Adeleke, O.A., Latiff, A.A.A., Saphira, M.R., Daud, Z., Ismail, N., Ahsan, A., Ab Aziz, N.A., Al-Gheethi, A., Kumar, V., Fadilat, A., and Apandi, N., 2019, Principles and Mechanism of Adsorption for the Effective Treatment of Palm Oil Mill Effluent for Water Reuse, *Nanotechnol. Water Wastewater Treat. Theory Appl.*, 1–33.
- Adlin, N., 2014, Zeolit Termodifikasi Magnetit Berbasis Metode Kopresipitasi Sebagai Adsorben Zn(II), *Skripsi*, Universitas Gadjah Mada.
- Aghel, B., Mohadesi, M., Gouran, A., and Razmegir, M.H., 2019, Use of Modified Iranian Clinoptilolite Zeolite for Cadmium and Lead Removal from Oil Refinery Wastewater, *Int. J. Environ. Sci. Technol.*, 17, 1239–1250.
- Aksu, Z. and Kabasakal, E., 2004, Batch Adsorption of 2,4-dichlorophenoxy-acetic acid (2,4-D) from Aqueous Solution by Granular Activated Carbon, *Sep. Purif. Technol.*, 35, 223–240.
- Alyasi, H., Mackey, H.R., Loganathan, K., and McKay, G., 2020, Adsorbent Minimisation in a Two-Stage Batch Adsorber for Cadmium Removal, *J. Ind. Eng. Chem.*, 81, 153–160.
- Aminy, D.E., Rusdiarso, B., and Mudasir, M., 2021, Adsorption of Cd(II) Ion from the Solution Using Selective Adsorbent of Dithizone-Modified Commercial Bentonite, *Int. J. Environ. Sci. Technol.*, 1–12.
- Anang, M.A., Zugle, R., and Ntiri, B.S., 2020, Comparing the Efficiencies of the Removal of Cadmium from Industrial Wastewater Using Zeolites, *Int. Res. J. Pure Appl. Chem.*, 21, 6–18.
- Anonim, 2004, *Cadmium in Drinking-Water: Background Document for Development of WHO Guidelines for Drinking-Water Quality* (No. WHO/SDE/WSH/03.04/80), World Health Organization.
- Anonim, 2014, *Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah*, Jakarta, Kementerian Lingkungan Hidup Republik Indonesia.
- Anonim, 2016, *Aquatic Life Ambient Water Quality Criteria Cadmium*, United States, Environmental Protection Agency.
- Ayawei, N., Ebelegi, A.N., and Wankasi, D., 2017, Modelling and Interpretation of Adsorption Isotherms, *J. Chem.*, 2017, 1-11.



- Bardestani, R., Roy, C., and Kaliaguine, S., 2019, The Effect of Biochar Mild Air Oxidation on The Optimization of Lead(II) Adsorption From Wastewater, *J. Environ. Manage.*, 240, 404–420.
- Batool, F., Akbar, J., Iqbal, S., Noreen, S., and Bukhari, S.N.A., 2018, Study of Isothermal, Kinetic, and Thermodynamic Parameters for Adsorption of Cadmium: An Overview of Linear and Nonlinear Approach and Error Analysis, *Bioinorg. Chem. Appl.*, 2018, .
- Belova, T.P., 2019, Adsorption of Heavy Metal Ions ( $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Co}^{2+}$  and  $\text{Fe}^{2+}$ ) from Aqueous Solutions by Natural Zeolite, *Heliyon.*, 5, e02320.
- Bian, Y., Bian, Z., Zhang, J., Ding, A., Liu, S., Zheng, L., and Wang, H., 2015, Adsorption of Cadmium Ions from Aqueous Solutions by Activated Carbon with Oxygen-Containing Functional Groups, *Chinese J. Chem. Eng.*, 23, 1705–1711.
- Cakicioglu-Ozkan, F. and Ulku, S., 2005, The Effect of HCl Treatment on Water Vapor Adsorption Characteristics of Clinoptilolite Rich Natural Zeolite, *Microporous Mesoporous Mater.*, 77, 47–53.
- Cao, J. lin, Liu, X.W., Fu, R., and Tan, Z. Yang, 2008, Magnetic P Zeolites: Synthesis, Characterization and the Behavior in Potassium Extraction from Seawater, *Sep. Purif. Technol.*, 63, 92–100.
- Chunhabundit, R., 2016, Cadmium Exposure and Potential Health Risk from Foods in Contaminated Area, Thailand, *Toxicol. Res.*, 32, 65.
- Delkash, M., Ebazi Bakhshayesh, B., and Kazemian, H., 2015, Using Zeolitic Adsorbents to Cleanup Special Wastewater Streams: A Review, *Microporous Mesoporous Mater.*, 214, 224–241.
- E. White, W., 1936, Dithizone as an analytical reagent, *J. Chem. Educ.*, 13, 369–373 .
- Elboughdiri, N., 2020, The Use of Natural Zeolite to Remove Heavy Metals Cu (II), Pb (II) and Cd (II), from Industrial Wastewater, *Cogent Eng.*, 7, 1782623.
- Emmanuel, K.A. and Rao, V.A., 2008, Adsorption of Mn (II) from Aqueous Solutions using Pithacelobium Dulce Carbon, *Rasayan J. Chem.*, 1, 840–852.
- Fang, G., Chen, H., Zhang, Y., and Chen, A., 2016, Immobilization of Pectinase onto  $\text{Fe}_3\text{O}_4@\text{SiO}_2-\text{NH}_2$  and Its Activity and Stability, *Int. J. Biol. Macromol.*, 88, 189–195.
- Feng, G., Ma, J., Zhang, X., Zhang, Q., Xiao, Y., Ma, Q., and Wang, S., 2019, Magnetic Natural Composite  $\text{Fe}_3\text{O}_4$ -chitosan@bentonite for Removal of Heavy Metals from Acid Mine Drainage, *J. Colloid Interface Sci.*, 538, 132–141.
- Gaffer, A., Al Kahlawy, A.A., and Aman, D., 2017, Magnetic Zeolite-Natural Polymer Composite for Adsorption of Chromium (VI), *Egypt. J. Pet.*, 26, 995–999.



- García-Zubiri, I.X., González-Gaitano, G., and Isasi, J.R., 2009, Sorption Models in Cyclodextrin Polymers: Langmuir, Freundlich, and a Dual-Mode Approach, *J. Colloid Interface Sci.*, 337, 11–18.
- Günay, A., Arslankaya, E., and Tosun, I., 2007, Lead Removal from Aqueous Solution by Natural and Pretreated Clinoptilolite: Adsorption Equilibrium and Kinetics, *J. Hazard. Mater.*, 146, 362–371.
- Guo, S., Dan, Z., Duan, N., Chen, G., Gao, W., and Zhao, W., 2018, Zn(II), Pb(II), and Cd(II) Adsorption from Aqueous Solution by Magnetic Silica Gel: Preparation, Characterization, and Adsorption, *Environ. Sci. Pollut. Res.*, 25, 30938–30948.
- Hernández-Montoya, V., Pérez-Cruz, M.A., Mendoza-Castillo, D.I., Moreno-Virgen, M.R., and Bonilla-Petriciolet, A., 2013, Competitive Adsorption of Dyes And Heavy Metals on Zeolitic Structures, *J. Environ. Manage.*, 116, 213–221.
- Hesas, H., MS, B., H, R., J, G., and A, H., 2019, An Investigation on the Capability of Magnetically Separable Fe<sub>3</sub>O<sub>4</sub>/Mordenite Zeolite For Refinery Oily Wastewater Purification, *J. Environ. Manage.*, 241, 525–534.
- Ho, Y.S. and McKay, G., 1999, Pseudo-Second Order Model for Sorption Processes, *Process Biochem.*, 34, 451–465.
- Hodaifa, G., Ochando-Pulido, J.M., Driss Alami, S. Ben, Rodriguez-Vives, S., and Martinez-Ferez, A., 2013, Kinetic and Thermodynamic Parameters of Iron Adsorption onto Olive Stones, *Ind. Crops Prod.*, 49, 526–534.
- Hu, H. and Xu, K., 2020, Physicochemical Technologies for HRPs and Risk Control, *High-Risk Pollut. Wastewater*, 169–207.
- Huda, B.N., Wahyuni, E.T., and Mudasir, M., 2021, Eco-Friendly Immobilization of Dithizone on Coal Bottom Ash For the Adsorption of Lead(II) Ion from Water, *Results Eng.*, 10, 100221.
- Hutton, A.T., 1987, Studies on the Existence of a Tautomeric Equilibrium in Solutions of the Analytical Reagent Dithizone, *Polyhedron*, 6, 13–23.
- Irving, H. and Bell, C.F., 1952, 219. Studies with Dithizone. Part IV. The Dissociation Constant of Dithizone, *J. Chem. Soc.*, 1216–1220.
- Irving, H.M.N.H. and Iwantscheff, G., 2008, The Analytical Applications of Dithizone, *Crit. Rev. Anal. Chem.*, 8, 321–366.
- Istarani, F., Istarani, F.F., and Pandebesie, E.S., 2014, Studi Dampak Arsen (As) Dan Kadmium (Cd) Terhadap Penurunan Kualitas Lingkungan, *J. Tek. ITS.*, 3, D53–D58.
- Jafarnejad, M., Asli, M.D., Taromi, F.A., and Manoochehri, M., 2020, Synthesis of Multi-Functionalized Fe<sub>3</sub>O<sub>4</sub>-NH<sub>2</sub>-SH Nanofiber Based on Chitosan for Single and Simultaneous Adsorption of Pb(II) And Ni(II) from Aqueous System, *Int. J. Biol. Macromol.*, 148, 201–217.



- Javadian, H., Ghorbani, F., Tayebi, H. Allah, and Asl, S.M.H., 2015, Study of the Adsorption of Cd (II) from Aqueous Solution Using Zeolite-Based Geopolymer, Synthesized from Coal Fly Ash; Kinetic, Isotherm and Thermodynamic Studies, *Arab. J. Chem.*, 8, 837–849.
- Jiang, W.-J., Gu, L., Li, L., Zhang, Y., Zhang, X., Zhang, L.-J., Wang, J.-Q., Hu, J.-S., Wei, Z., and Wan, L.-J., 2016, Understanding the High Activity of Fe–N–C Electrocatalysts in Oxygen Reduction: Fe/Fe<sub>3</sub>C Nanoparticles Boost the Activity of Fe–Nx, *J. Am. Chem. Soc.*, 138, 3570–3578.
- Jiménez-Reyes, M., Almazán-Sánchez, P.T., and Solache-Ríos, M., 2021, Radioactive Waste Treatments by Using Zeolites. A Short Review, *J. Environ. Radioact.*, 233, 106610.
- Jorfi, S., Shooshtarian, M.R., and Pourfadakari, S., 2019, Decontamination of Cadmium from Aqueous Solutions Using Zeolite Decorated by Fe<sub>3</sub>O<sub>4</sub> Nanoparticles: Adsorption Modeling and Thermodynamic Studies, *Int. J. Environ. Sci. Technol.*, 17, 273–286.
- Jovanovic, M., Rajic, N., and Obradovic, B., 2012, Novel Kinetic Model of The Removal of Divalent Heavy Metal Ions From Aqueous Solutions By Natural Clinoptilolite, *J. Hazard. Mater.*, 233–234, 57–64.
- Kajjumba, G.W., Emik, S., Öngen, A., and Aydin, H.K.Ö. and S., 2018, Modelling of Adsorption Kinetic Processes—Errors, Theory and Application, *Adv. Sorption Process Appl.*, 187-206.
- Karapinar, N., 2009, Application of Natural Zeolite for Phosphorus and Ammonium Removal from Aqueous Solutions, *J. Hazard. Mater.*, 170, 1186–1191.
- Kavand, M., Eslami, P., and Razeh, L., 2020, The Adsorption of Cadmium and Lead Ions from The Synthesis Wastewater with The Activated Carbon: Optimization of The Single and Binary Systems, *J. Water Process Eng.*, 34, 101151.
- Khodadadi, M., Malekpour, A., and Ansaritabar, M., 2017, Removal of Pb (II) and Cu (II) from Aqueous Solutions ny Na-A Zeolite Coated Magnetic Nanoparticles and Optimization of Method Using Experimental Design, *Microporous Mesoporous Mater.*, 248, 256–265.
- Kozlenko, D.P., Dubrovinsky, L.S., Kichanov, S.E., Lukin, E. V., Cerantola, V., Chumakov, A.I., and Savenko, B.N., 2019, Magnetic and Electronic Properties of Magnetite Across the High Pressure Anomaly, *Sci. Reports.*, 91, 1–9.
- Králik, M., 2014, Adsorption, Chemisorption, and Catalysis, *Chem. Pap.*, 68, 1625–1638.
- Kuczajowska-Zadrożna, M., Filipkowska, U., and Jóźwiak, T., 2020, Adsorption of Cu (II) and Cd (II) from Aqueous Solutions by Chitosan Immobilized in Alginate Beads, *J. Environ. Chem. Eng.*, 8, 103878.
- Kumar, P.S., Ramakrishnan, K., and Gayathri, R., 2010, Removal of Nickel (II)



from Aqueous Solutions by Ceralite IR 120 Cationic Exchange Resins, *J. Eng. Sci. Technol.*, 5, 232–243.

Kurama, H., Zimmer, A., and Reschetilowski, W., 2002, Chemical Modification Effect on the Sorption Capacities of Natural Clinoptilolite, *Chem. Eng. Technol.*, 25, 301–305.

Lei, T., Li, S.J., Jiang, F., Ren, Z.X., Wang, L.L., Yang, X.J., Tang, L.H., and Wang, S.X., 2019, Adsorption of Cadmium Ions from an Aqueous Solution on a Highly Stable Dopamine-Modified Magnetic Nano-Adsorbent, *Nanoscale Res. Lett.*, 1, 1–17.

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.

Lima, E.C., Hosseini-Bandegharaei, A., Moreno-Piraján, J.C., and Anastopoulos, I., 2019, A Critical Review of the Estimation of the Thermodynamic Parameters on Adsorption Equilibria. Wrong Use of Equilibrium Constant in The Van't Hoof Equation for Calculation of Thermodynamic Parameters of Adsorption, *J. Mol. Liq.*, 273, 425–434.

Liu, H., Peng, S., Shu, L., Chen, T., Bao, T., and Frost, R.L., 2013, Magnetic Zeolite NaA: Synthesis, Characterization Based on Metakaolin and Its Application for The Removal of Cu<sup>2+</sup>, Pb<sup>2+</sup>, *Chemosphere.*, 91, 1539–1546.

Liu, X. and Lee, D.J., 2014, Thermodynamic Parameters for Adsorption Equilibrium of Heavy Metals and Dyes from Wastewaters, *Bioresour. Technol.*, 160, 24–31.

Łobiński, R. and Marczenko, Z., 1996, *Spectrochemical Trace Analysis for Metals and Metalloids*, Elsevier, Amsterdam.

Maharana, M. and Sen, S., 2021, Magnetic zeolite: A Green Reusable Adsorbent in Wastewater Treatment, *Mater. Today Proc.*, 47, 1490-1495.

Mahmoud, M.E., Osman, M.M., and Amer, M.E., 2000, Selective Pre-Concentration and Solid Phase Extraction of Mercury(II) from Natural Water By Silica Gel-Loaded Dithizone Phases, *Anal. Chim. Acta.*, 415, 33–40.

de Man, A.J.M., Ueda, S., Annen, M.J., Davis, M.E., and van Santen, R.A., 1992, The Stability and Vibrational Spectra of Three-Ring Containing Zeolitic Silica Polymorphs, *Zeolites.*, 12, 789–800.

Marczenko, Z., 1986, *Spectrophotometric Determination of Elements*, E. Horwood., New York.

Matsui, M., Kiyozumi, Y., Mizushina, Y., Sakaguchi, K., and Mizukami, F., 2015, Adsorption and Desorption Behavior of Basic Proteins on Zeolites, *Sep. Purif. Technol.*, 149, 103–109.

Mesdaghinia, A., Azari, A., Nodehi, R.N., Yaghmaeian, K., Bharti, A.K., Agarwal, S., Gupta, V.K., and Sharafi, K., 2017, Removal of Phthalate Esters (PAEs)



- by Zeolite/Fe<sub>3</sub>O<sub>4</sub>: Investigation on The Magnetic Adsorption Separation, Catalytic Degradation and Toxicity Bioassay, *J. Mol. Liq.*, 233, 378–390.
- Milonjić, S.K., Kopečni, M.M., and Ilić, Z.E., 1983, The Point of Zero Charge And Adsorption Properties Of Natural Magnetite, *J. Radioanal. Chem.*, 78, 15–24.
- Mockovčiaková, A., Orolínová, Z., Matik, M., Hudec, P. and Kmecová, E., 2006, Iron Oxide Contribution to The Modification of Natural Zeolite, *Acta. Montan. Slovaca.*, 11, 353-357.
- Mockovčiaková, A., Orolínová, Z. and Škvarla, J., 2010. Enhancement of the Bentonite Sorption Properties, *J. Hazard. Mater.*, 180, 274-281.
- Mohamed, T., Attia, S., Lin, X., Da, H.&, Yin, Q., Attia, M.S., Hu, L., and Qiang Yin, D., 2012, Synthesised Magnetic Nanoparticles Coated Zeolite (MNCZ) for The Removal of Arsenic (As) from Aqueous Solution, *J. Exp. Nanosci.*, 9, 551-560
- Mohammed, A.A. and Samaka, I.S., 2018, Bentonite Coated with Magnetite Fe<sub>3</sub>O<sub>4</sub> Nanoparticles As a Novel Adsorbent for Copper (II) Ions Removal from Water/Wastewater, *Environ. Technol. Innov.*, 10, 162–174.
- Mohseni-Bandpi, A., Al-Musawi, T.J., Ghahramani, E., Zarabi, M., Mohebi, S., and Vahed, S.A., 2016, Improvement of Zeolite Adsorption Capacity for Cephalexin by Coating with Magnetic Fe<sub>3</sub>O<sub>4</sub> Nanoparticles, *J. Mol. Liq.*, 218, 615–624.
- Mourabet, M., El Boujaady, H., El Rhilassi, A., Ramdane, H., Bennani-Ziatni, M., El Hamri, R., and Taitai, A., 2011, Defluoridation of Water Using Brushite: Equilibrium, Kinetic and Thermodynamic Studies, *Desalination*, 278, 1–9.
- Moyo, M., Chikazaza, L., Nyamunda, B.C., and Guyo, U., 2013, Adsorption Batch Studies on the Removal of Pb(II) Using Maize Tassel Based Activated Carbon, *J. Chem.*, 2013, 1-8.
- Mozgawa, W., Król, M., and Pichór, W., 2009, Use of Clinoptilolite for the Immobilization of Heavy Metal Ions and Preparation of Autoclaved Building Composites, *J. Hazard. Mater.*, 168, 1482–1489.
- Mudasir, M., Baskara, R.A., Suratman, A., Yunita, K.S., Perdana, R., and Puspitasari, W., 2020, Simultaneous Adsorption of Zn(II) and Hg(II) Ions on Selective Adsorbent of Dithizone-Immobilized Bentonite in the Presence of Mg(II) Ion, *J. Environ. Chem. Eng.*, 8, 104002.
- Mudasir, M., Karelius, K., Aprilita, N.H., and Wahyuni, E.T., 2016, Adsorption of Mercury(II) on Dithizone-Immobilized Natural Zeolite, *J. Environ. Chem. Eng.*, 4, 1839–1849.
- Mudasir, Siswanta, D., and Ola, P.D., 2007, Adsorption Characteristics of Pb (II) and Cd (II) Ions on Dithizone-loaded Natural Zeolite, *J. Ion Exch.*, 18, 564–569.
- Niculescu, A.G., Chircov, C., and Grumezescu, A.M., 2021, Magnetite



Nanoparticles: Synthesis Methods – A Comparative Review, *Methods*, 2021, 1046–2023.

Ntoi, L.L.A., Buitendach, B.E., and Von Eschwege, K.G., 2017, Seven Chromisms Associated with Dithizone, *J. Phys. Chem. A*, 121, 9243–9251.

Oliveira, L.C.A., Petkowicz, D.I., Smaniotto, A., and Pergher, S.B.C., 2004, Magnetic Zeolites: A New Adsorbent for Removal of Metallic Contaminants from Water, *Water Res.*, 38, 3699–3704.

Oćcik, J., 1982, *Adsorption*, John Wiley & Sons, Chichester.

Padmavathy, K.S., Madhu, G., and Haseena, P.V., 2016, A Study on Effects of pH, Adsorbent Dosage, Time, Initial Concentration and Adsorption Isotherm Study for the Removal of Hexavalent Chromium (Cr (VI)) from Wastewater by Magnetite Nanoparticles, *Procedia Technol.*, 24, 585–594.

Pambudi, T., Wahyuni, E.T., and Mudasir, M., 2020, Recoverable Adsorbent of Natural Zeolite / Fe<sub>3</sub>O<sub>4</sub> for Removal of Pb (II) in Water, *J. Mater. Environ. Sci.*, 11, 69–78.

Patel, H., 2021, Review on Solvent Desorption Study from Exhausted Adsorbent, *J. Saudi Chem. Soc.*, 25, 101302.

Patricha, I.F., 2014, Efek Magnetisasi Zeolit Alam Terhadap Kristalinitasi, Sifat Pori dan Kinerjanya Sebagai Adsorben Pb(II), *Skripsi*, Universitas Gadjah Mada.

Petrucci, R.H., Herring, F.G., and Madura, J.D., 2010, *General Chemistry: Principles and Modern Applications*, Pearson Prentice Hall, New Jersey.

Putri, V.B.A.S., 2019, Adsorpsi Ion Cu(II) dan Cd(II) pada Abu Layang Batubara yang Diimobilisasi Ditizon, *Tesis*, Universitas Gadjah Mada.

Radnia, H., Ghoreyshi, A.A., Younesi, H., and Najafpour, G.D., 2012, Adsorption of Fe(II) Ions from Aqueous Phase by Chitosan Adsorbent: Equilibrium, Kinetic, and Thermodynamic Studies, *Desalin. Water Treat.*, 50, 348–359.

Rahim Pouran, S., Abdul Raman, A.A., and Wan Daud, W.M.A., 2014, Review on the Application of Modified Iron Oxides As Heterogeneous Catalysts in Fenton Reactions, *J. Clean. Prod.*, 64, 24–35.

Ringot, D., Lerzy, B., Chaplain, K., Bonhoure, J.P., Auclair, E., and Larondelle, Y., 2007, In Vitro Biosorption of Ochratoxin A on the Yeast Industry By-Products: Comparison of Isotherm Models, *Bioresour. Technol.*, 98, 1812–1821.

Saha, P. and Chowdhury, S., 2011, Insight Into Adsorption Thermodynamics, *Thermodynamics.*, 16, 349–364.

Sahoo, T.R. and Prelot, B., 2020, Adsorption Processes for the Removal of Contaminants from Wastewater: The Perspective Role of Nanomaterials And Nanotechnology, *Nanomater. Detect. Remov. Wastewater Pollut.*, 161–222.

Saravanan, A., Kumar, P.S., Govarthanan, M., George, C.S., Vaishnavi, S.,



- Moulishwaran, B., Kumar, S.P., Jeevanantham, S., and Yaashikaa, P.R., 2021, Adsorption Characteristics of Magnetic Nanoparticles Coated Mixed Fungal Biomass for Toxic Cr(VI) Ions in Aquatic Environment, *Chemosphere.*, 267, 129226.
- Selvanantharajah, N., Iyngaran, P. and Abiman, P., 2020, Quantitative Studies of Cadmium Ion ( $Cd^{2+}$ ) Adsorption on Oxidized Graphite Powder, *Mater. Today Proc.*, 23, 105-110.
- Shofwunnada, S., Aprilita, N.H., and Mudasir, M., 2021, Adsorption of Silver(I) on Dithizone-Immobilized Coal Fly Ash, *Key Eng. Mater.*, 884, 17–24.
- Singh, L.H., Pati, S.S., Coaquiria, J.A.H., Matilla, J., Guimarães, E.M., Oliveira, A.C., Kuzmann, E., and Garg, V.K., 2016, Magnetic Interactions in Cubic Iron Oxide Magnetic Nanoparticle Bound to Zeolite, *J. Magn. Magn. Mater.*, 416, 98–102.
- Smith, J. V., 1984, Definition of a Zeolite, *Zeolites.*, 4, 309–310.
- Soliman, N.K. and Moustafa, A.F., 2020, Industrial Solid Waste for Heavy Metals Adsorption Features and Challenges; A Review, *J. Mater. Res. Technol.*, 9, 10235–10253.
- Sorokhaibam, L.G. and Ahmaruzzaman, M., 2014, Phenolic Wastewater Treatment: Development and Applications of New Adsorbent Materials, *Ind. Wastewater Treat. Recycl. Reuse.*, 323–368.
- Srisung, S., Wasukan, N., Kuno, M., Somsri, S., and Tanjedrew, N., 2021, Raman Enhanced Scattering and DFT Studies on the Adsorption Behaviour of Dithizone on Silver Nanoparticle, *Inorg. Chem. Commun.*, 126, 108480.
- Stumm, W. and Morgan, J.J., 2012, *Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters*, 3<sup>rd</sup> Ed., John Wiley & Sons., New York.
- Taamneh, Y. and Sharadqah, S., 2017, The Removal of Heavy Metals from Aqueous Solution Using Natural Jordanian Zeolite, *App. Water Sci.*, 7, 2021-2028.
- Tao, Y., Zhang, C., and Lü, T., 2020, Applied Sciences Removal of Pb (II) Ions from Wastewater by Using Magnetic Nanoparticles, *App. Sci.*, 10, 948.
- Tighadouini, S., Radi, S., Ferbinteanu, M., and Garcia, Y., 2019, Highly Selective Removal of Pb(II) by a Pyridylpyrazole- $\beta$ -ketoenol Receptor Covalently Bonded onto the Silica Surface, *ACS Omega*, 4, 3954–3964.
- Verma, M. and Kaur, G., 2021, A Mini Review on Zeolite, *Mater. Today Proc.*, 2021, 2214-7853.
- Wang, C., Leng, S., Guo, H., Cao, L., and Huang, J., 2019, Acid and Alkali Treatments for Regulation of Hydrophilicity/Hydrophobicity of Natural Zeolite, *Appl. Surf. Sci.*, 478, 319–326.
- Wang, S. and Peng, Y., 2010, Natural Zeolites as Effective Adsorbents in Water and Wastewater Treatment, *Chem. Eng. J.*, 156, 11–24.



- Wei, Y., Han, B., Hu, X., Lin, Y., Wang, X., and Deng, X., 2012, Synthesis of  $\text{Fe}_3\text{O}_4$  Nanoparticles and Their Magnetic Properties, *Procedia Eng.*, 27, 632–637.
- Wirawan, S.K., Sudibyo, H., and Setiaji, M.F., 2015, Development of Natural Zeolites Adsorbent: Chemical Analysis and Preliminary TPD Adsorption Study, *J. Eng. Sci. Technol.*, 3, 87–95.
- Yamaura, M. and Fungaro, D.A., 2013, Synthesis and Characterization of Magnetic Adsorbent Prepared by Magnetite Nanoparticles and Zeolite from Coal Fly Ash, *J. Mater. Sci.*, 48, 5093–5101.
- Yang, Y., Zhang, P., Jiang, J., Dai, Y., Wu, M., Pan, Y., and Ni, L., 2018, Synthesis and Properties of Magnetic Zeolite with Good Magnetic Stability from Fly Ash, *J. Sol-Gel Sci. Technol.*, 87, 408–418.
- Yuan, M., Xie, T., Yan, G., Chen, Q., and Wang, L., 2018, Effective Removal of  $\text{Pb}^{2+}$  from Aqueous Solutions by Magnetically Modified Zeolite, *Powder Technol.*, 332, 234–241.
- Zamani, F. and Izadi, E., 2014, Polyvinyl Amine Coated  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  Magnetic Microspheres for Knoevenagel Condensation, *Cuihua Xuebao/Chinese J. Catal.*, 35, 21–27.
- Zargoosh, K. and Babadi, F.F., 2015, Highly Selective and Sensitive Optical Sensor for Determination of  $\text{Pb}^{2+}$  and  $\text{Hg}^{2+}$  Ions Based on The Covalent Immobilization of Dithizone on Agarose Membrane, *Spectrochim. Acta Part A Mol. Biomol. Spectrosc.*, 137, 105–110.
- Zendehdel, M., Ramezani, M., Shoshtari-Yeganeh, B., Cruciani, G., and Salmani, A., 2019, Simultaneous Removal of Pb(II), Cd(II) and Bacteria from Aqueous Solution Using Amino-Functionalized  $\text{Fe}_3\text{O}_4/\text{NaP}$  Zeolite Nanocomposite, *Environ. Technol.*, 40, 3689–3704.
- Zhang, S., Yang, X., Liu, L., Ju, M., and Zheng, K., 2018, Adsorption Behavior of Selective Recognition Functionalized Biochar to Cd(II) in Wastewater, *Materials.*, 11, 299.
- Zhang, Z., Wang, T., Zhang, H., Liu, Y., and Xing, B., 2021, Adsorption of Pb(II) and Cd(II) by Magnetic Activated Carbon and Its Mechanism, *Sci. Total Environ.*, 757, 143910.