DAFTAR PUSTAKA

Abdullah, A., 2009. *Adsorbsi Karbon Aktif dari Sabut Kelapa (Cocos Nucifera) Terhadap Penurunan Fenol* (Doctoral dissertation, Universitas Islam Negeri Alauddin Makassar).

Ahmad, A., Rafatullah, M., Sulaiman, O., Ibrahim, M.H., and Hashim, R., 2009, Scavenging behaviour of meranti sawdust in the removal of methylene blue from aqueous solution. *J. Hazard. Mater.*, 170:357–65.

Ahmed, M.E.I., 2016, Selective adsorption of cadmium species onto organic clay using experimental and geochemical speciation modeling data, *Int. J. Eng. Sci. Technol.*, 8, 128–131.

Ahn, C.K., Kim, Y.M., Woo, S.H., and Park, J.M., 2009. Removal of cadmium using acid-treated activated carbon in the presence of nonionic and/or anionic surfactants. Hydrometallurgy 99, 209–213

Al-Degs, Y.S., El-Barghouthi, M.I., El-Sheikh, A.H., Walker, G.M. 2008. Effect of Solution pH, Ionic Strength, and Temperature on Adsorption Behaviour of Reactive Dyes on Activated Carbon. *Dyes and Pigments*. 77 : 16-23.

Al-Othman, Z.A., Hashem, A., and Habila, M.A., 2011, Kinetic, equilibrium and thermodynamic studies of cadmium(II) adsorption by modified agricultural wastes, *Molecules*, 16, 10443–10456.

Aleixo L. M., Godinho O. E. S., and da Costa W. F., 1992, Potentiometric study of acid-base properties of humic acid using functions for treatment of titration data. Anal. Chim. Acta 257, 35–39.

Anonim[a]., 2011, The European Parliament and the Council of the European Union, Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, *Off. J. Eur. Union*, 174, 88–110.

Anonim., 2001, Peraturan Pemerintah RI No. 82 tahun 2001 tentang Pengelolaan Kualitas Air dan Pengendalian Pencemaran Air.

Anonim., 1999, Peraturan Pemerintah Republik Indonesia Nomor 85 Tahun 1999. *Perubahan Atas Peraturan Pemerintah Republik Indonesia Nomor 18 tahun 1999 Tentang Pengelolaan Limbah Berbahaya dan Beracun.* 7 Oktober 1999. Lembaran Negara Republik Indonesia Tahun 1999. Jakarta

Anonim., 2008, World Health Organization, Guidelines for Drinking-Water Quality, WHO, Geneva.

Anonim[b]., 2011, World Health Organization, Guidelines for Drinking-Water Quality, WHO, Geneva.

Anonim., 2012, International Agency for Research on Cancer. IARC monographs on the evaluation of carcinogenic risks to humans. In: IARC (Ed.), Review of Human Carcinogens. IARC, Lyon, France.

Asuquo, E., Martin, A., Nzerem, P., Siperstein, F., and Fan, X., 2017, Adsorption of Cd(II) and Pb(II) Ions from Aqueous Solutions Using Mesoporous Activated Carbon Adsorbent: Equilibrium, Kinetics and Characterization Studies, *J. Environ. Chem. Eng,* 5, 679-698.

Bansal, R.C., and Goyal, M., 2005, *Activated Carbon Adsorption,* Taylor and Francis Group, New York.

Bhatnagar, A., Hogland, W., Marques, M., and Sillanpaa M, 2013, An overview of the modification methods of activated carbon for its water treatment applications, *Chem. Eng. J.*, 219, 499–51.

Bhattacharyya, K., and Gupta, S.S., 2008, Adsorption of a Few Heavy Metals on Natural and Modified Kaolinite and Montmorillonite: A Review, *Advances in colloid and interface science.,* 140, 114-31.

Blue, L.Y., Jana, P., and Atwood, D.A., 2010, Aqueous mercury precipitation with the synthetic dithiolate, BDTH2, *Fuel,* 89, 1326–1330.

Boddu, V.M., K. Abburi, I.L. Talbott and E.D. Smith., 2003, Removal of hexavalent chromium from wastewater using a new composite chitosan biosorbent, *Environ. Sci. Technol.*, 37, 4449-4456.

Bohli, T., Ouederni, A., Fiol, N., and Villaescusa, I., 2012, Uptake of Cd^{2+} and Ni^{2+} Metal Ions from Aqueous solutions by Activated Carbon Derivied from Waste Olive Stones, *Int. J. Chem. Eng. Appl.*, 3(4).

Bonetto, L.R., Ferrarini, F., De Marco, C., Crespo, J.S., Guégan, R., and Giovanela, M., 2015, Removal of methyl violet 2B dye from aqueous solution using a magnetic composite as an adsorbent, *J. Water Proc., Eng,*. 6, 11–20

Bortoleto, G., Macarovscha, G.T., and Cadore S., 2004, Determination of Cadmium by Flame-Atomic Absorption Spectrometry After Preconcentration on Silica Gel Modified with Cupferron, *J. Braz. Chem. Soc.*, 15(2), 313-317.

Brasquet, C., Rousseau, B., Estrade-Szwarckopf, H., and Le Cloirec, Pi., 2000, Observation of activated carbon fibres with SEM and AFM correlation with adsorption data in aqueous solution, *Carbon*., 38, 407-422

Chen, P.A., Hsu, C.F., Tsai, D.W., Lu, Y.M., and Huang, W.J., 2014, Adsorption of mercury from water by modified multiwalled carbon nanotubes: adsorption behaviour and interference resistance by coexisting anions, *Environ. Technol.*, 35, 1935–1944.

Chen, T., Gu, W., Li, G., Wang, Q., Liang, P., Zhang, X., and Huang, X., 2018, Significant enhancement in catalytic ozonation efficacy: from granular to super-fine powdered activated carbon, *Front. Environ.,* 12 (1), 6.

Chen, T., Zhou, Z., Han, R., Meng, R., Wang, H., and Lu, W., 2015, Adsorption of cadmium by biochar derived from municipal sewage sludge: impact factors and adsorption mechanism, *Chemosphere*, 134, 286–293.

Cheng, H.F., 2006, Cu(II) Removal From Lithium Bromide Refrigerant by Chemical Precipitation and Electrocoagulation, *Sep. Purif. Technol.*, 52, 191-195.

Crini, G., 2006, Non-Conventional Low-Cost Adsorbents for Dye Removal: A Review, *Bioresource Technology*, 97, 1061-1085.

Crini, G. and Badot, P.M., 2008, Application of Chitosan, a Natural Aminopolysaccharide, for Dye Removal from Aqueous Solutions by Adsorption Processes Using Batch Studies: A Review of Recent Literature, *Progress in Polymer Science*, 33, 399-447.

Da Silva, C, L.C., dos Santos, L.B.O., Masini, J.C., Abate, G., Cosentino, I.C., Fantini, M.C.A., and Matos, J.R., 2008, Adsorption of Pb2+, Cu2+ and Cd2+ in FDU-1 silica and FDU-1 silica modified with humic acid, *Microporous Mesoporous Mater.*, 110, 250–259.

Dahri, M.K., Kooh, M.R.R., and Lim, L.B.L., 2014, Water remediation using low cost adsorbent walnut shell for removal of malachite green: Equilibrium, kinetics, thermodynamic and regeneration studies. *J. Environ. Chem. Eng.*, 2:1434–44.

Darmono, 2001, Lingkungan Hidup dan Pencemaran : Hubungannya dengan Toksikologi Senyawa Logam, 139, 142, UI – Press, Jakarta.

Dashevsky, A.,1998, Proteinloss by the micro encapsulation of an enzyme (lactase) in alginate beads, *Int. J. Pharm.*, 161, 1–5.

Deng, B., Caviness, M., and Gu, Z., 2005, Arsenic Removal by Activated Carbon-based Materials, *ACS Symposium Series*, 284–293.

Ding, S., Huang, W., Yang, S., Mao, D., Yuan, J., Dai, Y., Kong, J., Sun, C., He, H., Li, S., and Zhang, L., 2018, Degradation of Azo dye direct black BN based on adsorption and microwave-induced catalytic reaction, *Front. Environ. Sci. Eng.*, 12(1), 5.

Dogan, M., Ozdemir, Y., Alkan, M. 2007. Adsorption Kinetics and Mechanism of Cationic Methyl Violet and Methylene Blue Dyes onto Sepiolite. *Dyes and Pigments.*, 75, 701-713.

Dolores, L., Juan, P.M., Falco, C., Titirici, M., and Diego, C., 2013,Porous biomass-derived carbons: activated carbons, Sustainable Carbon Materials From Hydrothermal Processes, 1, 100.

Feng, Z., and Zhu, L., 2018, Sorption of phenanthrene to biochar modified by base, *Front. Environ. Sci. Eng.*, 12 (2), 1.

Foo, K.Y., and Hameed, B.,2010, Insights into Modeling of Adsorption Isotherm Systems, *Chemical Engineering Journal.*, 156, 2-10.

Friberg, L., and Vahter, M., 1983, Assessment of exposure to lead and cadmium through biological monitoring: Results of a UNEP/WHO global study. *Environmental research.*, 30, 95-128.

Ghifari, A.S., 2011. Biosorpsi Logam Berat Di Lingkungan Akuatik Menggunakan Limbah Sekam Padi (Oryza Sativa L.) Sebagai Biosorben, *Sains Teknol. Kesehat.*

Gok, C., and Aytas, S., 2009, Biosorption of uranium (VI) from aqueous solution using calcium alginate manik, *J. Hazard. Mater*, 168, 369-375.

Gondar, D., Lopez, R., Fiol, J.M., and Antelo, F.a., 2006, Cadmium, lead and copper binding to humic acid and fulvic acid extracted from an omrotrophic peat bog, *Geoderma*, 135, 196-203.

González, P.G. and Pliego-Cuervo, Y.B., 2014, Adsorption of Cd(II), Hg(II) and Zn(II) from aqueous solution using mesoporous activated carbon produced from Bambusa vulgaris striata. *Chem. Eng. Res. Des.*, 92, 10.

Guo, Z., Fan, J., Zhang, J., Kang, Y., Liu, H., Jiang, L., and Zhang, C., 2016, Sorption heavy metal ions by activated carbons with well-developed microporosity and amino groups derived from Phragmites australis by ammonium phosphates activation, Journal of the Taiwan Institute of Chemical Engineers, 58, 290–296.

Hamza, I.A.A., 2013, Preparation and Evaluation of a Sugarcane Bagasse Multi-Walled Carbon Nanotube Composite for the Adsorption of Heavy Metals from Aqueous Solutions, *PhD Thesis*, University of KwaZulu-Natal, Durban, South Africa.

Handayani, M. dan E. Sulistiyono. 2009. Uji persamaan langmuir dan freundlich pada penyerapan limbah chrom (vi) oleh zeolit. Prosiding Seminar Nasional Sains dan Teknologi Nuklir PTNBR – BATAN Bandung.

Happy, A. R., Masyamir, dan Dhahiyat, Y., 2012, Distribusi Kanudngan Logam Berat Pb dan Cd pada Kolom Air dan Sedimen Daerah Airan Sungai Citarum Hulu, *Jurnal Perikanan dan Kelautan*, 3 (3), 175-182.

Hassan[a], A.F., Abdel-Mohsen, A.M., and Fouda, M., 2014, Comparative study of calcium alginate, activated carbon, and their composite beads on methylene blue adsorption, *Carbohydrate Polymers.*, 102, 192–198.

Hassan[b], A.F., Abdel-Mohsen, A.M., and Elhadidy, H., 2014, Adsorption of arsenic by activated carbon, calcium alginate and their composite beads, *International journal of biological macromolecules.*, 68, 125–130.

He, X., Liu, Y., Li, H., and Li, H., 2016, Single-stranded structure of alginate and its conformation evolvement after an interaction with calcium ions as revealed by electron microscopy, *RSC Adv.*, 6, 114779–114782.

Hefne, J.A., Mekhemer, W.K., Alandis, N.M., Aldayel, O.A., Alajyan, T. 2008. Kinetic and Thermodynamic study of the Adsorption of Pb(II) from Aqueous solution to The Natural and Treated Bentonite., *International Journal of Physical Sciences.*, 3(11), 281-288.

Ho, Y.S., and McKay, G, 1999, Batch Lead (II) Removal from Aqueous Solution by Peat : Equilibrium and Kinetics. *Trans IchemE.*, 77(B).

Hui, B., Zhang, Y., and Ye, L., 2015, Structure of PVA/gelatin hydrogel beads and adsorption mechanism for advanced Pb(II) removal, *J. Ind. Eng. Chem.*, 21(4): 868−876.

Ivezic, V., Almas, A, R., Singh, B, R., and Loncaric, Z., 2013, Prediction of trace metal concentrations (Cd, Cu, Fe, Mn and Zn) in wheat grain from unpolluted agricultural soils, Acta Agriculturae Scandinavica, Section B, Soil and Plant Science, 390, 301-310.

Igberase, E., Osifo, P. and Ofomaja, A., 2015, The Adsorption of Pb, Zn, Cu, Ni, and Cd by Modified Ligand in a Single Component Aqueous Solution: Equilibrium, Kinetic, Thermodynamic, and Desorption Studies, *J. Ind. Eng. Chem.*, 26, 340–347.

Jiang, T., Wei, S., Flanagan, D.c., li, M., Li, X., Wang, Q., and Luo, C., 2014, Effect of abiotic factors on the mercury reduction precess by humic acids in aqueous systems, *Pedosphere*, 24 (1), 125-136.

Johnson, B.B., 1990, Effect of pH, temperature, and concentration on the adsorption of cadmium on geothite, *Environ. Sci. Technol.*, 24, 112–118.

Juliandini, Fitrianita dan Trihadiningrum, Yulinah, 2008, Uji Kemampuan Karbon Aktif dari Limbah Kayu dalam Sampah Kota untuk Penyisihan Fenol, Prosiding Seminar Nasional Manajemen Teknologi VII Program Studi MMT-ITS, Surabaya Februari 2008. ISBN : 978-979-99735-4-2.

Kamari, Azlan, N, W, S., Wan, L, K., and Liew., 2009, Chitosan and chemically modified chitosan beads for acid dyes sorption., Journal of Env. Sci., 21, 296-302.

Kaklamani, G., Cheneler, D., Grover, L.M., Adams, M.J., and Bowen, J., 2014, Mechanical properties of alginate hydrogels manufactured using external gelation, *J. Mech. Behav. Biomed. Mater.*, 36, 135–142.

Kim, T.Y., Jin, H.J., Park S.S., Kim S.J., dan Cho, S.Y., 2008, Adsorption Equilibrium of Copper Ion and Phenol by Powdered Activated Carbon, Alginate Bead and Alginate-Activated Carbon Bead, J. *Ind. Eng. Chem.*, 14, 714–719.

Klavins, M., and Egilte, L., 2002, Immobilization of Humic Substances, *Colloids Surf.*, A, 203, 47-54.

Koukal, B., Gueguen, C., Pardos, M., and Dominik, J., 2003, Influence of humic substances on the toxic effects of cadmium and zinc to the green alga *Pseudokirchneriella subcapitata*, *Chemosphere*, 53(8), 953-961.

Krasaekoopt, W., Bhandari, B., and Deeth,H., 2003, Evaluation of encapsulation techniques of probiotics for yoghurt. *Int. Dairy J.*, 13(1), 3–13.

Kumar, P.S., Ramakrishnan, K., Kirupha, S.D., and Sivanesan, S., 2010, Thermodynamic and kinetic studies of cadmium adsorption from aqueous solution onto rice husk, *Braz. J. Chem. Eng.*, 27, 347–355.

Kwon, O.H., Kim, J.O., Cho, D.W., Kumar, R., Baek, S.H., Kurade, M.B., and Jeon, B.H., 2016, Adsorption of As(III), As(V) and Cu(II) on zirconium oxide immobilized alginate manik in aqueous phase, *Chemosphere.*, 160; 126–133.

Lawrie, G., Keen, I., Drew, B., Chandler-Temple, A., Rintoul, L., Fredericks, P., and Grøndahl, L., 2007, Interactions between alginate and chitosan biopolymers characterized using FTIR and XPS., *Biomacromolecules.*, 8(8), 2533-41.

Lee, H.H., Weng, Y., and Li, K., 2008, Electro-ultrafiltration study on Aldrich humic substances eith different molecular weights, *Sep. Purif. Technol*, 63 (1), 23-29.

Lee, Y., Mooney, J.K., and David., 2012, Alginate: Properties and biomedical applications, *Prog. Polym. Sci.*, 37, 106-126.

Lempang, M., 2014, Pembuatan dan kegunaan Arang Aktif, *Info Teknis* EBONI., 11, 65-80.

Li, Y., Yue, Q,Y., and Gao, B., 2010, Adsorption kinetics and desorption of Cu(II) and Zn(II) from aqueous solution onto humic acid, *Journal of Hazardous Materials*, 178(1−3), 455−461.

Li, F., Du, P., Chen, W., and Zhang, S., 2007, Preparation of silica supported porous sorbent for heavy metals ion removal in wastewater treatment by organic-inorganic hybridization combined with sucrose and polyethylene glycol imprinting, *Anal. Chem. Acta,* 585: 211–218.

Li, Y.H., Wang, S., Luan, Z., Ding, J., Xu, C., and Wu, D., 2003, Adsorption of cadmium(II) from aqueous solution by surface oxidized carbon nanotubes, *Carbon*, 41, 1057–1062.

Liang, J., Liu, J., Yuan, X., Dong, H., Zeng, G., Wu, H., Wang, H., Liu, J., Hua, S., Zhang, S., Yu, Z., He, X., and He, Y., 2015, Facile synthesis of alumina-decorated multi-walled carbon nanotubes for simultaneous adsorption of cadmium ion and trichloroethylene, *Chem. Eng. J.*, 273, 101–110.

Liu, F., Guo, Z., Zheng, S., and Xu, Z., 2012, Adsorption of tannic acid and phenol on mesoporous carbon activated by CO_2, *Chem. Eng. J.*, 183, 244–252.

Liu Q, Zheng T, Wang P, Jiang J, and Li N., 2010, Adsorption isotherm, kinetic and mechanism studies of some substituted phenols on activated carbon fibers, *Chem. Eng. J.*, 157, 348–356.

Lua, A.C., and Yang, T., 2004, Effects of vacuum pyrolysis conditions on the characteristics of activated carbons derived from pistachio-nut shells, J. Colloid Interface Sci., 276, 364–372

Mahmoodi, N, M., Hayati, B., Arami, M., and Bahrami, H., 2011, Preparation, characterization and dye adsorption properties of biocompatible composite (alginate/titania nanoparticle). *Desalination*., 275(1–3), 93–101.

Mai, T.H.A., Tran,V.N., and Le, V.V.M., 2013, Biochemical studies on the immobilized lactase in the combined alginate-carboxymethyl cellulose gel. *Biochem. Eng. J.*,74, 81–87.

Mammarella, E.J.,Vicín, D.A.D.P., and Rubiolo, A.C., 2002, Evaluation of stress-strain for characterization of therheological behavior of alginate and carrageenan gels. *Braz. J. Chem. Eng.*,19(1),403–409.

Marsac, R., Banik, N.L., Lutzenkirchen, J., Catrouillet, C., Marquardt, C.M., and Johannesson, K.H., 2017, Modeling metal ion-humic substances complexation in highly saline conditions, *Appl. Geochem*. 79, 52-64.

Matos, J.R., Cides da Silva, L.C., Dos Santos, L.B.O., Abate, G., Cosentino, I.C., Fantini, M.C.A., and Masini, J.C., 2007, Adsorption of Pb^{2+}, Cu^{2+} and Cd^{2+} in FDU-1 Silica and FDU-1 Silica Modified With Humic Acid, *Micropor. Mesopor. Mat.*, 110, 250-258.

Mirza, M.A., Agarwal, S.P., Rahman, M.A., Rauf, A., Ahmad, N., Alam, A., and Iqbal, Z., 2011, Role of humic acid on oral drug delivery of an antiepileptic drug, *Drug Dev. Ind. Pharm.*, 37(3), 310–319.

Mohammadi, M., Ghaemi, A., Torab-Mostaedi, M., Asadollahzadeh, M., and Hemmati, A., 2013, Adsorption of cadmium(II) and nickel(II) on dolomite powder, *Desal. Wat. Treat*., 53, 149–157

Mohan, D. , and Singh, K.P., 2002, Single- and multi-component adsorption of cadmium and zinc using activated carbon derived from bagasse—an agricultural waste, *Water Res.*, 36, 2304–2318

Muslich, Suryadarma P., and Hayuningtyas I., (2010) Kinetics of isothermal adsorption of b-carotene from crude palm olein using bentonite, J. Tek. Ind. Pert., 19(2), 93 – 100.

Mwamulima, T., Zhang, X., Wang, Y., Song, S., and Peng, C., 2018, Novel approach to control adsorbent aggregation: iron fixed bentonite-fly ash for Lead (Pb) and Cadmium (Cd) removal from aqueous media, *Front. Environ. Sci. Eng.*, 12 (2), 2.

Myat, D.S., Matthew, M., Max, Z., Oliver, D.O., John and Gray, Steve., 2013, Experimental and computional investigations of the interactions between model organic compounds and subsequent membrane fouling., *Water Res.*, 48, 10.

Nadavala, S.K., Swayampakula, K., Boddu, V.M., and Abburi, K., 2009, Biosorption of phenol and o-chlorophenol from aqueous solutions on to chitosan-calcium alginate blended beads, *J. Hazard. Mater.*, 162, 482–489.

Nafi'ah, R., 2016, Kinetika Adsorpsi Pb(II) dengan Adsorben Arag Aktif dari Sabut Siwalan, *Jurnal Farmasi Sains dan Praktis*,1(2), 28-37.

Naidoo, E. B. and Modise, S. J., 2010, Kinetic and Pseudo-Second-Order Modeling of Lead Biosorption onto Pine Cone Powder, *Ind. Eng. Chem. Res.*, *49* (6), 2562-2572.

Naiya, T.K., Bhattacharya, A.K., and Das, S.K., 2009, Adsorption of Cd(II) and Pb(II) from aqueous solutions on activated alumina, *J. Colloid Interface Sci.*, 333, 14–26.

Narayanan, R. P., Melman, G., Letourneau, N. J., Mendelson, N. L., and Melman, A., 2012, Photodegradable iron (III) cross-linked alginate gels. *Biomacromolecules*, 13, 2465–2471.

Nedovic, V., Kalusevic, A., Manojlovic, V., Levic, S., and Bugarski, B., 2011, An overview of encapsulation technologies for food applications, *Procedia Food Sci.*, 1, 1806–1815

Ngah[a], W.S.W., Fatinathan, S., and Yosop, N.A., 2011, Isotherm and kinetic studies on the adsorption of humic acid onto chitosan-H_2SO_4 beads, *Desalination.*, 272, 293–300.

Ngah[b], W.W.S., Teong, L.C., and Hanafiah, M.A.K.M., 2011, Adsorption of dyes and heavy metal ions by chitosan composites: A review, *Carbohydr. Polym.*, 83, 1446–1456.

Nguyen, M.L., Huang, C., and Juang, R.S., 2016, Synergistic biosorption between phenol and nickel(II) from Binary mixtures on chemically and biologically modified chitosan beads., *Chem. Eng. J.*, 286; 68–75.

Nordberg G, F., Nogawa, K., Nordberg, M., Friedmann, J, M., Cadmium. In: Nordberg GF, Fowler BA, Nordberg M, and Friberg L, 2007, Handbook on the Toxicology of Metals. Amsterdam: Elsevier, 445–486.

Oyetade, O., Nyamori, V., Jonnalagadda, S., and Martincigh, B., 2018, Removal of Cd 2+ and Hg 2+ from aqueous solutions by adsorption onto nitrogen-functionalized carbon nanotubes, *Desalination and water treatment*, 108. 253-267.

Paraskeva, P., Kalderis, E.D., and Diamadopoulos, 2008, Production of activated carbon from agricultural by-products, *J. Chem. Technol. Biotechnol.*, 83, 581–592.

Park, H.G., Kim, T.W., Chae, M.Y., and Yoo, I.K., 2007, Activated CarbonContaining Alginate Adsorbent for the Simultaneous Removal of Heavy Metals and Toxic Organics, *Process Biochem.*, 42, 1371–1377.

Pasparakis, G. and Bouropoulos, N., 2006, Swelling Studies and In Vitro Release of Verapamil from Calcium Alginate and Calcium Alginate–Chitosan Beads, *Int. J. Pharm*. 323, 34–42.

Perez-Aguilar, N.V., Muñoz-Sandoval, E., Diaz-Flores, P.E., and Rangel-Mendez, J.R., 2010, Adsorption of cadmium and lead onto oxidized nitrogen-doped multiwall carbon nanotubes in aqueous solution: equilibrium and kinetics, *J. Nanopart. Res.*, 12, 467–480.

Pavan, F.A., Dias, S.L.P., Lima, E.C., and Benvenutti, E.V., 2008, Removal of congo red from aqueous solution by anilinepropylsilica xerogel, *Dyes Pigm.*, 76, 64-69.

Perullini, M., Calcabrini, M., Jobbagy, M., and Bilmes, S., 2015, Alginate/porous silica matrices for the encapsulation of living organisms: tunable properties for biosensors, modular bioreactors, and bioremediation devices, *Mesoporous Biomater.*, 2, 3-12.

Rahman, M.S., and Islam, M.R.., 2009, Effects of pH on isotherms modeling for Cu(II) ions adsorption using maple wood sawdust. *Chem. Eng. J.*, 149:273–80.

Ratner, N., and Mandler, D., 2015, Electrochemical detection of low concentrations of mercury in water using gold nanoparticles, *Anal. Chem.*, 87, 5148–5155.

Rahimi, M. and Vadi, M., 2014, Langmuir, Freundlich and Temkin Adsorption Isotherms of Propranolol on Multi-Wall Carbon Nanotube, *J. Mod. Drug Discov. Drug Deliv. Res.*, 1-3.

Rocher, V., Siaugue, J.M., Cabuil, V., and Bee, A., 2008, Removal of organic dyes by magnetic alginate beads. *Water Research.*, 42(4–5), 1290–1298.

Rodiana, Y., Maulana, H., Marsitoh, S., dan Nurhasni., 2013, Pengkajian Metode Untuk Analisis Total Logam Berat dalam Sedimen Menggunakan Microwave Digestion, *Ecolab.*, 7 (2), 49 – 108.

Rokhati, N., Pramudono., Bambang., Widiasa., Nyoman, S., dan Heru., 2012, *Karakterisasi Film Komposit Alginat dan Kitosan.*, Reaktor. 14.

Sadeek, S.A., Negm, N.A., Hefni, H.H.H., and Abdel Wahab, M.M, 2015, Metal adsorption by agricurtural biosorbents: Adsorption isoterm, kinetic and biosorbents chemical structure, *Int. J. Biol. Macromol.*, 6, 1-13

Sanjay, H.G., A.K. Fataftah, D.S. Walia, and K.C. Srivastava, 1999, Humasorb CsTM: a Humic Acid-Based Adsorbent to Remove Organik and Inorganik Contaminants. Understanding Humic Substances: Advanced Methods, Properties and Applications., The Royal society of Chemistry, Cambridge.

Santoso, S.J., 2001, "Adsorption Kinetics of Cd(II) and Cr(III) by Humic Acid", dalam Prosiding Seminar Nasional Kimia IX, Jurusan Kimia Universitas Gadjah Mada, Yogyakarta.

Santoso, U.T., Irawati, U., Umaningrum, D dan Komari, N., 2007, Pengaruh Pengikatan-Silang Antarmolekul Asam Humat terhadap Kelarutan dan Kemampuannya Mengadsorpsi Pb(II) dan Cd(II), Seminar Nasional Kimia dan Pendidikan Kimia, Semarang.

Sarmento, B., Martins, S., Ribeiro, A., Veiga, F., Neufeld, R., and Ferreira, D., 2006, Development and comparison of different nanoparticulate polyelectrolyte complexes as insulin carriers, *Int. J. Pept. Res. Ther.* 12, 131–138.

Sharifpour, E., Khafri, H.Z., Ghaedi, M., Asfaram, A., and Jannesar, R., 2018, Isotherms and kinetic study of ultrasound-assisted adsorption of malachite green and Pb^{2+} ions from aqueous samples by copper sulfide nanorods

loaded on activated carbon: experimental design optimization, *Ultrason. Sonochem.,* 40, 373–382.

Singh, L., Pavankumar, A.R., Lakshmanan, R., and Rajarao, G.K., 2011, Effective Removal of Cu2+ Ions from Aqueous Medium Using Alginate as Biosorbent, *Ecol. Eng*., 38, 119– 124.

Šmejkalova, D., and Piccolo, A., 2008, Aggregation and disaggregation of́ humic supramolecular assemblies by NMR diffusion ordered spectroscopy (DOSY-NMR), *Environ. Sci. Technol*., 42, 699− 706.

Sonego, J. M., Santagapita, P. R., Perullini, M., dan Jobbágy, M., 2016, Ca(II) and Ce(III) homogeneous alginate hydrogels from the parent alginic acid precursor: A structural study. *Dalton Trans.*, 45(24), 10050–10057.

Stathi, P., and Deligiannakis, Y., 2010, Humic acid-inspired hybrid materials as heavy metal absorbents, *J. Colloid Interface Sci*., 351, 239–247.

Stevenson, F.J., 1994, Humus chemistry: genesis, composition, reactions. Wiley, New York.

Stokke, B., Drager, I., Yuguchi, K., Urakawa, Y., Kajiwara, H., and Kanji, 1997, Small-angle X-ray Scattering and Rheological Characterization of Alginate Gels, *Macromol. Symp.*, 120, 91 - 101.

Su, J., Xie, C., Chen, C., Yu, Y., Kennedy, G., Somorjai, G.A., and Yang, P., 2016, Insights into the mechanism of tandem alkene hydroformylation over a nanostructured catalyst with multiple interfaces, *J. Am. Chem. Soc.*, 138(36), 11568–11574.

Sudiono, S., 2001, Sifat Asam-Basa Asam Humat dan Interaksinya dengan Kromium(III), Tembaga(II), Kobalt(II) dan Nikel(II), *Tesis*, FMIPA, Universitas Gadjah Mada, Yogyakarta.

Sudirjo, E., 2005, Penentuan Distribusi Benzena Toluena pada Kolom Adsorpsi Fixed Bed Karbon Aktif, *Skripsi S1*, Jurusan Gas dan Petrokimia Fakultas Teknik Universitas Indonesia, Jakarta.

Swain, S.K., Patnaik, T., Patnaik, P.C., Jha, U., and Dey, R.K., 2012, Development of New Alginate Entrapped Fe(III)–Zr(IV) Binary Mixed Oxide for Removal of Fluoride from Water Bodies, *Chem. Eng. J.*, 215– 216 (2013) 763–771.

Tamez, C., Hernandez, R., and Parsons, J., 2016, Removal of Cu (II) and Pb (II) from aqueous solution using engineered iron oxide nanoparticles, *Microchem. J.*, 125, 97–104.

Tanasale, M., Killy, A., dan Laratmase, M., 2012, Kitosan dari Limbah Kulit Kepiting Rajungan (Portunus sanginolentus L.) sebagai Adsorbrn Zat Warna Biru Metilena, *J. Natur Indones.*, 14, 165-171.

Tavassoli-Kafrani E., Shekarchizadeh H., and Masoudpour Behabadi M., 2016, Development of edible films and coatings from alginates and carrageenans, *Carbohydr. Polym.,* 137, 360–374.

Tokuyama, H., Hisaeda, J., Nii, S., and Sakohara, S., 2010, Removal of heavy metal ions and humic acid from aqueous solutions by co-adsorption onto thermosensitive polymers, *Sep. Purif. Technol.,* 71, 83–88.

Tugba, S.K., Esengul, K., Sabrie, P.O., and Esin, K., 2010, Preparation and Characterization of P2FAn/PVDF Composite Cation-Exchange Membranes for The Removal of Cr(III) and Cu(II) by Donnan Dialysis, *React. Funct. Polym.*, 70, 900–907.

Vimonses, V., Lei, S., Jin, B., Chow, C.W.K. and Saint, C., 2009, Kinetic Study and Equilibrium Isotherm Analysis of Congo Red Adsorption by Clay Materials, *Chem. Eng. J.*, 148, 354.

Vucinic D, Miljavonic I, RosicA and Lazic P, 2002, Effect of Na2O/SiO2 mole Ratio on the Crystal Type of Zeolite Synthesized from Coal Fly Ash, J. *Serb. Chem. Soc.*, 68(6), 471-478.

Wang, S., and Baxter, L., 2007, Comprehensive Study of Biomass Fly Ash in Concrete : Strength, Microscopy, Kinetics and Durability, *Fuel Processing Technology.*, 88 : 1165-1170.

Wang, H., Zhu, J., Fu, Q., Hong, C., Hu, H., and Violante A., 2016, Phosphate adsorption on uncoated and humic acid-coated iron oxides, *J Soils Sediments.*, 16, 1911-20.

Wang, Y.J., and Ma, J., 2012, Research progress on natural organic matter humic acid in water environment. *J. Ecol. Env. Sci.*, 21(6), 1155-1165.

Wang, J.L., 2002, *Microbial Immobilization Techniques and Water Pollution Control*, Science Press, Beijing, China, 233-247.

Wang, J., Ji, Y., Ding, S., Ma, H., and Han, X., 2013, Adsorption and desorption behavior of tannic acid in aqueous solution on polyaniline adsorbent. Chinese, *J. Chem. Eng.*, 21, 594–599.

Wardani, R.J., Muzzaky, dan Taftazani, A., 2007, Model Adsorpsi Langmuir Pada Perpindahan Logam Ti, V, Mn Sistem Air Sedimen di sepanjang Sungai Code, Yogyakarta, *prosiding PPI-PDIPTN Pustek Akselerator dan Proses Bahan – BATAN*, 10 Juli 2007, Yogyakarta.

Wicaksono, I., dan Effendi, A,J., 2012, Adsorpsi Logam Krom dari Larutan Krom (III) Sulfat Menggunakan Electric Arc Furnace Slag (EAFS)", *Tesis*, Program Magister Teknik Lingkungan ITB.

Widowati, W., Astiana, S., dan Raymond, J.R., 2008, *Efek Toksik Logam Penegahan dan Penanggulangan Pencemaran*, Penerbit Andi, Yogyakarta.

Williams, C.J., Aderhold, D., and Edyvean, G.J., 1998, Comparison between biosorbents for the removal of metal ions from aqueous solutions, *Water Res*, 32, 216–224.

Wu, P., Zhang, Q., Dai, Y., Zhu, N., Dang, Z., Li, P., Wu, J., and Wang, X., 2011. Adsorption of Cu(II), Cd(II) and Cr(III) ions from aqueous solutions on humic acid modified Ca-montmorillonite., *Geoderma,* 164, 215-219.

Xiong, C., and Yao, C., 2009, Study on the adsorption of cadmium(II) from aqueous solution by D152 resin, *J. Hazard. Mater.*, 166, 815–820.

Yan, W.L., and Bai, R., 2005, Adsorption on lead and humic acid on chiitosan hydrogel beads, *Water Res.,* 39 : 668-698.

Yin, W., Zhao, C., Xu, J., Zhang, J., Guo, Z., and Shao, Y., 2019, Removal of Cd (II) and Ni (II) from aqueous solutions using activated carbon developed from powder-hydrolyzed-feathers and Trapa natans husks, *Colloids Surfaces A*, 560, 426–433.

Yu, K., Ho, J., McCandlish, E., Buckley, B., Patel, R., Li, Z., and Shapley, N.C., 2013, Copper ion adsorption by chitosan nanoparticles and alginate microparticles for water purification applications. Colloids Surfaces A Physicochem, *Eng. Asp.*, 425, 31–41.

Zhang, Z., Moghaddam, L., O'Hara, I.M., and Doherty, W.O.S., 2011, Congo red adsorption by ballmilled sugarcane bagasse, *Chem. Eng. J.*, 178, 122-128.

Zhang, Y., Zhao, L., Guo, R., Song, N., Wang, J., Cao, Y., Orndorff, W., and Pan, W.P., 2015, Mercury adsorption characteristics of HBr-modified fly ash in an entrained-flow reactor, *J. Environ. Sci.*, 33, 156–162.

Zhang, X., Huang, Q., Deng, F., Huang, H., Wan, Q., Liu, M., and Wei, Y., 2017, Mussel-inspired fabrication of functional materials and their environmental applications: progress and prospects, *Appl. Mater.*, 222–238.

Zhou, Q., Duan, Y., Zhu, C., Zhang, J., She, M., Wei, H., and Hong, Y., 2015, Adsorption equilibrium, kinetics and mechanism studies of mercury on coal-fired fly ash, *Korean J. Chem. Eng.*, 32, 1405–1413.