

DAFTAR PUSTAKA

- Anwar, 1994, Konversi Eugenol Menjadi Senyawa Lain yang Lebih Berdaya Guna, *Disertasi*, FMIPA Universitas Gadjah Mada, Yogyakarta
- Babcock W.C, R.W. Baker, D.J. Kelly, J.C. Kleiber, H.K. Lonsdale, 1979, *Coupled Transport System for Control of Heavy Metal Pollutants*. Industrial Enviromental Research Laboratory Office of Research and Development U.S . Enviromental Protection Agency Cincinnati, Ohio.
- Badmus M.A.O, Audu and B.U. Anyata, 2007, Removal of Heavy Metal Industrial Wastewater Using Hydrogen Peroxide, *African Journal of Biotechnology*, Vol. 6 (3), 238-242.
- Baes, F. C., and Mesmer, R. E., 1976, *The Hydrolysis of Cations*, John Willey, New York.
- Basolo, F. And Johnson, R., 1964. *Coordination Chemistry*, W. A. Benjamin Inc., New York, 81-119).
- Behr, J.P., Kirch, M., Lehn, J.M., 1985, Carrier-Mediated Transport through Bulk Liquid Membranes Dependence of Transport Rates and Selectivity on Carrier Properties in a Diffusion-Limited Process, *J. Am. Chem. Soc.*, 107, 241-246.
- Biermann Christopher J., and Ramani Narayan, 1990, Grafting of Poly(ethylenimine) onto Mesylated Cellulosa Acetate, Poly(methyl methacrylate) and Poly(vinyl chloride), *J. Carbohydrate Polymers*, 12, 323-327.
- Billmeyer, J.R, 1984, *Textbook of Polymer Science*, John Wiley and Sons Inc., New York.
- Bishop DF, 1968, Hydrogen Peroxide Catalytic Oxidation of Refractory Organic in Municipal Wastewaters, *Industrial Engr. Chem. Process Design and Devpt.*, 7, 1110-1117.
- Bouabdallah Ibrahim, Ismail Zidane, Brahim Hacht, Rachid Touzani, and Abdelkrim Ramdani, 2006, Liquid-liquid Extraction of copper(II), cadmium(II), and lead(II) using tripodal-N donor pyrazole Ligands, *Arkivoc* (xi), 59-65.
- Bryan, S. E., Tipping, E., Taylor, J. H., 2002, Comparison of measured and modelled copper binding by natural organic matter in freshwater, *Comp. Biochem. Physiol. Part C* 133, 37- 49.
- Bukhari Naheed, M. Ashraf Chaudry, M. Mazhar, 2006, Triethanolamine-cyclohexanone Supported Liquid Membranes Study for Extraction and

- Removal of Nickel Ions from Nickel Plating Wastes, *J. Memb. Sci.* 283, 182-189.
- Burgstahler Albert W. and Leonard R. Worden, 1973, Organic Syntheses, p.251, Department of Chemistry, University of Kansas, Lawrence, Kansas.
- Canet L., P. Seta, 2001, Extraction and Separation of Metal Cations in Solution by Supported Liquid Membrane Using Lasalocid A, *Pure Appl. Chem.*, 73, 2039-2046.
- Canizares P., Angel Perez, Rafael Camarillo, Maria Teresa Villajoz, 2005, Improvement and Modelling of a batch polyelectrolyte enhanced ultrafiltration process for the recovery of copper, *J. Desalination*, 184, 357-366.
- Cao J., K. C. Lam, R. W. Dawson, W. X. Liu, S. Tao, 2004, The effect of pH, ion strength and reactant content on the complexation of Cu^{2+} by various natural organic ligands from water and soil in Hong Kong, *Chemosphere*, 54, 507-514.
- Carballo R., A. Castineiras., B. Covelo., E. Garcia-Martinez., J. Niclos., E.M. and Vazquez-Lopez, 2004, Solid State Coordination Chemistry of Mononuclear Mixed-Ligand Complexes of Ni(II), Cu(II) and Zn(II) with α -Hydroxycarboxylic Acids and Imidazole, *Polyhedron*, 23, 1505-1518.
- Carey Francis A. and Richard J. Sundberg, 2000, *Advanced Organic Chemistry*, Part A: Structure and Mechanisms, ed^{4th}, New York.
- Caykara T., Recai Inam, Zulfiye Ozturk, and Olgun Guven, 2004, Determination of the complex formation constants for some water-soluble polymers with trivalent metal ions by differential pulse polarography, *Colloid Polym Sci* 282, 1282-1285.
- Chaudry. M. A., Naheed Bukhari, M. Mazhar, 2007, Coupled Transport of Chromium(III) Ions Across Triethanolamine/Cyclohexanone Based Supported Liquid Membranes for Tannery Waste Treatment, *Separation and Purification Technology*, 195, 205-212.
- Chen Chun-Chung and Elena E. Dormidontova, 2004, Supramolecular Polymer Formation by Metal-Ligand Complexation: Monte Carlo Simulation and Analytical Modeling, *JACS Articles*.
- Cleij Marco C., Paolo Scrimin, Paolo Tecilla, Umberto Tonellato. 1997. *Efficient and Highly Selective Copper (II) Transport across a Bulk Liquid Chloroform Membrane Mediated by Lipophilic Dipeptida*. Department of Chemical Sciences, University of Trieste, Trieste, Italy



- Cosar T., R. Ziyadanogullari, 1998, Separation of Molybdenum, Vanadium and Nickel by Liquid-Liquid Extraction. *Turk. J. Chem.*, 22, 379-386.
- Cotton, F.A dan Wilkinson, G., 1989, *Kimia Anorganik Dasar*, cetakan pertama, terjemahan Suharto, S., UI press, Jakarta.
- Courduvelis, Constantine I., George C., Gallager, 1981, *Selective Removal of Copper or Nickel from Complexing Aqueous Solution*, The Delphion Integrated View, United State of America.
- Cowan, J. A. 1997. *Inorganic Biochemistry: An Introduction*, Second Edition, Wiley-VCH, Inc.
- Cowd, M.A, 1982, *Polymer Chemistry*. John Murray Ltd, London, Diterjemahkan oleh Harry Firman, 1991, Kimia Polimer. ITB Bandung.
- Cram, J. D., and Hammond, S. G., 1964, *Organic Chemistry*, Second Edition, McGraw Hill-Book Company, London.
- Chrisstoffels, L.A.J., de Jong, F., Reinhoudt, D.N., 1996, Mechanistic Studies of Carrier-Mediated Transport Through Supported Liquid Membranes. In: Bartsch, R.A. and Way, J.D., Chemical separations with liquid membranes (eds.), ACS Symposium Series, 642, 20, *American Chemical Society*.
- Christian G. D., 1994, *Analytical Chemistry*. fifth edition, John Wiley and Sons. Inc, New York.
- Deep Akash, Paulo F. M. Correia, and Jorge M. R. de Carvalho, 2007, Liquid-Liquid Extraction and Separation of a Macro Concentration of Fe^{3+} , *Ind. Eng. Chem. Res.*, 46 (17), 5707 -5714.
- Diallo Mamadou S., Lajos Balogh, Abdul Shafagati, James H. Johnson , Jr., William A. Goddard, and Donald A. Tomalia, 1999, Poly(amidoamine) Dendrimers: A New Class of High Capacity Chelating Agents for Cu(II) Ions, *J. Environ. Sci. Technol.*, 33 (5), 820-824.
- Diamond, R.M., and Tuck, D.G. *Extraction of Inorganic Compounds into Organic Solvent*, dalam Cotton F.A, 1966, Progress in Inorganic Chemistry, Vol. 2, John Wiley and Sons , New York, 109-140.
- Dogra, S.K., dan Dogra, S., 1990, *Kimia Fisik dan Soal-Soal*, UI-Press, Jakarta, 645-655
- Dugo G, La Pera L, Lo Turco V, Di Bella G, Salvo F, 2004, Determination of Ni (II) in Beverage Without Any Sample Pretreatment by Adsorptive Stripping Chronopotentiometry (AdSCP), *J. Agric Food Chem.*, 52 (7), 1829-1834.

- Dzyazko, Y.S., 2006, Purification of a Diluted Solution Containing Nickel Using Electrodeionization, *Desalination*, 198, 47-55.
- Ferraz H. C, L. T. Duarte, M. Di Luccio T. L. M. Alves, A. C. Habert and C. P. Borges, 2007, Recent Achievements In Facilitated Transport Membranes For Separation Processes, *J. Braz. Chem. Engin.*, 24(1), 101-117.
- Fessenden, Ralph J. and Joan S. Fessenden, 1984, *Kimia Organik I*, Penerjemah: A. Hadyana Pudjaatmaka, Erlangga, Jakarta.
- Freiser, H., *Solvent Extraction*, dalam Barry, K.L., 1973, An Introduction to Separation Science, John Wiley and Sons, New York, 247-263.
- Furniss, B.S., Hannaford, A.J., Rogers, V., Smith, P.W.G., and Tatchell, A. R., 1978, *Vogel's Textbook of Practical Organic Chemistry. Including Qualitative Organic Analysis*, Fourth Edition, Longman Group Limited, New York.
- Gajda Bernadeta and Mariusz B. Bogazki, 2007, The Effect of Tributyl Phosphate on the Extraction of Nickel(II) and Cobalt(II) Ions with Di(2-Ethylhexyl Phosphoric Acid), *J. Physicochemical Problems of Mineral Processing*, 41, 145-152.
- Gawronski R., P. Religa, 2007, Transport mechanism of chromium(III) through the unmixed bulk liquid membrane containing dinonylnaphthalenesulfonic acid as carrier, *J. Memb. Sci.*, 289, 187-190.
- Geckeler, K.E., 2001, Polymer-metal complexes for environmental protection. Chemoremediation in the aqueous homogeneous phase, *Pure Appl. Chem.*, 73, 129-136.
- Gi Xue, DAI Qinpin, DING Jianfu, and WU Peiyi, 1989, Coordination Polymerization of Benzotriazole on the Surface of Metallic Copper. *Chinese J. of Polym. Sci.*, 7, (3), 239-244.
- Gil Eduardo Pinilla and Peter Ostapczuk, 1999, *Nikel and Cobalt Determination by Constant Current Potentiometry (Method Development)*, Institute of Applied Physical Chemistry, Research Center, Germany.
- Goswami Anupama and A. K. Singh., 2004, Hyperbranched polyester having nitrogen core: Synthesis and applications as metal ion extractant, *Reactive & Functional Polymer*, 61, 255-263.
- Gotfryd Leszek, 2005, Solvent Extraction of Nickel(II) Sulphate Contaminants, *J. Physicochemical Problems of Mineral Processing*, 39, 117-128.

- Gu Shuxiang, Yuanda Yu, Dingsheng He, and Ming Ma, 2006, Comparison of transport and separation of Cd(II) between strip dispersion hybrid liquid membrane (SDHLM) and supported liquid membrane (SLM) using tri-n-octylamine as carrier, *J. Separation and Purification Technology*, 51, 277-284.
- Hayashita, T., Yamasaki, K., Kunogi, K., Hiratani, K., Huang, X., Jang, Y., McGowen, D.E., and Bartsch, R.A., 1994, Proton-Ionizable Acyclic Dibenzopolyethers and Their Polymers for Use in Selective Lead (II) Separation, *Supramolecular Chem.*, 6, 347-352.
- Hawley, G.G., 1971, *The Condensed Chemical Dictionary*, eight edition, Van Nostrand Reinhold Company, New York.
- Helrich, K., 1990, *Official Methods of Analysis of the Association of Official Analytical Chemist*, 15th ed., Erlington, Virginia USA.
- Heng, L.Y., E.A.H. Hall., 2000, Producing Seft Plastizing Ion Selective Membrane, *J. Anal. Chem.*, 72, 42-51.
- Hiratani, K., Yamaguchi, K., Sugihara, H., 1991, Synthesis and Properties of Noncyclic Polyether Compounds. XVIII. A Noncyclic Polyether Carrier Exhibiting Magnesium Ion-Selective Transport, *J. Am., Chem., Soc.*, 81, 816.
- Hiratani, K. and Kasuga, K., 1996, *Chemical Separation with Liquid Membranes*, Ed. Bartsch, R.A. and Way, J.D. ACS Symposium Series 642, Eds. American Chemical Society, Washington D. C.
- Hiratani Kazuhisa, Toshikazu Takahashi, Hideki Sugihara, Kazuyuki Kasuga, Kyoko Fujiwara, Takahashi Hayashita, and Richart A Bartreh, 1997, Selective Liquid Membrane Transport of Lead (II) by an Acycle poliether Dicarboxylic Acid Ionophore. *J. Anal. Chem.*, 69, 3002-3007.
- Hiratani, K., Hirose, T., Kasuga, K., Saito, K., 1992, N-98Quinolyl-2-(2-pyrrdylmethyl)malonamide Derivatives as a Novel Cu(II) Carrier with High Efficiency and Selective for Proton-Driven Uphill Transport through Liquid Membranes, *J. Org. Chem.*, 57, 7083-7087.
- Hodgson, E. and Levi, P.E., 1997, *A Texbook of Modern Toxicology*, 2nd Ed., 262-269, McGraw-Hill, New York.
- Huang, Tingchia and Jaukai Wang, 1993, Selective Transport of Metal Ions Through Cation Exchange Membrane in the Presensce of a Complexing Agent, *J. Article Industrial and Engin. Chem. Research*, 32, 133-139.



- Izatt R. M., G. C. LindH, R. L. Bruening, J. S. Bradshaw, J. D. Lamb, and J. J. Christensen, 1986, Design of Cation Selectivity into Liquid Membrane Systems using Macrocyclic Carrier. *J. Pure & Appl. Chem.*, 58, (11), 1453-1460.
- Inczedy, J. D., 1978, *Analytical Application of Complex Equilibria*. John Wiley and Sons, New York.
- Jyothi, A., and Rao, G.N., 1988, Studies in Extraction of Metals with 3-Phenyl-4-Benzoyl-5-isoxazolone(HPBI), *Bull. Chem. Soc. Jpn.*, 61, 4497-4499
- Kakoi Takahiko, Toshikazu Toh, Fukiko Kubota, Masahiro Goto, Seiji Shinkai and Fumiyuki Nakashio, 1998, Liquid-liquid Extraction of Metal Ions with a Cyclic Ligand Calixarene Carboxyl Derivative. *J. Anal. Sci.*, 14, 501-506.
- Keshmirizadeh E., H. Modarress, A. Eliassi, and G. A. Mansoori, 2003, A New Theory for Polymer/Solvent Mixtures Based on Hard-Sphere Limit. *J. European Polymer*, 39, 1141-1150.
- Khopkar, S. M., 1990, *Konsep Dasar Kimia Analitik*, UI Press, Jakarta.
- Kordosky Gary, Mike Virnig, and Murdoch Mackenzie, 2003, Solvent Extraction –Reagent and Selectivity Control. Internet, <http://www.chem.davidson.edu/projects/che126/2003/ismiller>, diakses pada tanggal 12 September 2008.
- Kozlowski Cezary A., 2006, Facilitated transport of metal ions through composite and polymer inclusion membranes. *Desalination*, 198, 132-140.
- Kricheldorf, H. R., 1992, *Handbook of Polymer Synthesis*, Part A, Publisher New York.
- Kurth D.G., 2008, Metallo-supramolecular modules as a paradigm for materials science. *Sci. Technol. Adv. Mater*, 9, 141-153.
- Lee Chang Lyoul, Nam Goo-Kang, Young Sun-Chao, Jae-Suk Lee, Jang-Joo Kim., 2002, Polymer Electrophosphorescent Device: Comparison of Phosphorescent Dye Doped and Coordinated System. *Elsevier*, 21, 119-123.
- Lee Jae Wook, Ying Qi Louie, Daniel P. Walsh, and Tae Chang, 2002, Nitrophenol Resins for Facile Amide and Sulfonamide Library Synthesis. *J. Comb. Chem.*, A-D.
- Leu Wen-Tsuen and Sheng-Huei Hsiao, 2006, Synthesis and Properties of Novel Aromatic Poly(ester-imide)s bearing 1,5-bis(benzoyloxy)naphthalene units. *Elsevier*, 42, 328-335.

- Li, G., and Pickup, P.G., 2002, Ion Transport in Poly(3,4-ethylenedioxythiophene)-poly(styrene-4-sulfonate) Composites, *Chinese Chemical Letters*, 13:10, 1003-1004.
- Liao, X. C., wang, X. W., Tao, J. C., 2002, Liquid Membrane Transport Behavior of Functional Substituted Crown Ethers for Amino Acid, *Chinese Chemical Letters*, 13:10, 1003-1004.
- Lindoy L. F., 1990, *The Chemistry of Macrocycles Ligand Complexes*, First Paperback Ed., 166-180, Cambridge University Press, Cambridge.
- Maggalatung Bachtiar, 2003, *Peranan Ilmu Kimia pada Pabrik Peleburan Ferronikel*, PT. Aneka Tambang Tbk Unit Bisnis Pertambangan Nikel Operasi Pomalaa. Pomalaa, Sulawesi Tenggara.
- Maruyama, K., Tsukube, H., Araki, T., 1980, New Membrane Carrier for Selective Transport of Metal Ions, *J. Am. Chem. Soc.*, 102:9, 3246-3247
- Miner, R. A., and Keith, L., 1982, *Water Analysis*, Volume I, Inorganic Species, Part I, Academic Press. Inc., New York
- Muallem Al Hasan A, Mohamed I.M. Wazeer, Sk. Asrof Ali, 2002, Synthesis and solution properties of a new ionic polymer and its behavior in aqueous two-phase polymer systems, *J. Polymer*, 43, 1041-1050.
- Mulder M., 1991, *Basic Principles of Membrane Technology*. Kluwer Academic Publisher, Dordrecht.
- Nakamoto Kazuo, 1986, *Infrared and Raman Spectra of Inorganic and Coordination Compounds*, Fourth Edition, John Wiley and Sons.
- Nezhadali A., M. Hakimi, and M. Heydari, 2008, Competitive Bulk Liquid Membrane Transport and Extraction of Cu(II), Ni(II), Zn(II) and Mn(II) Cations using 5-Methyle 4-[thiophen-2-yl-methylen-amino]-3-thio-oxo-1,2,4-triazol -5-one and phthalic dicarboxaldehyde, *E-J. of Chem.*, 5, (1), 52-57.
- Nghiem Long D, Patrick Mornane, Ian D. Potter, Jilska M. Perera, Robert W. Cattrall, Spas D. Kolev, 2006, Extraction and transport of metal ions and small organic compounds using polymer inclusion membranes (PIMs), *J. Memb. Sci.*, 281, 7- 41.
- Nishihama Syouhei, Go Nishimura, Takayuki Hirai, and Isao Komasaawa, 2003, Separation and Recovery of Cr(VI) from Simulated Plating Waste Using Microcapsules Containing Quaternary Ammonium Salt Extractant and Phosphoric Acid Extractant, *Ind. Eng. Chem. Res.*, 43 (3), 751 -757.

- Oppelt E. Timothy, 1992, *Guide for Conducting Treatability Studies Under Cercla Solvent Extraction*, Risk Reduction Engineering Laboratory, Washington D.C.
- Ouejhani A., M. Dachraout, G. Lalleve, and J. F. Fauvarque, 2003, Hexavalent Chromium Recovery by Liquid-Liquid Extraction with Tributylphosphate from Acidic Chloride Media, *J. Anal. Sci.*, 19, 11, 1499-1503.
- Pospiech Beata, Wladyslaw Walkowiak, and Michal J. Wozniak, 2005, Application of TBP in Selective Removal of Iron (III) in Solvent Extraction and Transport Through Polymer Inclusion Membrane Processes, *Physicochemical Problems of Mineral Processing*, 39, 89-98.
- Radi Smaail, Abderrahman Yahyi, Abdelkrim Ramdani, Ismail Zidane, and Ibrahim Hacht, 2006, A new tetrapyrazolic macrocycle. Synthesis and its use in extraction and transport of K^+ , Na^+ , and Li^+ . *Tetrahedron*, (62) 9153-9155.
- Rice N. M., H. M. N. H. Irving, M. A. Leonard, 1993, Nomenclature for Liquid-liquid Distribution (Solvent Extraction). *J. Pure & Appl. Chem*, 65(11), 2373-2396.
- Rosen, S.L., 1993, *Fundamental Principles of Polymeric Materials*, Second Edition, John Wiley and Sons Inc., New York
- Saf Ahmet O., Sabri Alpaydin, Abdulkadir Sirit, 2006, Transport Kinetic of Chromium(VI) Ions Through a Bulk Liquid Membrane Containing p-ter-butyl calyx[4]arene 3-morpholino propyl diamide derivative. *J. Memb. Sci.*, 283, 448-455.
- Sakamoto H, Takagaki H, Nakamura M, Kimura K., 2005, Photoresponsive Liquid Membrane Transport of Alkali Metal Ions Using Crowned Spirobenzopyran, *J. Anal. Chem.*, 77 (7), 1999-2006.
- Santarosa, V.E., F. Peretti., V. Caldart., J. Zoppas., M. Zeni, 2002, Study of ion-selective membrane from electrodialysis removal of industrial effluent metals II: Zn and Ni. *Desalination*, 149, 389-391.
- Schubert Ulrich S., Christian Eschbaumer, and Christian H. Weidl, 1999, Design of Supramolecular Metal Complexing Polymer: Synthesis, Complexation, of Polymerization of 5,5'' bisfunctionalized Terpyridine Building Blocks, *J. Designed Monomers and Polymer*, 2, (3), 185-198.
- Setyowati, L., 1998, Sintesis Poli (eugenol sulfonat) dan Pemanfaatannya untuk Ekstraksi Logam Alkali, *Tesis*, Universitas Gadjah Mada, Yogyakarta.



- Sharma, R. K., 2001, Design, Synthesis and Application of Chelating Polymers for Separation and Determination of Trace and Toxic Metal Ions, A Green Analytical Method, *Pure Appl. Chem.*, 73,181-186.
- Shemirani F., S. D. Abkenar, R. R. Kozani, M. S. Niasari, and A. A Mirrohandel, 2003, The application of Cloud Point Extraction for the Preconcentration and Speciation of Chromium by Flame Atomic Absorption Spectrometry, *J. Canadian Anal. Sci. and Spectroscopy*, 49(1), 31-36.
- Shiau, R. J., R. L. Smith, and B. Avellar, 2000, Effect of steam Explosion Processing and organic acid on CCA removal was treated wood waste, *Wood Sci. Technol.*, 34, (5), 377-388.
- Shuling Gong, LU Xueran, LU Xianming and CHEN Yuanyin, 1995, Linear Polysiloxane with Benzo-18-Crown-6 Moieties as Liquid Membrane Carrier, *J. Chinese Polymer Sci.*, 2, 173-179.
- Silva J. E., A. P. Paiva, D. Soares, A. Labrincha, and F. Castro, 2005, Solvent Extraction applied to the recovery of heavy metals from galvanic sludge, *J. Hazardous Materials*, 120, 113-118.
- Silverstein, R. M., Bassler, G. C., and Morrill, T. C., 1991, *Spectrometric Identification of Organic Compounds*, 117-118, 5th Edition, John Wiley & Sons, Inc., Singapore.
- Siswanta, D., 1993, Design and Synthesis of Selective Ammonium Ionophores for An Ion-Selective Electrode, *Thesis*, Keio University, Keio.
- Skjutare, L., Ave, A., Bjorling, G., Reinhard., and Ryberg, J., 1971, *Separation of Iron, cobalt and Nickel from Scrap Alloy by a Solvent Extraction Proces*, International solvent extraction Conference, Den Haag
- Sorenson, W.R and T.W. Campbell, 1968, *Preparative Methods of Polymer Chemistry*, International, New York.
- Sriram, S., Manchanda, V. K., 2001, *Transport of Metal Ionacross a Suported Liquid Membrane (SLM) using Dimethyl Dibutyl Tetradecyl-1,3-Malonamide(DMDBTDMA) as The Carrier*, Rhabha Atomic Research Centre, Pune.
- Steven, M.P., 1975. *Polymer Chemistry An Introduction*, Addison-Wesley, Publishing Company Inc., London.
- Stevenson, F. J., Fitch, A., Brar, M. S., 1993, Stability of constants of Cu(II) humate complexes: comparison of select models, *J. Soil Sci.*, 155, 77-91.

- Stum, W., dan Morgan, J.J., 1996, *Aquatic Chemistry : Chemical Equilibria and Rates in Natural Waters*, edisi 3, John Wiley and Son, Inc., New York.
- Tayeb, A., Tsien, H.H., Goetz, Grandmonc, G.J., Brunette, J.P., and Leroy M. J. F., 1990, Analytical Spectroscopy Study and Zinc Extraction With 1-10-bis (1-Phenyl-3-Methyl-5-Hidroxy-4-Pyrazolyl) 1-10 decanedione, *Solvent Exc. And Ion Exch.*, 8,1. 1-34.
- Sykes Peter, 1989, *Pemuntun Mekanisme Reaksi Kimia Organik*, PT Gramedia, Jakarta.
- Teppen, B. J., David M. Miller, 2006, Hidration Energy Determines Isovalent Cation Exchange Selectivity by Clay Minerals, *Soil Science Society of America Journal*, 70, 31-40.
- Thomas R. Dulski, 1999, *Trace Elemental Analysis of Metals. Methods and Techniques*, Marcel Dekker Inc. New York.
- Tomaszewski, John J., Koch, Kenneth A., 1985, *Selective Nickel Stripping Compositions and Method of Stripping*, The Delphion Integrated View, United State of America.
- Tuelue M., and K.E. Geckeler, 1999, Synthesis the DTPA-polyester for Environmental Protection, *Polym. Int.*, 48, 909-914.
- Wan, C.C., Chiang, S., Corsini, A., 1985, Two-Column Method for Preconcentration of Trace Metals in Natural Waters on Acrylate Resin. *J. Anal. Chem.*, 57, 719-723.
- Wang Bing and Michael R. Wasielewski, 1997, Design and Synthesis of Metal Ion- Recognition-Induced Conjugated Polymer: An Approach to Metal Ion Sensory Materials, *J. Am. Chem. Soc.*, 119, 12-21.
- Weng Liping, Willen H. Van Riemsdijk, and E. J. M. Temminghoff, 2005, Kinetic Aspects of Donnan Membrane Technique for Measuring Free Trace Cation Concentration, *J. Anal. Chem.*, 77, 2852-2861.
- Wuryanti, 1998, Polimerisasi Kationik Eugenol dan Sifat Pertukaran Kation Poligaramnya, *Tesis*, FMIPA Universitas Gadjah Mada, Yogyakarta.



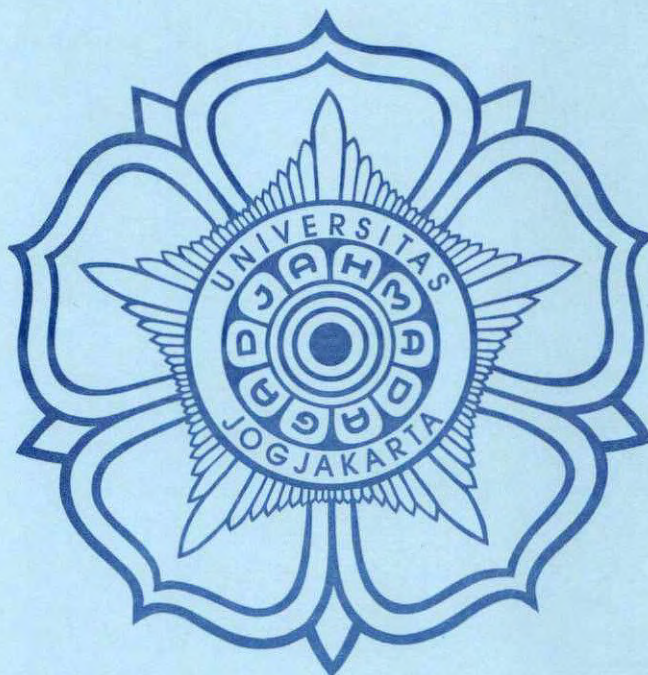
UNIVERSITAS
GADJAH MADA

**SINTESIS AMIDA, ESTER DAN ASAM TURUNAN POLLEUGENOL DAN KAJIAN APLIKASINYA UNTUK
PENGOMPLEKS LOGAM**

PADA METODE PEMISAHAN EKSTRAKSI CAIR-CAIR DAN TRANSPOR MEMBRAN CAIR RUAH

La Harimu, Prof. Dr. Sabirin Matsjeh

Universitas Gadjah Mada, 2019 | Diunduh dari <http://etd.repository.ugm.ac.id/>



Lampiran 1. Persentase ion logam yang terekstraksi terhadap variasi pH, rasio mol ligan/logam, waktu ekstraksi dan konsentrasi ion logam menggunakan engemban ion PEAS

a. Variasi pH

Variasi pH	Persentase ion logam yang terekstraksi (%)					
	Fe(III)	Cr(III)	Ni(II)	Co(II)	Cu(II)	Pb(II)
2	85,81					
3	100	63,8	24,4	21,2	65,8	39,1
4	100	77,1	28,4	23,8	78,4	86,7
5	100	85,7	32,3	29,5	85,3	94,7
6	94,3	78,1	29,6	28,2	87,0	100

b. Rasio mol ligan/logam

Rasio mol ligan/logam	Persentase ion logam yang terekstraksi (%)					
	Fe(III)	Cr(III)	Ni(II)	Co(II)	Cu(II)	Pb(II)
2,5	64,1					
4	96,9					
5	100	81,1	28,6	20,9	48,9	81,9
10	100	100	41,3	38,0	88,5	85,6
15	100	96,3	40,5	36,3	92,3	100
20	100	93,2	38,1	34,5	91,0	98,1

c. Rasio mol ligan/logam (awal) terhadap rasio mol ligan/logam (fasa organik)

Rasio mol ligan/logam (awal)	Rasio mol ligan/logam (fasa organik)					
	Fe(III)	Cr(III)	Ni(II)	Co(II)	Cu(II)	Pb(II)
5	4,90	6,71	17,46	70,86	7,34	5,64
10	9,81	9,54	24,17	48,72	10,89	10,80
15	14,71	14,31	36,97	66,81	16,59	13,86
20	19,61	20,47	52,38	115,48	22,52	18,49