

## DAFTAR PUSTAKA

- Abdulrachman, S dan Sembiring, H., 2006, Penentuan Takaran Pupuk Fosfat untuk Tanaman Padi Sawah, *Iptek Tanaman Pangan*, 1(1), 79–87.
- Agusman, Fransiska, D., Nurhayati, Irianto, H. E., Priambudi, P., Abdullah, A. H. D., Nissa, R. C., Asri, P. P. P., Masruchin, N., Sedayu, B. B., Hakim, A. R., Wullandari, P., and Handoyo, W. T., 2021, Effects of Water on Hydrophobization and Mechanical Properties of Thermoplastic Agar, *IOP Conference Series: Earth and Environmental Science*, 715(1), 012057.
- Ahren, L.H., 1952, The Use of Ionization Potentials-L. Ionic Radii of The Elements, *Geochim. Cosmochim. Acta* 2, 155-169.
- Akalin, G.O., and Pulat, M., 2018, Preparation of Sodium Carboxymethyl Cellulose Hydrogels for Controlled Release of Copper Micronutrient. *Technology, Engineering & Mathematics (EPSTEM)*, 2(2), 25–34.
- Akbar, M.I., 2018, Pembuatan Karboksimetil Selulosa-Gliserol-N, P, K-Zeolit sebagai Model Pupuk Lepas-lambat N, P, K., *Skripsi*, Program Studi S1 Kimia MIPA Universitas Gadjah Mada, Yogyakarta.
- Aprillisyandy, T.H., 2017, Kinetika Lepas-lambat Fe(III) dan Cu(II) dari Komposit Alginat/Zeolit-Fe(III)-Cu(II), *Skripsi*, Program Studi S1 Kimia MIPA Universitas Gadjah Mada, Yogyakarta.
- Azizati, Z., 2017, Pembuatan Karboksimetil Selulosa-Kolin Klorida-Urea-Bentonit sebagai Model Pupuk Nitrogen Lepas Lambat, *Tesis*, Program Magister Kimia MIPA Universitas Gadjah Mada, Yogyakarta.
- Azeem, B., KuShaari, K., Naqvi, M., Keong, L. K., Almesfer, M. K., Al-Qodah, Z., Naqvi, S. R., and Elboughdiri, N., 2020, Production and Characterization of Controlled Release Urea using Biopolymer and Geopolymer as Coating Materials. *Polym*, 12(2).
- Barker, A.V., and Pilbeam, D.J., 1937, *Handbook of Plant Nutrition*, London New York: Taylor and Francis Group.
- Baller, M. A., Pacheco, P. D. G., Peres, F. M., Monti, M., and Carciofi, A. C., 2018, The Effects of In-Barrel Moisture on Extrusion Parameters, Kibble Macrostructure, Starch Gelatinization, and Palatability of a Cat Food, *Anim. Feed Sci. Technol*, 246, 82–90.
- Bandyopadhyay, S., Ghosh, K., and Varadachari, C, 2014, Multimicronutrient Slow-Release Fertilizer of Zinc, Iron, Manganese, and Copper, *International Int. J. Chem. Eng*, 7.

- Beig, B., Niazi, M. B. K., Jahan, Z., Hussain, A., Zia, M. H., and Mehran, M. T., 2020, Coating Materials For Slow Release of Nitrogen From Urea Fertilizer: A Review, *J. of Plant Nutrition*.
- Bi, S., Barinelli, V., and Sobkowicz, M. J., 2020, Degradable Controlled Release Fertilizer Composite Prepared Via Extrusion: Fabrication, Characterization, and Release Mechanisms, *Polym*, 12(2), 11–13.
- Boles, J.R., 1972, Composition, Optical Properties, Cell Dimensions, and Thermal Stability of Some Heulandite Group Zeolites, *Am. Mineral*, 57, 1463-1493.
- Brupbacher, R. H., Bonner, W. P., and Sedberry, Jr, J., 1968, *Analytical methods and procedures used in the soil testing laboratory*, Louisiana State University.
- Cahyono, Y., Wijayanto, Y., and Hermiyanto, B., 2019, Prediksi Hasil Tanaman Padi Berdasarkan Input Nitrogen dengan Simulasi Model Cropsyst di Kecamatan Mayang, *Jurnal Ilmu Tanah Dan Lingkungan*, 21(2), 58–65.
- Dash, S., Narashima, M.P., and Lilakanta, N., 2010, Review Kinetic Modeling on Drug Release from Controlled Drug Delivery Systems, *Acta Polinae Pharm. Drug Res*, 67(3), 217–223.
- Dibb, D., 1988, Potassium for Agriculture. *Better Crops With Plans Food*, 3, 39.
- Dobermann, A and Fairhurst, T., 2000, *Rice: Nutrient Disorders and Nutrient Management*, International Rice Research Institute Makati.
- El-Newehy, M. H., El-Naggar, M. E., Alotaiby, S., El-Hamshary, H., Moydeen, M., and Al-Deyab, S., 2016, Preparation of Biocompatible System Based on Electrospun CMC/PVA Nanofibers as Controlled Release Carrier of Diclofenac Sodium, *J. Makromol Sci. Part A Pure Appl. Chem.*, 53(9), 566–573.
- Elliot, A., and Zhang, D.K., 2005, Controlled Release Zeolit Fertilizers: A Value Added Product Produced from Fly Ash, *World of Coal Ash (WOCA)*, 1–32.
- Fu, J., Wang, C., Chen, X., Huang, Z., and Chen, D., 2018, Classification Research and Types of Slow Controlled Release Fertilizers (SRFs) Used - A Review, *Commun. Soil Sci. Plant Anal*, 49(17), 2219–2230.
- Ghobashy, M. M., 2019, The Application of Natural Polymer-Based Hydrogels For Agriculture, *Hydrogels Based on Natural Polymers*
- Giraldo, J. D., and Rivas, B. L., 2017, Determination of Urea Using p-N,N-Dimethylaminobenzaldehyde: Solvent Effect and Interference of Chitosan, *J. Chill.Chem. Soc.*, 62(2), 3538–3542.
- Godiya, C. B., Cheng, X., Li, D., Chen, Z., and Lu, X., 2019, Carboxymethyl

- Cellulose/Polyacrylamide Composite Hydrogel for Cascaded Treatment/Reuse of Heavy Metal Ions in Wastewater, *J. Hazard. Mater.*, 36, 28–38.
- Goenadi, D., 2006. *Pupuk dan Teknologi Pemupukan Berbasis Hayati dari Cawan Petri ke Lahan Petani* (Edisi Pert), Yayasan John Hi-Tech Idetama, Jakarta
- Hakim, A. R., Handoyo, W. T., Fauzi, A., dan Sarwono, W., 2020, Desain dan Kinerja Mesin Ekstruder Twin Screw untuk Pembuatan Pakan Ikan Terapung, *Jurnal Keteknik Pertanian*, 7(2), 129–136.
- Hakim, A. R., Handoyo, W. T., Novianto, T. D., and Prasetyo, A. W., 2019, Effects of Twin-Screw Extruders Condition to Physical Properties of Floating Fish Feed, *Jurnal Perikanan Universitas Gadjah Mada*, 21(2), 79.
- Harmaen, A. S., Khalina, A., Ali, H. M., and Azowa, I. N., 2016, Thermal, Morphological, and Biodegradability Properties of Fertilizer Composites Made of Oil Palm Biomass, Fertilizer, and Poly(hydroxybutyrate-co-valerate), *Int. J. Polym. Sci.*
- Hermida, L., and Agustian, J., 2019, Slow-Release Urea Fertilizer Synthesized Through Recrystallization of Urea Incorporating Natural Bentonite Using Various Binders, *Environ. Technol. Innovation*, 13, 113–121.
- Himmah, N. I. F., Djajakirana, G., and Darmawan, D., 2018, Nutrient Release Performance of Starch Coated NPK Fertilizers and Their Effects on Corn Growth, *SAINS TANAH - J. Sci. Agroclimatology*, 15(2), 104.
- Ho, Y.S., and McKay, G., 2002, Application of Kinetic Models To the Sorption of Copper (II) on To Peat, *Asorpt. Sci. Technol.*, 20(8), 797–815
- Humaira, 2012, Pengembangan Material dari Blending Tepung Konjac Glukomannan (KGM) dan Kitosan menggunakan Single Screw Extruder, *Skripsi*, Program Studi S1 Kimia FST Universitas Airlangga, Surabaya.
- Irfan, S.A., Razali, R., Kushaari, K., Mansor, N., Azeem, B., Versypt, A.N.F., 2017, A Review of Mathematical Modeling and Simulation of Controlled-Release Fertilizer, *J. Controlled Release*, 271, 45-54.
- Jamingan, Z., Ahmad, M. B., Hashim, K., and Zainuddin, N., 2015, Sago Starch Based Hydrogel Prepared Using Electron Beam Irradiation Technique for Controlled Release Application, *Malaysian. J. Anal. Sci.*, 19(3), 503–512.
- Janssen, L., and Moscicki, L., 2010, *Thermoplastic Starch: A Green Materials for Various Industries*, WILEY-VCH Verlag GmbH and Co. KGaA, Weiheim.
- Ji, Z., Yu, L., Liu, H., Bao, X., Wang, Y., and Chen, L., 2017, Effect of Pressure with Shear Stress on Gelatinization of Starches with Different

Amylose/Amylopectin Ratios, *Food Hydrocolloids*, 72, 331–337.

- Kartini, I., Iskandar, K. H., Chotimah, Kunarti, E.S., and Rochamdi., 2019, Effect of Zeolit Addition on the Properties of Composites of Carboxymethyl Cellulose-Urea, *Wood Mater. Sci. Eng. Wood.*, 948, 175–180.
- Korsmeyer, R. W., Gurny, R., Doelker, E., Buri, P., and Peppas, N. A., 1983, Mechanisms of Solute Release from Porous Hydrophilic Polymers, *Int. J. Pharm.*, 15(1), 25–35.
- Kristianingrum, S., 2012, Kajian Berbagai Proses Destruksi Sampel dan Efeknya. *Seminar Nasional Penelitian, Pendidikan Dan Penerapan MIPA*, 2(3), 195–202.
- Kumar, B. V. S., Siddaramaiah., Shayan, M. B., Manjula, K. S., Ranganathaiah, C., Rao, G. V. N., Basavalingu, B., dan Byrappa, K., 2010, Effect of Zeolite Particulate Filler on the Properties of Polyurethane Composites. *J. Polym. Res*, 17(1), 135–142.
- Kumar, K. V., Khaddour, I. A., and Gupta, V. K., 2010, A Pseudo Second-Order Kinetic Expression for Dissolution Kinetic Profiles of Solids in Solutions, *Ind. Eng. Chem. Res*, 49(16).
- Latifah, O., Ahmed, O. H., and Majid, N. M. A., 2017, Enhancing Nitrogen Availability from Urea Using Clinoptilolite Zeolit, *Geoderma*, 306, 152–159.
- Maharani, D. K., Dwiningsih, K., Savana, R. T., and Andika, P. M. V., 2018, Usage Of Zeolit and Chitosan Composites as Slow Release Fertilizer, *AHE*, 1 179–182.
- Marfitania, T., 2019, Enkapsulasi Urea dengan Kompoait Zeolit/Lempung/Kalsium Oksida/Karboksimetil Selulosa sebagai Model Pupuk Lepas Lambat, *Tesis*, Universitas Gadjah Mada, Yogyakarta.
- McCabe, K. G., Currey, C. J., Schrader, J. A., Grewell, D., Behrens, J., and Graves, McCabe, K. G., Currey, C. J., Schrader, J. A., Grewell, D., Behrens, J., and Graves, W. R., 2016, Ekstrudat ized Soy-Based Fertilizers for Container-Crop Production, *HortScience*, 51(11), 1417–1426.
- Mihaly, C. L., Mihaly, C. A., Peter, A., Nicula, C., Tutu, H., Silipas, D., and Indrea, E., 2014, Adsorption of Heavy Metal Cations by Na-Clinoptilolite: Equilibrium and Selectivity Studies, *J. Enviro. Manage*, 137, 69–80.
- Mihok, F., Macko, J., Oriňak, A., Orinakova, R., Koval, K., Sisakova, K., Petrus, O., and Kostecka, Z., 2020, Controlled Nitrogen Release Fertilizer Based on Zeolite Clinoptilolite: Study of Preparation Process and Release Properties Using Molecular Dynamics, *Curr. Res. Green Sustainable Chem*, 3, 100030.

- Mpapa, B., 2016, Analisis Kesuburan Tanah Tempat Tumbuh Pohon Jati (*Tectona Grandis L.*) Pada Ketinggian Yang Berbeda, *Jurnal Agrista Unsyiah*, 20(3), 135–139.
- Mumpton, F. A., 1999, La roca magica: Uses of natural zeolites in agriculture and industry, *Proceedings of the National Academy of Sciences of the United States of America*, 96(7), 3463–3470.
- Nasution, H., Harahap, H., Pandia, S., and Al Fath, M. T., 2020, The Effect of Filler Content on the Properties of Zeolite Particle Reinforced Unsaturated Polyester Composites, *AIP Conference Proceedings*, 2267.
- Nasution, H., Harahap, H., Pandia, S., and Wijaya, F., 2020, Comparison of Silica and Zeolite as Fillers on Unsaturated Polyester Resin (UPR) Composites: The Effect on Tensile Properties, *Icosteerr 2018*, 227–231.
- Olad, A., Gharekhani, H., Mirmohseni, A., & Bybordi, A., 2017, Synthesis, Characterization, and Fertilizer Release Study of the Salt and pH-Sensitive NaAlg-g-poly(AA-co-AAm)/RHA Superabsorbent Nanocomposite. *Poly. Bull.*, 74(8), 3353–3377.
- Olad, A., Zebhi, H., Salari, D., Mirmohseni, A., and Reyhani Tabar, A., 2018, Slow-Release NPK Fertilizer Encapsulated by Carboxymethyl Cellulose-Based Nanocomposite with the Function of Water Retention in Soil, *Wood Mater. Sci. Eng. Wood.*, 90, 333–340.
- Padhi, P., Rout, S. K., and Panda, D., 2014, Effect of Modification of Zeolite A Using Sodium Carboxymethylcellulose (CMC), *Bulgarian Chemical Communications*, 46(4), 777–783.
- Pang, W., Hou, D., Wang, H., Sai, S., Wang, B., Ke, J., Wu, G., Li, Q., and Holtzapple, M. T., 2018, Preparation of Microcapsules of Slow-Release NPK Compound Fertilizer and The Release Characteristics. *J. Braz. Chem. Soc.*, 29(11), 2397–2404.
- Peppas, N. A., and Narasimhan, B., 2014, Mathematical Models in Drug Delivery: How Modeling Has Shaped The Way We Design New Drug Delivery Systems, *J. Controlled Release*.
- Pereira, T. D. S., Binotto, V. D. D. N., and Faez, R., 2020, Multilayer Films of Carboxymethylcellulose/ZeoLit as Smart Materials for Macro and Micronutrients Delivery, *Microporous and Mesoporous Mater.*, 302, 110195.
- Persson, I., 2010, Hydrated Metal Ions in Aqueous Solution: How Regular Are Their Structures, *Pure Appl. Chem.*, 82(10), 1901–1917.
- Philipp, C., Oey, I., Silcock, P., Beck, S. M., and Buckow, R., 2017, Impact of

- Protein Content on Physical and Microstructural Properties of Extruded Rice Starch-Pea Protein Snacks, *J. Food Eng.*, 212, 165–173.
- Popescu, M. C., Dogaru, B. I., and Popescu, C. M., 2020, Effect of Cellulose Nanocrystals Nanofiller on The Structure and Sorption Properties of Carboxymethyl Cellulose-Glycerol-Cellulose Nanocrystals Nanocomposite Systems, *Materials*, 13(13).
- Rahmayani, R. F. I., Arryanto, Y., dan Kartini, I., 2019, The Effect of Mixing Method on Preparing Chitosan-Zeolite-Fe Composites on Fe(III) Release. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, 4(3), 205.
- Rani, M. S. A., Rudhzhiah, S., Ahmad, A., and Mohamed, N. S., 2014, Biopolymer Electrolyte Based on Derivatives of Cellulose from Kenaf Bast Fiber, *Polym.*, 6(9), 2371–2385.
- Rashidzadeh, A., and Olad, A., 2014, Slow-Released NPK Fertilizer Encapsulated By NaAlg-g-poly(AA-co-AAm)/MMT Superabsorbent Nanocomposite, *Carbohydr. Polym.*, 114, 269–278.
- Rashidzadeh, A., Olad, A., Salari, D., and Reyhanitabar, A., 2014, On The Preparation and Swelling Properties of Hydrogel Nanocomposite Based on Sodium Alginate-G-Poly (Acrylic Acid-Co-Acrylamide)/Clinoptilolite and Its Application as Slow Release Fertilizer, *J. Polym. Res.*, 21(2).
- Rauf, A. W., Syamsuddin, T., dan Sihombing, S. R., 2000, *Peranan Pupuk NPK Pada Tanaman Padi*, Loka Pengkajian Teknologi Pertanian Koya Barat, Irian Jaya.
- Rehakova, M., Cuvanova, S., Dzivak, M., Rimar, J., and Gaval'Ova, Z., 2004, Agricultural and Agrochemical Uses of Natural Zeolite of The Clinoptilolite Type, *Curr. Opin. Solid State Mater. Sci.*, 8(6), 397–404.
- Safitri, D., Rahim, E. A., Prismawiryanti, P., dan Sikanna, R., 2017, Sintesis Karboksimetil Selulosa (CMC) dari Selulosa Kulit Durian (*Durio Zibethinus*), *Kovalen*, 3(1), 58.
- Safitri, I., Riza, M., dan Syaubari, S., 2016, Uji Mekanik Plastik Biodegradable dari Pati Sagu dan Grafting Poly(Nipam)-Kitosan dengan Penambahan Minyak Kayu Manis (*Cinnamomum burmannii*) sebagai Antioksidan, *Jurnal Litbang Industri*, 6(2), 107.
- Sangeetha, C., and Baskar, P., 2016, Zeolite and Its Potential Uses in Agriculture : A Critical Review, *Agricultural Reviews*, 37, 101–108.
- Shahid, M., Shukla, A. K., Bhattacharyya, P., Tripathi, R., Mohanty, S., Kumar, A., Lal, B., Gautam, P., Raja, R., Panda, B. B., Das, B., and Nayak, A. K., 2016, Micronutrients (Fe, Mn, Zn and Cu) balance under long-term application of

- fertilizer and manure in a tropical rice-rice system, *J. Soils Sediments*, 16(3), 737–747.
- Silsia, D., Efendi, Z., dan Timotius, F., 2018, Karakterisasi Karboksimetil Selulosa (CMC) Dari Pelepah Kelapa Sawit, *Agroindustri*, 8(1), 53–61.
- Su, J. F., Huang, Z., Yuan, X. Y., Wang, X. Y., and Li, M., 2010, Structure and Properties of Carboxymethyl Cellulose/Soy Protein Isolate Blend Edible Films Crosslinked By Maillard Reactions, *Carbohydr. Polym.*, 79(1), 145–153.
- Suminta, S., 2006, Penghalusan Struktur Sangkar Kristal Mordenit Dan Klinoptilolit Alam Dengan Metode Rietveld, *Jurnal Sains Materi Indonesia*, 7, 73–78.
- Supriyadi, S., Diana, N. E., dan Djumali, D., 2018, Pengaruh Pupuk Majemuk Berbentuk Granul dan Briket Terhadap Pertumbuhan, Produktivitas, dan Rendemen Tebu, *Buletin Tanaman Tembakau, Serat & Minyak Industri*, 9(1), 34.
- Trenkel, 2013, Slow and Controlled-Release and stabilized Fertilizers, *J. Chemical Information and Modelinng*, 53.
- Trenkel, M. E., 2010, Slow and Controlled-Release and Stabilized Fertilizers: An Option For Enhancing Nutrient Use Efficiency In Agriculture, *J. Chemical Information and Modeling*, 53.
- Tuhekih, E., and Sipahutar, I. A., 2008, Pengaruh Pupuk NPKMajemuk (16:16:15) Terhadap Pertumbuhan dan Hasil Jagung (*Zea mays* L) di Tanah Inceptisols E, *Balai Penelitian Tanah*, 77–90.
- Wang, A., Liu, D., Yin, H., Wu, H., Wada, Y., Ren, M., Jiang, T., Cheng, X., and Xu, Y., 2007, Size-Controlled Synthesis of Hydroxyapatite Nanorods by Chemical Precipitation In The Presence of Organic Modifiers, *Mater. Sci. Eng.C*, 27(4), 865–869.
- Wei, J., Sun, Q., Sun, X., and Sun, W., 2013, A Study on Rotor Profiles Design For A Novel Twin-Screw Kneader, *Int. J. Precis. Eng. Manuf*, 14(3), 451–459.
- Winarso, S., 2005, *Kesuburan Tanah Dasar Kesehatan dan Kualitas Tanah*. Gava Media, Yogyakarta.
- Wiyantoko, B., Kurniawati, P., dan Purbaningtias, T. E., 2017, Pengujian Nitrogen Total, Kandungan Air dan Cemaran Logam Timbal Pada Pupuk Anorganik NPK Padat, *JST (Jurnal Sains Dan Teknologi)*, 6(1), 51–60.
- Xu, D., and Xue, D., 2005, Morphology Control of KDP crystallites. *Physica B: Condensed Matter*, 370(1–4), 84–89.
- Yruela, I., 2019, Copper in plants : Acquisition , transport and interactions Copper

in plants : acquisition , transport and interactions, *Funct. Plant Biol*, 36, 409-430.

Zhao, X and Wang, Z., 2019, A pH-Sensitive Microemulsion-Filled Gellan Gum Hydrogel Encapsulated Apigenin: Characterization and in Vitro Release Kinetics, *Colloids Surf., B*, 178, 245-252.