

DAFTAR PUSTAKA

1. Rahmi, R.; Sajidah. Pemanfaatan Adsorben Alami (Biosorben) Untuk Mengurangi Kadar Timbal(Pb) Dalam Limbah Cair. *Pros. Semin. Nas. Biot.* 2017, 271–279.
2. Pratiwi, D. Y. Dampak Pencemaran Logam Berat (Timbal, Tembaga, Merkuri, Kadmium, Krom) Terhadap Organisme Perairan Dan Kesehatan Manusia. *J. Akuatek* 2020, 1 (1), 59–65.
3. Sudarmawan, A. R.; Suteja, Y.; Widiastuti, W. Logam Berat Timbal (Pb) Pada Air Dan Plankton Di Teluk Benoa, Badung, Bali. *J. Mar. Aquat. Sci.* 2020, 6 (1), 133.
4. Núñez, D.; Serrano, J. A.; Mancisidor, A.; Elgueta, E.; Varaprasad, K.; Oyarzún, P.; Cáceres, R.; Ide, W.; Rivas, B. L. Heavy Metal Removal from Aqueous Systems Using Hydroxyapatite Nanocrystals Derived from Clam Shells. *RSC Adv.* 2019, 9 (40), 22883–22890.
5. Jiang, J.; Long, Y.; Hu, X.; Hu, J.; Zhu, M.; Zhou, S. A Facile Microwave-Assisted Synthesis of Mesoporous Hydroxyapatite as an Efficient Adsorbent for Pb²⁺ Adsorption. *J. Solid State Chem.* 2020, 289 (April), 121491.
6. Zhang, Z.; Wang, T.; Zhang, H.; Liu, Y.; Xing, B. Adsorption of Pb(II) and Cd(II) by Magnetic Activated Carbon and Its Mechanism. *Sci. Total Environ.* 2021, 757 (ii), 143910.
7. Chen, X.; Tao, J.; Sun, P.; Yu, F.; Li, B.; Dun, L. Effect of Calcination on the Adsorption of Chifeng Zeolite on Pb²⁺ and Cu²⁺. *Int. J. Low-Carbon Technol.* 2022, 17 (March), 462–468.
8. Wadhawan, S.; Jain, A.; Nayyar, J.; Mehta, S. K. Role of Nanomaterials as Adsorbents in Heavy Metal Ion Removal from Waste Water: A Review. *J. Water Process Eng.* 2020, 33 (October 2019), 101038.
9. Long, Y.; Jiang, J.; Hu, J.; Hu, X.; Yang, Q.; Zhou, S. Removal of Pb(II) from Aqueous Solution by Hydroxyapatite/Carbon Composite: Preparation and Adsorption Behavior. *Colloids Surfaces A Physicochem. Eng. Asp.* 2019, 577 (June), 471–479.
10. Abd-Rabboh, H. S. M.; Fawy, K. F.; Awwad, N. S. Removal of Copper(II) from Aqueous Samples Using Natural Activated Hydroxyapatite Sorbent Produced from Camel Bones. *Desalin. Water Treat.* 2019, 164, 300–309.
11. Fatimah, I.; Aulia, G. R.; Puspitasari, W.; Nurillahi, R.; Sopia, L.; Herianto, R. Microwave-Synthesized Hydroxyapatite from Paddy Field Snail (*Pila Ampullacea*) Shell for Adsorption of Bichromate Ion. *Sustain. Environ. Res.* 2018, 28 (6), 462–471.
12. Meski, S.; Tazibt, N.; Khireddine, H.; Ziani, S.; Biba, W.; Yala, S.; Sidane, D.; Boudjouan, F.; Moussaoui, N. Synthesis of Hydroxyapatite from Mussel Shells for Effective Adsorption of Aqueous Cd(II). *Water Sci. Technol.* 2019, 80 (7), 1226–1237.
13. Alif, M. F.; Aprillia, W.; Arief, S. Peat Water Purification by Hydroxyapatite (HAp) Synthesized from Waste Pensi (*Corbicula Moltkiana*) Shells. *IOP Conf. Ser. Mater. Sci. Eng.* 2018, 299 (1).
14. Muhamadin, R. C.; Permata Ningtyas, A. H.; Pahlawan, I. A.; Hidayatullah, R. A.; Ismail, R.; Fitriyana, D. F.; Fadhilah, N.; Rachman, G. T. Characterization and Synthesis Hydroxyapatite from Scallop Mussel Shells Prepared by the Microwave-Assisted Precipitation Methods. *J. Sains dan Teknol. Ind.* 2023, 21 (1), 175..
15. Agbeboh, N. I.; Oladele, I. O.; Daramola, O. O.; Adediran, A. A.; Olasukanmi, O. O.; Tanimola, M. O. Environmentally Sustainable Processes for the Synthesis of Hydroxyapatite. *Helijon* 2020, 6 (4), e03765.
16. Shafiq Uz Zaman Muhammad Irfan, M. I. N. M. M. K. U. Z. A. R. S.-R. Overview of Hydroxyapatite; Composition, Structure, Synthesis Methods and Its Biomedical Uses . *Biomed. Lett. ISSN 2410-955X– An Int. Biannually J.* 2020, 6 (Nanotechnology in Nanomedicine), 84–99.
17. Bulina, N. V.; Makarova, S. V.; Baev, S. G.; Matvienko, A. A.; Gerasimov, K. B.; Logutenko, O. A.; Bystrov, V. S. A Study of Thermal Stability of Hydroxyapatite. *Minerals* 2021, 11 (12), 1–15.
18. Van Hoa, N.; Minh, N. C.; Cuong, H. N.; Dat, P. A.; Nam, P. V.; Viet, P. H. T.; Phuong, P. T. D.; Trung, T. S. Highly Porous Hydroxyapatite/Graphene Oxide/Chitosan Beads

- as an Efficient Adsorbent for Dyes and Heavy Metal Ions Removal. *Molecules* 2021, **26** (20).
19. Ebrahimi, S.; Mohd Nasri, C. S. S.; Bin Arshad, S. E. Hydrothermal Synthesis of Hydroxyapatite Powders Using Response Surface Methodology (RSM). *PLoS One* 2021, **16** (5 May), 1–24.
20. Catauro, M.; Barrino, F.; Blanco, I.; Piccolella, S.; Pacifico, S. Use of the Sol-Gel Method for the Preparation of Coatings of Titanium Substrates with Hydroxyapatite for Biomedical Application. *Coatings* 2020, **10** (3).
21. Sirait, M.; Sinulingga, K.; Siregar, N.; Siregar, R. S. D. Synthesis of Hydroxyapatite from Limestone by Using Precipitation Method. *J. Phys. Conf. Ser.* 2020, **1462** (1).
22. Castro, M. A. M.; Portela, T. O.; Correa, G. S.; Oliveira, M. M.; Rangel, J. H. G.; Rodrigues, S. F.; Mercury, J. M. R. Synthesis of Hydroxyapatite by Hydrothermal and Microwave Irradiation Methods from Biogenic Calcium Source Varying PH and Synthesis Time. *Bol. la Soc. Esp. Ceram. y Vidr.* 2022, **61** (1), 35–41.
23. Fadila, R.; Fadli, A.; Yenti, S. R. Sintesis Hidroksiapatit Menggunakan Metode Wet Mechanochemical Dengan Variasi Waktu Reaksi Dan Rasio Bola Penggiling. *Jom FTEKNIK* 2019, **6**, 2–7.
24. Bystrov, V.; Paramonova, E.; Avakyan, L.; Coutinho, J.; Bulina, N. Simulation and Computer Study of Structures and Physical Properties of Hydroxyapatite with Various Defects. *Nanomaterials* 2021, **11** (10), 1–30.
25. Fiume, E.; Magnaterra, G.; Rahdar, A.; Verné, E.; Baino, F. Hydroxyapatite for Biomedical Applications: A Short Overview. *Ceramics* 2021, **4** (4), 542–563.
26. Shi, H.; Zhou, Z.; Li, W.; Fan, Y.; Li, Z.; Wei, J. Hydroxyapatite Based Materials for Bone Tissue Engineering: A Brief and Comprehensive Introduction. *Crystals* 2021, **11** (2), 1–18.
27. Balasooriya, I. L.; Chen, J.; Gedara, S. M. K.; Han, Y.; Wickramaratne, M. N. Applications of Nano Hydroxyapatite as Adsorbents: A Review. *Nanomaterials* 2022, **12** (14), 1–24.
28. Pekanbaru, L. D. I. Strategi Adaptasi Pedagang Pensi Dan Langkitang Di Pekanbaru. 2023, **1**, 1–7.
29. Rahmayeni; Wendari, T. P.; Ramadani, S.; Stiadi, Y.; Sofyan, N.; Zulhadjri. CuFe₂O₄/Hydroxyapatite Magnetic Nanocomposite Synthesized Using Pensi Clam Shells as a Source of Calcium for Degradation of Dye and Anti-Bacterial Applications. *Case Stud. Chem. Environ. Eng.* 2023, **8** (September), 100482.
30. Ullya, W.; Jonuarti, R. Effect of Calcination Temperature on Microstructure , Porosity and Hardness of Cao / SiO₂ Nanocomposites for Bone Implants. 2022, **15** (2), 111–118.
31. Syukri, S.; Muhammad, M.; Pratiwi, I.; Yutaro, D. R. The Ability of Pensi (. 2023, 020099 (ii).
32. Nugraha Putra, M. D.; Widada, S.; Atmodjo, W. Studi Kandungan Logam Berat Timbal (Pb) Pada Sedimen Dasar Di Perairan Banjir Kanal Timur Semarang. *Indones. J. Oceanogr.* 2022, **4** (3), 13–21.
33. Saleh, T. A.; Majeed, S.; Nayak, A.; Bhushan, B. Principles and Advantages of Microwave- Assisted Methods for the Synthesis of Nanomaterials for Water Purification. *Adv. Nanomater. Water Eng. Treat. Hydraul.* 2017, No. March 2018, 40–57.
34. Ajmer Singh Grewal, Karunesh Kumar, Sonika Redhu, S. B. Microwave Assisted Synthesis: A Green Chemistry Approach. 2013, **3** (5), 192–196.
35. Torres, E. Biosorption: A Review of the Latest Advances. *Processes* 2020, **8** (12), 1–23.
36. Fomina, M.; Gadd, G. M. Biosorption: Current Perspectives on Concept, Definition and Application. *Bioresour. Technol.* 2014, **160**, 3–14.
37. Asiva Noor Rachmayani. *Biosorben Dan Aplikasinya*; 2015.
38. Aktar, J. *Batch Adsorption Process in Water Treatment*; Elsevier Inc., 2020. <https://doi.org/10.1016/B978-0-12-819671-7.00001-4>.
39. Indriyani, L. A.; Arif, Z.; Linda, R.; Purwaningsih, H.; Rafi, M. Optimization of Cd(II) Adsorption Condition by Glycine-Modified Silica-Based Adsorbent Using Central Composite Design. *J. Kim. Sains dan Apl.* 2019, **22** (5), 184–191.
40. Sylvia, N.; Damanik, S.; Muhammad, M.; ZA, N. Kajian Kolom Adsorpsi Zat Warna

- Methyl Orange Menggunakan Adsorben Dari Ampas Teh. *J. Teknol. Kim. Unimal* 2022, 11 (2), 122.
41. Astuti, W. *Adsorpsi Menggunakan Material Berbasis Lignoselulosa*; 2018.
42. Maryam, S.; Hidayanti, N. Identifikasi Gugus Fungsi Limbah Minyak Trafo Yang Digunakan Sebagai Minyak Obat Luka Menggunakan FTIR. *Makassar Pharm. Sci. J.* 2023, 1 (2), 2023–2115.
43. Nurhamzah, R.; Hasan, T.; Dwijayanti, E. Karakterisasi Kitosan Dan Nanokitosan Pada Cangkang Kerang Kijing (Plisbryoconcha Exilis) Asal Kabupaten Maros Menggunakan Ftir Dan Sem. *AlGhazali J. Chem. Sci. Technol.* 2024, 1 (01), 24–35.
44. Nandiyanto, A. B. D.; Oktiani, R.; Ragadhita, R. How to Read and Interpret Ftir Spectroscopic of Organic Material. *Indones. J. Sci. Technol.* 2019, 4 (1), 97–118.
45. Hosta Ardhyananta, S. T. W. Pengaruh Penambahan Serat Cangkang Kelapa. 2018, 7 (1).
46. Khairurrijal, K. Review : Karakterisasi Nanomaterial Review : Karakterisasi Nanomaterial. *J. Nanosains dan Nanoteknologi* 2014, 2 (January 2009), 1–9.
47. Julinawati; Marlina; Rosnani Nasution; Sheila Tinta. Applying Sem-Edx Techniques To Identify of Mineral of Jades (Giok) Takengotheon, Aceh. *J. Nat.* 2015, 15 (2), 45–48.
48. Fachrully S, A.; Erna S, N.; Susilo. Analisis Citra Hasil Scanning Electron Microscopy Energy Dispersive X-Ray (SEM EDX) Komposit Resin Timbal Dengan Metode Contrast to Noise Ratio (CNR). *Indones. J. Math. Nat. Sci.* 2021, 44 (2), 81–85.
49. Brouwer, P. *Theory of XRF*; 2010.
50. Munasir; Triwikantoro; Zainuri, M.; Darminto. *CaCO₃ / SiO₂*. 2011, 3 (1), 20–29.
51. Sari, W. P.; Sumantri, D.; Imam, D. N. A.; Sunarintyas, S. Pemeriksaan Komposisi Glass Fiber Komersial Dengan Teknik X-Ray Fluorescence Spectrometer (Xrf). *B-Dent J. Kedokt. Gigi Univ. Baiturrahmah* 2018, 1 (2), 155–160.
52. Ali, A.; Chiang, Y. W.; Santos, R. M. X-Ray Diffraction Techniques for Mineral Characterization: A Review for Engineers of the Fundamentals, Applications, and Research Directions. *Minerals* 2022, 12 (2).
53. Muttaqin, R. Pengembangan Buku Panduan Teknik Karakterisasi Material : X-Ray Diffractometer (XRD) Panalytical Xpert3 Powder. *Indones. J. Lab.* 2023, 1 (1), 9.
54. Irwansyah, F. S.; Amal, A. I.; y, D. R.; Risdiana, R.; Suryana, S.; Zain, S. B. M. How to Make and Characterize Hydroxyapatite from Eggshell Using the Hydrothermal Method: Potential Insights for Drug Delivery System. *Indones. J. Sci. Technol.* 2023, 8 (3), 469–486.
55. Marsyahyo, E. Analisis Brunnaeur Emmet Teller (Bet) Topografi Permukaan Serat Rami (Boehmeria Nivea) Untuk Media Penguatan Pada Bahan Komposit. *J. Flywheel* 2009, 2 (2), 33–41.
56. Hatina, S.; Winoto, E. Pemanfaatan Karbon Aktif Dari Serbuk Kayu Merbau Dan Tongkol Jagung Sebagai Adsorben Untuk Pengolahan Limbah Cair Aas. *J. Redoks* 2020, 5 (1), 32.
57. Sugito, S.; Marliyana, S. D. Uji Performa Spektrofotometer Serapan Atom Thermo Ice 3000 Terhadap Logam Pb Menggunakan CRM 500 Dan CRM 697 Di UPT Laboratorium Terpadu UNS. *Indones. J. Lab.* 2021, 4 (2), 67..
58. Yanti, P. H.; Pebrianti, R. Microwave-Assisted of Synthesis and Characterization of Nanocomposite Hydroxyapatite-Chitosan. *J. Phys. Conf. Ser.* 2021, 1842 (1).
59. Anggraini, W.; Puryanti, D. Identifikasi Pencemaran Logam Berat Tembaga (Cu), Timbal (Pb) Dan Kadmium (Cd) Air Laut Di Sekitar Pelabuhan Teluk Bayur Kota Padang. *J. Ilmu Fis. | Univ. Andalas* 2019, 11 (2), 95–101.
60. Zein, R.; Ramadhani, P.; Aziz, H.; Suhaili, R. Pensi Shell (*Corbicula Moltkiana*)as a Biosorbent for Metanil Yellow Dyes Removal: PH and Equilibrium Model Evaluation. *J. Litbang Ind.* 2019, 15–22.
61. Hariani, P. L.; Muryati; Said, M. Kinetic and Thermodynamic Adsorption of Nickel (II) onto Hydroxyapatite Prepared from Snakehead (*Channa Striata*) Fish Bone. *Mediterr. J. Chem.* 2019, 9 (2), 85–94.
62. Goh, K. W.; Wong, Y. H.; Ramesh, S.; Chandran, H.; Krishnasamy, S.; Sidhu, A.; Teng, W. D. Effect of PH on the Properties of Eggshell-Derived Hydroxyapatite Bioceramic Synthesized by Wet Chemical Method Assisted by Microwave Irradiation. 2021, 47 (7),

- 8879–8887.
63. Anggresani, F.; Sutrisno, D. Pengaruh Variasi Perbandingan Mol Ca / P Pada Hidroksiapatit Berpori Tulang Ikan Tenggiri (*Scomberomorus Guttatus*). *J. Farm.* 2020, 12 (1), 55–64.
 64. Bambang Sunendar Purwasasmita, R. S. G. Calcium Oxide (Calcium Oxide). *J. Bionatura* 2008, 10 (2), 155–167.
 65. Siregar, R. F.; Sulistyowati, E. Karakteristik Hidroksiapatit Porous Characteristics of Porous Hydroxyapatite from Precursors of Rice Conch Shells and Porogeneous Materials of Breadfruit. *Eksbergi* 2019, 16 (2), 59–63.
 66. Purba, R. A. P.; Restianingsih, T.; Anggraini, R. M.; Fendriani, Y.; Deswardani, F. Ekstraksi Dan Karakterisasi Hidroksiapatit (HAp) Dari Tulang Ikan Tenggiri (*Scomberomorus Commersoni*) Dengan Metode Heat Treatment. *J. Fis. Unand* 2024, 13 (2), 247–253.
 67. Asuquo, E.; Martin, A.. Adsorption of Cd(II) and Pb(II) Ions from Aqueous Solutions Using Mesoporous Activated Carbon Adsorbent: Equilibrium, Kinetics and Characterisation Studies. CORE View Metadata, Citation and Similar Papers at Core.Ac.Uk Provided by Lancaster E-Prints. 2017, No. li, 1–63.
 68. Medjdoub, A.; Nemchi, F.; Bourahla, S.; Belhakem, M.; Benderdouche, N. Adsorptive Potential of Synthesized Sea Urchin-Based Hydroxyapatite for Supranol Yellow and Nickel Ion Recovery from Aqueous Media: 2022, 252, 348–360.
 69. Ayodele, O.; Olusegun, S. J.; Oluwasina, O. O.; Okoronkwo, E. A.; Olanipekun, E. O.; Mohallem, N. D. S.; Guimaraes, W. G.; Gomes, B. L. F. d. M.; Souza, G. de O.; Duarte, H. A. Experimental and Theoretical Studies of the Adsorption of Cu and Ni Ions from Wastewater by Hydroxyapatite Derived from Eggshells. *Environ. Nanotechnology, Monit. Manag.* 2021, 15 (February).
 70. Wang, H.; Yan, K.; Xing, H.; Chen, J.; Lu, R. Effective Removal of Cu²⁺ from Aqueous Solution by Synthetic Abalone Shell Hydroxyapatite Microspheres Adsorbent. *Environ. Technol. Innov.* 2021, 23.
 71. Martina, D.; Hastuti, R.; Widodo, D. S. Jurnal Kimia Sains Dan Aplikasi Peran Adsorben Selulosa Tongkol Jagung (Zea Mays) Dengan. *J. Kim. Sains Dan Apl.* 2016, 19 (3), 77–82.
 72. Hevira, L.; Zilfa; Rahmayeni; Ighalo, J. O.; Aziz, H.; Zein, R. Terminalia Catappa Shell as Low-Cost Biosorbent for the Removal of Methylene Blue from Aqueous Solutions. *J. Ind. Eng. Chem.* 2021, 97 (January), 188–199.
 73. Farch, S.; Yahoum, M. M.; Toumi, S.; Tahraoui, H.; Lefnaoui, S.; Kebir, M.; Zamouche, M.; Amrane, A.; Zhang, J.; Hadadi, A.; Mouni, L. Application of Walnut Shell Biowaste as an Inexpensive Adsorbent for Methylene Blue Dye: Isotherms , Kinetics , Thermodynamics , and Modeling. 2023.
 74. Zein, R.; Putri, C. N.; Deswati; Fauzi, S. Pb(II) Removal from Aqueous Solutions Using Citric Acid Modified Kepok Banana Peel: Batch and Kinetic Studies. *Anal. Bioanal. Chem. Res.* 2024, 11 (2), 227–238.
 75. Agustiyanti, R. D.; Azis, Y.; Helwani, Z. Sintesis Hidroksiapatit Dari Precipitated Calcium Carbonate (PCC) Cangkang Telur Ayam Ras Melalui Proses Presipitas. *Jom FTEKNIK* 2018, 5 (1), 1–6.
 76. He, Y.; Wu, P.; Xiao, W.; Li, G.; Yi, J.; He, Y.; Chen, C.; Ding, P.; Duan, Y. Efficient Removal of Pb(II) from Aqueous Solution by a Novel Ion Imprinted Magnetic Biosorbent: Adsorption Kinetics and Mechanisms. *PLoS One* 2019, 14 (3), 1–17.
 77. Sari, R. N.; Fransiska, D.; Dewi, F. R.; Sinurat, E. Karakteristik Sediaan Hidroksiapatit Dari Cangkang Kerang Simping (*Amusium Pleuronectes*) Dengan Perlakuan Suhu Dan Waktu Sintesis. *J. Pascapanen dan Bioteknol. Kelaut. dan Perikan.* 2022, 17 (1), 31.
 78. Shi, D.; Tong, H.; Lv, M.; Luo, D.; Wang, P.; Xu, X.; Han, Z. Optimization of Hydrothermal Synthesis of Hydroxyapatite from Chicken Eggshell Waste for Effective Adsorption of Aqueous Pb(II). *Environ. Sci. Pollut. Res.* 2021, 28 (41), 58189–58205.
 79. Hariani, P. L.; Riyanti, F.; Fatma; Rachmat, A.; Herbanu, A. Removal of Pb(II) Using Hydroxyapatite from Golden Snail Shell (*Pomacea Canaliculata* L.) Modified with Silica. *Molekul* 2020, 15 (2), 130–139.