

**DAFTAR PUSTAKA**

- Alonso, E., Sherman, A. M., Wallington, T. J., Everson, M. P., Field, F. R., Roth, R., & Kirchain, R. E. (2012). *Evaluating Rare Earth Element Availability: A Case with Revolutionary Demand from Clean Technologies.*
- Anggraini, M., Sumarni, Sumiarti, S., R., & W, S. (2012). (2012). *Pengendapan Unsur Tanah Jarang Hasil Digesti Monasit Bangka Menggunakan Asam Sulfat.* 33(2), 121–128.
- Atmawinata, A., Yahya, F., Widhianto, S., Irianto, D., & Adlir, A. (2014). *Telaah penguatan struktur industri pemetaan potensi logam tanah jarang di indonesia.*
- Battsengel, A., Batnasan, A., Narankhuu, A., Haga, K., Watanabe, Y., & Shibayama, A. (2018). Recovery of light and heavy rare earth elements from apatite ore using sulphuric acid leaching, solvent extraction and precipitation. *Hydrometallurgy*, 179(2017), 100–109. <https://doi.org/10.1016/j.hydromet.2018.05.024>
- Belkin, H. E., Tewalt, S. J., Hower, J. C., Stucker, J. D., & O'Keefe, J. M. K. (2009). Geochemistry and petrology of selected coal samples from Sumatra, Kalimantan, Sulawesi, and Papua, Indonesia. *International Journal of Coal Geology*, 77(3–4), 260–268. <https://doi.org/10.1016/j.coal.2008.08.001>
- Beltrami, D., Deblonde, G. J. P., Bélair, S., & Weigel, V. (2015). Recovery of yttrium and lanthanides from sulfate solutions with high concentration of iron and low rare earth content. *Hydrometallurgy*, 157, 356–362. <https://doi.org/10.1016/j.hydromet.2015.07.015>
- Besari, D. A. A., Anggara, F., Rosita, W., & Petrus, H. T. B. M. (2022). Characterization and mode of occurrence of rare earth elements and yttrium in fly and bottom ash from coal-fired power plants in Java, Indonesia. In *International Journal of Coal Science and Technology* (Vol. 9, Issue 1). <https://doi.org/10.1007/s40789-022-00476-2>
- Blissett, R. S., Smalley, N., & Rowson, N. A. (2014). An investigation into six coal fly ashes from the United Kingdom and Poland to evaluate rare earth element content. *Fuel*, 119(March), 236–239. <https://doi.org/10.1016/j.fuel.2013.11.053>



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

UNIVERSITAS
GADJAH MADA

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Brady, P. V., & Walther, J. V. (1990). Kinetics of quartz dissolution at low

temperatures. *Chemical Geology*, 82(C), 253–264. [https://doi.org/10.1016/0009-2541\(90\)90084-K](https://doi.org/10.1016/0009-2541(90)90084-K)

Callow, R. (1968). *The Industrial Chemistry of the Lanthanons, Yttrium, Thorium, and Uranium*. 14, 6940.

Cao, S., Zhou, C., Pan, J., Liu, C., Tang, M., Ji, W., Hu, T., & Zhang, N. (2018). Study on Influence Factors of Leaching of Rare Earth Elements from Coal Fly Ash. *Energy and Fuels*, 32(7), 8000–8005. <https://doi.org/10.1021/acs.energyfuels.8b01316>

Carino, A., Testino, A., Andalibi, M. R., Pilger, F., Bowen, P., & Ludwig, C. (2017). Thermodynamic-Kinetic Precipitation Modeling. A Case Study: The Amorphous Calcium Carbonate (ACC) Precipitation Pathway Unravelled. *Crystal Growth and Design*, 17(4), 2006–2015. <https://doi.org/10.1021/acs.cgd.7b00006>

Choo, T. K., Etschmann, B., Selomulya, C., & Zhang, L. (2016). Behavior of Fe²⁺/3+ Cation and Its Interference with the Precipitation of Mg²⁺ Cation upon Mineral Carbonation of Yallourn Fly Ash Leachate under Ambient Conditions. *Energy and Fuels*, 30(4), 3269–3280. <https://doi.org/10.1021/acs.energyfuels.5b02867>

da Silva, R. G., de Moraes, C. A., Teixeira, L. V., & de Oliveira, É. D. (2018). Selective removal of impurities from rare earth sulphuric liquor using different reagents. *Minerals Engineering*, 127(August), 238–246. <https://doi.org/10.1016/j.mineng.2018.08.007>

Dai, S., Zhao, L., Hower, J. C., Johnston, M. N., Song, W., Wang, P., & Zhang, S. (2014). Petrology, mineralogy, and chemistry of size-fractioned fly ash from the Jungar power plant, Inner Mongolia, China, with emphasis on the distribution of rare earth elements. *Energy and Fuels*, 28(2), 1502–1514. <https://doi.org/10.1021/ef402184t>

Dai, S., Zhao, L., Peng, S., Chou, C., Wang, X., Zhang, Y., Li, D., & Sun, Y. (2010). Abundances and distribution of minerals and elements in high-alumina coal fly ash from the Jungar Power Plant, Inner Mongolia, China. *International Journal of Coal Geology*, 81(4), 320–332. <https://doi.org/10.1016/j.coal.2009.03.005>



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

UNIVERSITAS
GADJAH MADA

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Das, G., Lencka, M. M., Eslamimanesh, A., Wang, P., Anderko, A., Rimani, R. E., &

Navrotsky, A. (2019). Rare earth sulfates in aqueous systems: Thermodynamic modeling of binary and multicomponent systems over wide concentration and temperature ranges. *Journal of Chemical Thermodynamics*, 131, 49–79. <https://doi.org/10.1016/j.jct.2018.10.020>

Direktorat Jenderal Mineral dan Batubara. (2021). *Road Map Pengembangan dan Pemanfaatan Batubara*.

Dushyantha, N., Batapola, N., Ilankoon, I. M. S. K., Rohitha, S., Premasiri, R., Abeysinghe, B., Ratnayake, N., & Dissanayake, K. (2020). The story of rare earth elements (REEs): Occurrences, global distribution, genesis, geology, mineralogy and global production. *Ore Geology Reviews*, 122(March), 103521. <https://doi.org/10.1016/j.oregeorev.2020.103521>

Fan, X. lu, Lv, S. qing, Xia, J. lan, Nie, Z. yuan, Zhang, D. rui, Pan, X., Liu, L. zhu, Wen, W., Zheng, L., & Zhao, Y. dong. (2019). Extraction of Al and Ce from coal fly ash by biogenic Fe³⁺ and H₂SO₄. *Chemical Engineering Journal*, 370(February), 1407–1424. <https://doi.org/10.1016/j.cej.2019.04.014>

Fioravante, I., Nunes, R. S., Acciari, H. A., & Codaro, E. N. (2019). *Films Formed on Carbon Steel in Sweet Environments - A Review*. November. <https://doi.org/10.21577/0103-5053.20190055>

Fisher, G. L. (1983). *Biomedically Relevant Chemical and Physical Properties of Coal Combustion Products*. 47, 189–199.

Fogler, H. S. (2016). *Elements of Chemical Reaction Engineering*.

Goodenough, K. M., Wall, F., & Merriman, D. (2018). The Rare Earth Elements: Demand, Global Resources, and Challenges for Resourcing Future Generations. *Natural Resources Research*, 27(2), 201–216. <https://doi.org/10.1007/s11053-017-9336-5>

Güneş, H., Obuz, H. E., & Alkan, M. (2019). Selective Precipitation of Th and Rare-Earth Elements from HCl Leach Liquor. *Minerals, Metals and Materials Series*, 81–86. https://doi.org/10.1007/978-3-030-05740-4_9



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Gupta, C. K., & Krishnamurthy, N. (1992). *Extractive metallurgy of rare earths*. 37(5).

Ham, F. S. (1958). *THEORY OF DIFFUSION-LIMITED PRECIPITATION*. 6, 335–351.

Han, K. N., & Kim, R. (2021). *Thermodynamic Analysis of Precipitation Characteristics of Rare Earth Elements with Sulfate in Comparison with Other Common Precipitants*.

Handini, T., Purwoto, & Mulyono. (2007). *PEMISAHAN ITRIUM DARI KONSENTRAT LOGAM TANAH JARANG DENGAN PENGENDAPAN FRAKSIONAL HIDROKSIDA*. 273–277.

Handoyo, H., Bendiyasa, I. M., & Prasetya, A. (2019). Pelindian Neodymium dari Magnetik Coal Fly Ash menggunakan Asam Asetat sebagai Pelarut. *Eksbergi*, 16(2), 42. <https://doi.org/10.31315/e.v16i2.3027>

Harjanto, S., Virdhian, S., Afrilinda, E., Treatment, H., & Industries, M. (2010). *Characterization of Indonesia Rare Earth Minerals*. August 2014.

Hassas, B. V., Shekarian, Y., & Rezaee, M. (2022). Resources , Conservation & Recycling Selective precipitation of rare earth and critical elements from acid mine drainage - Part I: Kinetics and thermodynamics of staged precipitation process. *Resources, Conservation & Recycling*, 188(June 2022), 106654. <https://doi.org/10.1016/j.resconrec.2022.106654>

Henderson, P. (1983). General Geochemical Properties and Abundances of the Rare Earth Elements. *Rare Earth Element Geochemistry*, 1–32. <https://doi.org/10.1016/b978-0-444-42148-7.50006-x>

Hower, J. C., Henke, K. R., Dai, S., Ward, C. R., French, D., Liu, S., & Graham, U. M. (2017). Generation and nature of coal fly ash and bottom ash. In *Coal Combustion Products (CCP's)*. Elsevier Ltd. <https://doi.org/10.1016/B978-0-08-100945-1.00002-2>

Humphries, M. (2011). Rare Earth Elements: The Global Supply Chain. *Critical Materials Strategy for Clean Energy Technologies*, 143–158.



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

UNIVERSITAS

GADJAH MADA

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Innocenzi, V., & Veglio, F. (2012). Recovery of rare earths and base metals from spent

nickel-metal hydride batteries by sequential sulphuric acid leaching and selective precipitations. *Journal of Power Sources*, 211, 184–191.
<https://doi.org/10.1016/j.jpowsour.2012.03.064>

Juda-Rezler, K., & Kowalczyk, D. (2013). Size distribution and trace elements contents of coal fly ash from pulverized boilers. *Polish Journal of Environmental Studies*, 22(1), 25–40.

Kashiwakura, S., Kumagai, Y., Kubo, H., & Wagatsuma, K. (2013). Dissolution of Rare Earth Elements from Coal Fly Ash Particles in a Dilute H₂SO₄ Solvent. *Open Journal of Physical Chemistry*, 03(02), 69–75.
<https://doi.org/10.4236/ojpc.2013.32009>

Kim, E. (2012). Hydrometallurgy Aqueous stability of thorium and rare earth metals in monazite hydrometallurgy : Eh – pH diagrams for the systems Th – , Ce – , La – , Nd – (PO 4) – (SO 4) – H 2 O at 25 ° C. *Hydrometallurgy*, 113–114, 67–78.
<https://doi.org/10.1016/j.hydromet.2011.12.007>

Kim, R., Cho, H., Han, K. N., Kim, K., & Mun, M. (2016). Optimization of acid leaching of rare-earth elements from mongolian apatite-based ore. *Minerals*, 6(3).
<https://doi.org/10.3390/min6030063>

Kolker, A., Scott, C., Hower, J. C., Vazquez, J. A., Lopano, C. L., & Dai, S. (2017). Distribution of rare earth elements in coal combustion fly ash, determined by SHRIMP-RG ion microprobe. *International Journal of Coal Geology*, 184, 1–10.
<https://doi.org/10.1016/j.coal.2017.10.002>

Kuppusamy, V. K., Kumar, A., & Holuszko, M. (2019). Simultaneous Extraction of Clean Coal and Rare Earth Elements From Coal Tailings Using Alkali-Acid Leaching Process. *Journal of Energy Resources Technology, Transactions of the ASME*, 141(7), 1–7. <https://doi.org/10.1115/1.4043328>

Kutchko, B. G., & Kim, A. G. (2006). Fly ash characterization by SEM-EDS. *Fuel*, 85(17–18), 2537–2544. <https://doi.org/10.1016/j.fuel.2006.05.016>

Lefler, H., Zhang, Y., Fang, Z. Z., Free, M., & Huang, Z. (2017). Removal of silicon



Lewis, A., Rene, E. R., Sahinkaya, E., & Lens, P. N. L. (2017). *Precipitation of Heavy Metals*. 8(March), 1–288. <https://doi.org/10.1007/978-3-319-58622-9>

Lin, R., Howard, B. H., Roth, E. A., Bank, T. L., Granite, E. J., & Soong, Y. (2017). Enrichment of rare earth elements from coal and coal by-products by physical separations. *Fuel*, 200, 506–520. <https://doi.org/10.1016/j.fuel.2017.03.096>

Lin, R., Stuckman, M., Howard, B. H., Bank, T. L., Roth, E. A., Macala, M. K., Lopano, C., Soong, Y., & Granite, E. J. (2018). Application of sequential extraction and hydrothermal treatment for characterization and enrichment of rare earth elements from coal fly ash. *Fuel*, 232(May), 124–133. <https://doi.org/10.1016/j.fuel.2018.05.141>

Maidel, M., Jerônimo de Santana Ponte, M. J., & de Araújo Ponte, H. (2019). Recycling lanthanum from effluents of elektrokinetic treatment of FCC spent catalyst, using a selective precipitation technique. *Separation and Purification Technology*, 210, 251–257. <https://doi.org/10.1016/j.seppur.2018.08.001>

Manurung, H., Rosita, W., Bendiyasa, M., Prasetya, A., Anggara, F., Astuti, W., Djuanda, D. R., & Tri, Himawan Murti, B. (2020). *RECOVERY OF RARE EARTH ELEMENTS AND YTRIUM FROM NON-MAGNETIC COAL FLY ASH USING ACETIC ACID SOLUTION*.

Manurung, H., Rosita, W., Petrus, H. B. T. M., & I M Bendiyasa1, 2. (2020). *Amorphous Silicate Decomposition from Non- Magnetic Coal Fly Ash using Sodium Hydroxide Amorphous Silicate Decomposition from Non-Magnetic Coal Fly Ash using Sodium Hydroxide*. <https://doi.org/10.1088/1757-899X/742/1/012041>

Mayfield, D. B., & Lewis, A. S. (2013). Environmental Review of Coal Ash as a Resource for Rare Earth and Strategic Elements. *2013 World of Coal Ash (WOCA) Conference*, April 2013, 1–10. <http://www.flyash.info/2013/051-Mayfield-2013.pdf>



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

UNIVERSITAS
GADJAH MADA

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

McGill, I. (2000). Rare Earth Elements. In *Ullmann's Encyclopedia of Industrial Chemistry*. https://doi.org/10.1002/14356007.a22_607

McNeil, M. A., Karali, N., & Letschert, V. (2019). Forecasting Indonesia's electricity load through 2030 and peak demand reductions from appliance and lighting efficiency. *Energy for Sustainable Development*, 49, 65–77. <https://doi.org/10.1016/j.esd.2019.01.001>

Meawad, A. S., Bojinova, D. Y., & Pelovski, Y. G. (2010). An overview of metals recovery from thermal power plant solid wastes. *Waste Management*, 30(12), 2548–2559. <https://doi.org/10.1016/j.wasman.2010.07.010>

Napitupulu, H. Y. S., Azis, Y., & Komalasari. (2018). *Pengaruh Temperatur Terhadap Kinetika Reaksi Pembentukan Hidroksiapatit (HAp) dari Precipitated Calcium Carbonate (PCC) Cangkang Telur Itik Melalui Proses Presipitasi*. 5, 1–6.

Obuz, H. E., Günes, H., Kara, A., Ugurluer, D., Babuccuoglu, Y., & Alkan, M. (2018). *Leaching Kinetics of Rare-Earth Elements from Complex Ores by Acidic Solutions*. 2391–2398. https://doi.org/10.1007/978-3-319-95022-8_201

Oncel, M. S., Muhcü, A., Demirbas, E., & Kobya, M. (2013). A comparative study of chemical precipitation and electrocoagulation for treatment of coal acid drainage wastewater. *Journal of Environmental Chemical Engineering*, 1(4), 989–995. <https://doi.org/10.1016/j.jece.2013.08.008>

Pan, J., Nie, T., Vaziri Hassas, B., Rezaee, M., Wen, Z., & Zhou, C. (2020). Recovery of rare earth elements from coal fly ash by integrated physical separation and acid leaching. *Chemosphere*, 248, 126112. <https://doi.org/10.1016/j.chemosphere.2020.126112>

Park, S., Kim, M., Lim, Y., Yu, J., Chen, S., Woo, S. W., Yoon, S., Bae, S., & Kim, H. S. (2021). Characterization of Rare Earth Elements Present in Coal Ash by Sequential Extraction. *Journal of Hazardous Materials*, 402(April 2020), 123760. <https://doi.org/10.1016/j.jhazmat.2020.123760>

Park, S., & Liang, Y. (2019). Bioleaching of trace elements and rare earth elements from coal fly ash. *International Journal of Coal Science and Technology*, 6(1), 74–



Peiravi, M., Ackah, L., Guru, R., Mohanty, M., Liu, J., Xu, B., Zhu, X., & Chen, L. (2017). Chemical extraction of rare earth elements from coal ash. *Minerals and Metallurgical Processing*, 34(4), 170–177. <https://doi.org/10.19150/mmp.7856>

Perry, R. H., & Green, D. W. (1997). *Perrys Chemical Engineers Handbook*.

PLN. (2021). Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) PT PLN (Persero) 2021-2030. *Rencana Usaha Penyediaan Tenaga Listrik 2021-2030*, 2019–2028.

Porvali, A., Wilson, B. P., & Lundström, M. (2018). Lanthanide-alkali double sulfate precipitation from strong sulfuric acid NiMH battery waste leachate. *Waste Management*, 71, 381–389. <https://doi.org/10.1016/j.wasman.2017.10.031>

Powell, J. E. (1964). The Rare-Earth Elements. In *Journal of the American Chemical Society* (Vol. 86, Issue 21). <https://doi.org/10.1021/ja01075a061>

Pui-Kwan Tse. (2011). China's Rare-Earth Industry. *Proceedings of the TMS Fall Meeting*, 131–144.

Rosita, W., Bendiyasa, I. M., Perdana, I., & Anggara, F. (2020a). Experimental study of rare earth element enrichment from Indonesian coal fly ash: Alkaline leaching. *Key Engineering Materials*, 840 KEM, 514–519.
<https://doi.org/10.4028/www.scientific.net/kem.840.514>

Rosita, W., Bendiyasa, I. M., Perdana, I., & Anggara, F. (2020b). Recovery of rare earth elements and Yttrium from Indonesia coal fly ash using sulphuric acid leaching. 050004(April).

Rosita, W., Bendiyasa, I. M., Perdana, I., & Anggara, F. (2020c). Sequential particle-size and magnetic separation for enrichment of rare-earth elements and yttrium in Indonesia coal fly ash. *Journal of Environmental Chemical Engineering*, 8(1), 103575. <https://doi.org/10.1016/j.jece.2019.103575>

Rosita, W., Dea, A. A. B., Bendiyasa, I. M., Indra, P., Ferian, A., & Himawan, T. B. M. P. (2020). Potency of rare earth elements and yttrium in indonesia coal ash. *Key Engineering Materials*, 849 KEM, 102–107.



Roth, E., Lin, R., Howard, B. H., Bank, T. L., Granite, E. J., & Soong, Y. (2017).

Distributions and Extraction of Rare Earth Elements from Coal and Coal By-Products. *World of Coal Ash (WOCA) Conference*, 200, 506–520.
<http://www.flyash.info/>

Safruddin, H., Pramudya, Y. G., Anggoro, H. S. B., Maksum, H., Febri F W Kusuma, S. B., & Wachid Marindra H S, Fajar Rahmadhy, Hari Dwi Wijayanto, R. W. P. (2021). RENCANA UMUM KETENAGALISTRIKAN NASIONAL 2019 - 2038. In *Direktorat Jenderal Ketenagalistrikan* (Issue December).

Saputra, F., Fadli, A., & Amri, A. (2016). Kinetika Reaksi pada Sintesis Hidroksiapatit dengan Metode Presipitasi. *Jom FTEKNIK*, 3(1), 1–6.

Seredin, V. V. (2010). A New Method for Primary Evaluation of the Outlook for Rare Earth Element Ores. *Geology of Ore Deposits*, 52(5), 428–433.
<https://doi.org/10.1134/S1075701510050077>

Seredin, V. V., & Dai, S. (2012). Coal Deposits as Potential Alternative Sources for Lanthanides and Yttrium. *International Journal of Coal Geology*, 94(January), 67–93. <https://doi.org/10.1016/j.coal.2011.11.001>

Shimpi, R. (2019). *a Review of Kinetics of Oxidation of Organic Compounds By Hexacyanoferrate (II)*. 5(164), 164–181. <https://doi.org/10.26479/2019.0502.13>

Silva, R. G., Morais, C. A. froze. food sogood, & Oliveira, É. D. (2019). Selective precipitation of rare earth from non-purified and purified sulfate liquors using sodium sulfate and disodium hydrogen phosphate. *Minerals Engineering*, 134(January), 402–416. <https://doi.org/10.1016/j.mineng.2019.02.028>

Silva, R. G., Morais, C. A., Teixeira, L. V., & Oliveira, É. D. (2019). Selective Precipitation of High-Quality Rare Earth Oxalates or Carbonates from a Purified Sulfuric Liquor Containing Soluble Impurities. *Mining, Metallurgy and Exploration*, 36(5), 967–977. <https://doi.org/10.1007/s42461-019-0090-6>

Smith, J. M., Ness, H. C. Van, & Abbot, M. M. (2001). *Introduction to Chemical*



Smith, R. C., Taggart, R. K., Hower, J. C., Wiesner, M. R., & Hsu-Kim, H. (2019).

Selective Recovery of Rare Earth Elements from Coal Fly Ash Leachates Using Liquid Membrane Processes. *Environmental Science and Technology*, 53(8), 4490–4499. <https://doi.org/10.1021/acs.est.9b00539>

Starink, M. J. (2014). Thermochimica Acta A new model for diffusion-controlled precipitation reactions using the extended volume concept. *Thermochimica Acta*, 596, 109–119. <https://doi.org/10.1016/j.tca.2014.09.016>

Suganal, S., Umar, D. F., & Mamby, H. E. (2018). Identifikasi Keterdapatannya Unsur Logam Tanah Jarang dalam Abu Batubara Pusat Listrik Tenaga Uap Ombilin, Sumatera Barat. *Jurnal Teknologi Mineral Dan Batubara*, 14(2), 111–125. <https://doi.org/10.30556/jtmb.vol14.no2.2018.395>

Sukmajaya, S., Handini, T., Pusptasari, D. J., & Biyantoro, D. (2016). Proses pemisahan logam tanah jarang berat dari pasir senotim. *Prosiding Seminar Penelitian Dan Pengelolaan Perangkat Nuklir*, 115–124.

Sulaksana Permaniaa, Rachela, D., Prasetyoa, A. B., Majidc, R. A., Kartikad, W., Susantoe, I., & Soedarsono, J. W. (2020). *Pengkayaan Unsur Yttrium Dan Cerium Pada Terak Timah Bangka: Analisis Termodinamika*. 2, 45–52.

Supriyanto, D., Wardhana, A. I., Saputra, M., Margareth, C., Aji, I., Simorangkir, D. P., Jumbadi, Asdriargo, A., Arif, I., Hidayat, T., Achmad, T. L., Dilasari, B., Muhammad, F., Suhendar, D., Santoso, I., Fathoni, W., Halim, N., Hanafi, M., Situmorang, B. T., ... Juangga M Mangunsong. (2021). Grand Strategy Mineral dan Batubara. *Direktorat Jenderal Mineral Dan Batubara Kementerian Energi Dan Sumber Daya Mineral*, 1–435.

Taggart, R. K., Hower, J. C., & Hsu-Kim, H. (2018). Effects of roasting additives and leaching parameters on the extraction of rare earth elements from coal fly ash. *International Journal of Coal Geology*, 196(February), 106–114. <https://doi.org/10.1016/j.coal.2018.06.021>

Tang, M., Zhou, C., Zhang, N., Pan, J., Cao, S., Hu, T., Ji, W., Wen, Z., & Nie, T.



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

UNIVERSITAS
GADJAH MADA

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

(2019). Extraction of rare earth elements from coal fly ash by alkali fusion–acid leaching: Mechanism analysis. *International Journal of Coal Preparation and Utilization*, 0(0), 1–20. <https://doi.org/10.1080/19392699.2019.1623206>

Taylor, P., Mejri, W., Korchef, A., Tlili, M., & Amor, M. Ben. (2013). *Desalination and Water Treatment Effects of temperature on precipitation kinetics and microstructure of calcium carbonate in the presence of magnesium and sulphate ions*. July 2013, 37–41. <https://doi.org/10.1080/19443994.2013.808813>

Trinopiawan, K., Avifa, V. N., Sugeng, Y., Susilo, B., & Rakhma, E. (2020). *Studi Pendahuluan Pengendapan Cerium , Lanthanum , dan Neodymium dari Larutan Klorida Menggunakan Sodium Karbonat pada Pengolahan Monasit Bangka*. 41(1), 37–44. <https://doi.org/10.17146/eksplorium.2020.41.1.5871>

Trinopiawan, K., Mubarok, M. Z., Mellawati, J., Ani, B. Y., Prapatan, M., & Metalurgi, T. (2016). *Pelindian logam tanah jarang dari terak timah dengan asam klorida setelah proses fusi alkali*. 37(1), 41–50.

Trisnawati, I., Yulandra, A., Prameswara, G., Rachmi, W., & Panut, P. (2021). Optimization of Multistage Precipitation Processes for Rare Earth Element Purification from Indonesian Zircon Tailings. *Journal of Sustainable Metallurgy*, 7(2), 537–546. <https://doi.org/10.1007/s40831-021-00353-3>

USGS. (2022). U.S. Geological Survey, Mineral Commodity Summaries, January 2022. *Earth*, 703, 2009–2010.

Vassilev, S. V., & Vassileva, C. G. (2007). *A new approach for the classification of coal fly ashes based on their origin , composition , properties , and behaviour*. 86, 1490–1512. <https://doi.org/10.1016/j.fuel.2006.11.020>

Vaziri Hassas, B., Rezaee, M., & Pisupati, S. V. (2020). Precipitation of rare earth elements from acid mine drainage by CO₂ mineralization process. *Chemical Engineering Journal*, 399(March), 125716. <https://doi.org/10.1016/j.cej.2020.125716>

Vignes, A. (2013). Extractive Metallurgy 1. In *Extractive Metallurgy 1*. <https://doi.org/10.1002/9781118618974>



Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton Dengan Menggunakan Sodium Sulfat
I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.
Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>
Walawalkar, M., Nichol, C. K., & Azimi, G. (2016). Process investigation of the acid leaching of rare earth elements from phosphogypsum using HCl, HNO₃, and H₂SO₄. *Hydrometallurgy*, 166, 195–204.
<https://doi.org/10.1016/j.hydromet.2016.06.008>

Wang, J., Huang, X., Cui, D., Wang, L., Feng, Z., Hu, B., Long, Z., & Zhao, N. (2017). Recovery of rare earths and aluminum from FCC waste slag by acid leaching and selective precipitation. *Journal of Rare Earths*, 35(11), 1141–1148.
<https://doi.org/10.1016/j.jre.2017.05.011>

Wang, W., Qin, Y., Sang, S., Zhu, Y., Wang, C., & Weiss, D. J. (2008). Geochemistry of rare earth elements in a marine influenced coal and its organic solvent extracts from the Antaibao mining district, Shanxi, China. *International Journal of Coal Geology*, 76(4), 309–317. <https://doi.org/10.1016/j.coal.2008.08.012>

Wang, Z., Dai, S., Zou, J., French, D., & Ian, T. (2019). Rare earth elements and yttrium in coal ash from the Luzhou power plant in Sichuan, Southwest China: Concentration, characterization and optimized extraction. *International Journal of Coal Geology*, 2018, #pagerange#. <https://doi.org/10.1016/j.coal.2019.01.001>

Wiyono, M., & Wahyudi, W. (2018). Analisis Unsur dalam Fly Ash dari Industri PLTU Batubara dengan Metode Analisis Aktivasi Neutron. *Jurnal Teknologi Lingkungan*, 19(2), 221. <https://doi.org/10.29122/jtl.v19i2.2778>

Wu, S., Wang, L., Zhao, L., Zhang, P., El-Shall, H., Moudgil, B., Huang, X., & Zhang, L. (2018). Recovery of rare earth elements from phosphate rock by hydrometallurgical processes – A critical review. *Chemical Engineering Journal*, 335(August 2017), 774–800. <https://doi.org/10.1016/j.cej.2017.10.143>

Yan, K., Guo, Y., Ma, Z., Zhao, Z., & Cheng, F. (2018). Quantitative analysis of crystalline and amorphous phases in pulverized coal fly ash based on the Rietveld method. *Journal of Non-Crystalline Solids*, September 2017, 0–1. <https://doi.org/10.1016/j.jnoncrysol.2017.12.043>

Yao, Z. T., Li, J. H., Xia, M. S., & Ye, Y. (2010). The Preparation of Silica White from Fly Ash and Its Characterization. *Selected Proceedings of the Fifth International Conference on Waste Management and Technology(Icwmt 5)*, December, 638–641.



**Studi Presipitasi Logam Tanah Jarang Dari Purified Liquor Abu Terbang Batu Bara PLTU Paiton
Dengan
Menggunakan Sodium Sulfat**

I DARARI TAJAYANI, Ir. Sutijan, M.T., Ph.D. ; Prof. Dr. Ir. Sarto, M.Sc., IPU.

UNIVERSITAS
GADJAH MADA

Universitas Gadjah Mada, 2023 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Yu, M., Jiang, X., Mei, G., & Chen, X. (2018). Leaching kinetic study of Y and Eu from waste phosphors using hydrochloric acid solution containing hydrogen peroxide. *Physicochemical Problems of Mineral Processing*, 54(2), 238–248. <https://doi.org/10.5277/ppmp1808>

Zhang, F. S., Yamasaki, S., & Kimura, K. (2001). Rare earth element content in various waste ashes and the potential risk to Japanese soils. *Environment International*, 27(5), 393–398. [https://doi.org/10.1016/S0160-4120\(01\)00097-6](https://doi.org/10.1016/S0160-4120(01)00097-6)

Zhang, W., & Honaker, R. Q. (2018). Rare Earth Elements Recovery Using Staged Precipitation from a Leachate Generated from Coarse Coal Refuse. *International Journal of Coal Geology*, 195, 189–199. <https://doi.org/10.1016/j.coal.2018.06.008>

Zorn, C., & Kaminski, N. (2017). *Temperature – humidity – bias testing on insulated-gate bipolartransistor modules – failure modes and acceleration due to high voltage*. May. <https://doi.org/10.1049/iet-pel.2015.0031>