

## DAFTAR PUSTAKA

- Ahn, J. W., Thriveni, T., & Jegal, Y. (2015). Occurrence and Distribution of Rare Earths with Different Coal Power Plants Ash and Recovery of Critical Rare Earths from Coal Ash for Simultaneous Utilization of CO<sub>2</sub>. In World of Coal Ash (WOMCA) Conference. University of Kentucky Center for Applied Energy Research, Nashville, TN
- 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. *Environmental Science & Technology*, 46, 3406–3414. <https://doi.org/10.1021/es203518d>
- Anggara, F., Amijaya, D. H., Harijoko, A., Tambaria, T. N., Sahri, A. A., & Asa, Z. A. N. (2018). Rare Earth Element and Yttrium Content of Coal in The Banko Coal Field, South Sumatra Basin, Indonesia: Contributions from tonstein layers. *Int J Coal Geology*, 196, 159–172. <https://doi.org/10.1016/j.coal.2018.07.006>
- Antonick, P. J., Hu, Z., Fujita, Y., LTJd, D. W., Das, G., Wu, L., Shivaramaiah, R., Kim, P., Eslamimanesh, A., Lencka, M. M., Jiao, Y., Anderko, A., Navrotsky, A., & Rimann, R. E. (2019). Bio- and Mineral Acid Leaching of Rare Earth Elements from Synthetic Phosphogypsum. *J. Chem. Thermodyn.* 132, 491–496. <https://doi.org/10.1016/j.jct.2018.12.034>
- Araucz, K., Aurich, A., & Kołodyńska, D. (2020). Novel Multifunctional Ion Exchangers for Metal Ions Removal in The Presence of Citric Acid. *Chemosphere*, 251, 126331. <https://doi.org/10.1016/j.chemosphere.2020.126331>
- Astuti, W., Hirajima, T., Sasaki, K., & Okibe, N. (2016). Comparison of Atmospheric Citric Acid Leaching Kinetics of Nickel from Different Indonesian Saprolitic Ores. *Hydrometallurgy* 161, 138–151. <https://doi.org/10.1016/j.hydromet.2015.12.015>
- Aung, K. M. M., & Ting, Y. P. (2005). Bioleaching of Spent Fluid Catalytic Cracking Catalyst Using Aspergillus Niger. *J. Biotechnology*. 116(2), 159–170. <https://doi.org/10.1016/j.biotech.2004.10.008>
- Aurich, A., Hofmann, J., Oltrogge, R., Wecks, M., Gläser, R., Blömer, L., Mauersberger, S., Müller, R.A., Sicker, D., & Giannis, A. (2017). Improved Isolation of Microbiologically Produced (2R,3S)-Isocitric Acid by Adsorption on Activated Carbon and Recovery with Methanol. *Org. Process Res. Dev.* 21(6), 866–870. <https://doi.org/10.1021/acs.oprd.7b00090>

- Badan Geologi Kementerian ESDM. (2023). *Potensi Logam Tanah Jarang di Indonesia. Pusat Sumber Daya Mineral, Batubara dan Panas Bumi*
- Bartonova, L. (2015). Unburned Carbon from Coal Combustion Ash: An Overview. *Fuel Processing Technology*, 134, 136–158. <https://doi.org/10.1016/j.fuproc.2015.01.028>
- Bauer, D., Diamond, D., Li, J., McKittrick, M., Sandalow, D., & Telleen, P. (2011). Critical Materials Strategy. Washington, DC. <https://doi.org/10.2172/1043921>
- Belkin, H. E., & Tewalt, S. J. (2007). Geochemistry of selected coal samples from Sumatra, Kalimantan, Sulawesi, and Papua, Indonesia. *U.S. Geological Survey Open-File Report*, 1202, 34. <https://doi.org/10.3133/ofr20071202>
- 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. *Int J Coal Sci Technol.* 9(20). <https://doi.org/10.1007/s40789-022-00476-2>
- Borra, C. R., Pontikes, Y., Binnemans, K., & Gerven, T. V. (2015). Leaching of Rare Earths from Bauxite Residue (Red Mud). *Minerals Engineering*, 76, 20–27. <https://doi.org/10.1016/j.mineng.2015.01.005>
- Buchanan, C. A., Ko, E., Cira, S., Balasubramanian, M., Goldsmith, B. R., & Singh, N. (2020). Structures and FTIR Energies of Cerium Ions in Acidic Electrolytes. *Inorg. Chem.* 59(17), 12552–12563. <https://doi.org/10.1021/acs.inorgchem.0c01645>
- Chen, L., He, X., Dan, X., Wang, X., Liu, W., Zhang, D., & Yang, T. (2024). Rare earth dissolution from polishing powder waste in H<sub>2</sub>O<sub>2</sub>-H<sub>2</sub>SO<sub>4</sub> system: Condition optimization and leaching mechanism. *Hydrometallurgy*. 224, 106248. <https://doi.org/10.1016/j.hydromet.2023.106248>
- Choudhary, A. K. S., Kumar, S., & Maity, S. (2022). A Review on mineralogical speciation, global occurrence and distribution of rare earths and yttrium (REY) in coal ash. *J. Earth Syst. Sci.* 131(3), 188. <https://doi.org/10.1007/s12040-022-01913-1>
- Crundwell, F. K. (2013) The dissolution and leaching of minerals. *Hydrometallurgy* 139, 132–148. <https://doi.org/10.1016/j.hydromet.2013.08.003>
- Dai, S., Jiang, Y., Ward, C. R., Gu, L., Seredin, V. V., Liu, H., Zhou, D., Wang, X., Sun, Y., Zou, J., & Ren, D. (2012). Mineralogical and geochemical compositions of the coal in the Guanbanwusu Mine, Inner Mongolia, China: further evidence for the existence of an Al (Ga and LTJ) ore deposit in the

- Jungar Coal field. *Int. J. Coal Geol.* 98, 10–40. <https://doi.org/10.1016/j.coal.2012.03.003>
- Dai, S., Seredin, V. V., Ward, C.R., Jiang, J., Hower, J. C., Song, X., Jiang, Y., Wang, X., Gornostaeva, T., Li, X., Liu, H., Zhao, L., & Zhao, C. (2014a). Composition and modes of occurrence of minerals and elements in coal combustion products derived from high-Ge coals. *Int. J. Coal Geol.* 121, 79–97. <https://doi.org/10.1016/j.coal.2013.11.004>
- Dai, S., Zhao, L., Hower, J. C., Johnston, M. N., Song, W., Wang, P., & Zhang, S. (2014b). 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 Fuels*, 28, 1502–1514. <https://doi.org/10.1021/ef402184t>
- Dai, S., Zhao, L., Peng, S., Chou, C. L., 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. *Int. J. Coal Geol.* 81, 320–332. <https://doi.org/10.1016/j.coal.2009.03.005>
- Ding, J., Ma, S., Zheng, S., Zhang, Y., Xie, Z., Shen, S., & Liu, Z. (2016). Study of extracting alumina from high-alumina PC fly ash by a hydro-chemical process. *Hydrometallurgy*, 161, 58–64. <https://doi.org/10.1016/j.hydromet.2016.01.025>
- Ekaputri, J. J., Brahmantyo, D., Rahmadina, A., Wijaya, A. L., Karuru, R. S., Raizal, P., Bari, M. S. A., Muhammad, A. R. (2019). Laporan TW IV: Kajian Karakterisasi Kandungan Fly ash - Bottom Ash PLTU Air Anyir
- Espinosa, D. C. R., & Mansur, M. B. (2019). *Recycling batteries. Waste Electrical and Electronic Equipment (WEEE) Handbook*, 371–391. <https://doi.org/10.1016/b978-0-08-102158-3.00014-8>
- Finkelman, R. B., Palmer, C. A., & Wang, P. (2018). Quantification of the modes of occurrence of 42 elements in coal. *Int. J. Coal Geol.* 185, 138–160. <https://doi.org/10.1016/j.coal.2017.09.005>
- Firman, F., Haya, A., Sahidi, A. A. (2020). Identifikasi Kandungan Logam Tanah Jarang pada Abu Batubara PLTU Mulut Tambang. *Jurnal GEOMining*, 1(1), 18–24. <https://doi.org/10.33387/geomining.v1i1.2089>
- Firman., & Haya, A. (2021). Study on the Potential Rare Earth Elements in Coal Combustion Product from Banjarsari Power Plant, South Sumatera. *IOP Conf. Ser.: Mater. Sci. Eng.* 1125, 012003. <https://doi.org/10.1088/1757-899X/1125/1/012003>
- Gergoric, M., Ravaux, C., Steenari, B. M., Espegren, F., & Retegan, T. (2018). Leaching and recovery of rare-earth elements from neodymium magnet

- waste using organic acids. *Metals (Basel)*, 8, 1–17. <https://doi.org/10.3390/met8090721>
- Golev, A., Scott, M., Erskine, P. D., Ali, S. H., & Ballantyne, G. R. (2014). Rare earths supply chains: Current status, constraints and opportunities. *Resources Policy*, 41, 52–59. <https://doi.org/10.1016/j.resourpol.2014.03.004>
- Gollakota, A. R. K., Volli, V., & Shu, C. M. (2019). Progressive utilisation prospects of coal fly ash: A review. *Sci. Total Environ.* 672, 951–989. <https://doi.org/10.1016/j.scitotenv.2019.03.337>
- Gu, K., Li, W., Han, J., Liu, W., Qin, W., & Cai, L. (2019). Arsenic removal from lead-zinc smelter ash by NaOH-H<sub>2</sub>O<sub>2</sub> leaching. *Sep. Purif. Technol.* 209, 128–135. <https://doi.org/10.1016/j.seppur.2018.07.023>
- Gupta, C. K., & Krishnamurthy, N. (1992). Extractive metallurgy of rare earths. *International Materials Reviews*, 37(1), 197-248. <https://doi.org/10.1179/imr.1992.37.1.197>
- Haq, S. R., Tamamura, S., Igarashi, T., & Kaneko, K. (2018a). Characterization of organic substances in lignite before and after hydrogen peroxide treatment: Implications for microbially enhanced coal bed methane. *International Journal of Coal Geology*, 185, 1–11. <https://doi.org/10.1016/j.coal.2017.11.009>
- Haq, S. R., Tamamura, S., Ueno, A., Tamazawa, S., Aramaki, N., Murakami, T., Alam, A. K. M. B., Igarashi, T., Kaneko, K. (2018b). Biogenic methane generation using solutions from column reactions of lignite with hydrogen peroxide. *International Journal of Coal Geology*. 197, 66–73 <https://doi.org/10.1016/j.coal.2018.08.007>
- Haselhuhn, H. J., Carlson, J. J., & Kawatra, S. K. (2012). Water chemistry analysis of an industrial selective flocculation dispersion hematite ore concentrator plant. *International Journal of Mineral Processing*. 102-103, 99-106. <https://doi.org/10.1016/j.minpro.2011.10.002>
- Haxel, G. B., Hedrick, J. B., & Orris, G. J. (2005). Rare earth elements—critical resources for high technology. Geological Survey, US
- He, L. P., Sun, S. Y., Song, X.F., & Yu, J. G. (2017) Leaching process for recovering valuable metals from the LiNi<sub>1/3</sub>Co<sub>1/3</sub>Mn<sub>1/3</sub>O<sub>2</sub> cathode of lithium-ion batteries. *Waste Manag* 64, 171–181. <https://doi.org/10.1016/j.wasman.2017.02.011>
- Hovey, J. L., Dittrich, T. M., & Allen, M. J. (2023). Coordination chemistry of surface-associated ligands for solid–liquid adsorption of rare-earth

- elements. *J. Rare Earths.* 41(1), 1–18. <https://doi.org/10.1016/j.jre.2022.05.012>
- Hower, J.C. (2012). Petrographic examination of coal-combustion fly ash. *Int. J. Coal Geol.* 92, 90–97. <https://doi.org/10.1016/j.coal.2011.12.012>
- Huang, K., Inoue, K., Harada, H., Kawakita, H., & Ohto, K. (2011). Leaching of heavy metals by citric acid from fly ash generated in municipal waste incineration plants. *J. Mater. Cycles Waste Manag.* 13, 118–126. <https://doi.org/10.1007/s10163-011-0001-5>
- Humphries, M. (2013). Rare earth elements: The global supply chain. In Rare earth Minerals: Policies and Issues
- Innocenzi, V., & Vegliò, F. (2012). Recovery of rare earths and base metals from spent nickel-metal hydride batteries by sequential sulphuric acid leaching and selective precipitations. *J. Power Sources.* 211, 184–191. <https://doi.org/10.1016/j.jpowsour.2012.03.064>
- Ji, B., Li, Q., & Zhang, W. (2022). Leaching Recovery of Rare Earth Elements from Calcination Product of a Coal Coarse Refuse Using Organic Acids. *J. Rare Earths.* 40(2), 318-327. <https://doi.org/10.1016/j.jre.2020.11.021>
- Jin, S., Zhao, Z., Jiang, S., Sun, J., Pan, H., & Jiang, L. (2021). Comparison and Summary of Relevant Standards for Comprehensive Utilization of Fly ash at Home and Abroad. *IOP Conf. Ser.: Earth Environ. Sci.* 621(1), 012006. <https://doi.org/10.1088/1755-1315/621/1/012006>
- Junior, A. B. B., Espinosa, D. C. R., Vaughan, J., & Tenório, A. S. T. (2022). Extraction of Rare-Earth Elements from Silicate-Based Ore through Hydrometallurgical Route. *Metals,* 12(7), 1133. <https://doi.org/10.3390/met12071133>
- Kashiwakura, S., Kumagai, Y., Kubo, H., & Wagatsuma, K. (2013). Dissolution of Rare Earth Elements from Coal Fly ash Particles in a Dilute H<sub>2</sub>SO<sub>4</sub> Solvent. *Open J. Phys. Chem.* 3(2), 69–75. <https://doi.org/10.4236/ojpc.2013.32009>
- Kasmiyatun, M., & Jos, B. (2008). Ekstraksi Asam Sitrat Dan Asam Oksalat : Pengaruh Trioctylamine sebagai Extracting Power dalam Berbagai Solven Campuran Terhadap Koefisien Distribusi. *Reaktor,* 12(2), 107-116. <https://ejournal.undip.ac.id/index.php/reaktor/article/viewFile/1637/1399>.
- Kementerian Energi dan Sumber Daya Mineral, Badan Geologi, Pusat Sumber Daya Mineral, Batubara, dan Panas Bumi. (2023). Potensi sumberdaya unsur tanah jarang (Rare Earth Element, REY) dalam batubara dan abunya. Jakarta: Kementerian Energi dan Sumber Daya Mineral.
- Kertalli, E., Rijnsoever, L. S., Paunovic, V., Schouten, J. J., D'Angelo, M. F., & Nijhuis, T. A. (2016). Propylene epoxidation with hydrogen peroxide in

- acidic conditions. *Chemical Engineering Science*, 156, 36–43. <https://doi.org/10.1016/j.ces.2016.09.008>
- Ketris, M. P., & Yudovich, Y. E. (2009). Estimations of clarkes for carbonaceous biolithes: World averages for trace element contents in black shales and coals. *Int. J. Coal Geol.* 78, 135–148. <https://doi.org/10.1016/j.coal.2009.01.002>
- Klupa, A. (2016). Determination of properties of clean coal technology post-process residue. *J. Sustainable Mining*. 15, 143–150. <http://dx.doi.org/10.1016/j.jsm.2017.03.002>
- 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. *Int. J. Coal Geol.* 184, 1–10. <https://doi.org/10.1016/j.coal.2017.10.002>
- Kutchko, B. G., Kim, A. G. (2006). Fly ash Characterization by SEM-EDS. *Fuel* 85, 2537–2544. <https://doi.org/10.1016/j.fuel.2006.05.016>
- Li, L., Ge, J., Wu, F., Chen, R., Chen, S., & Wu, B. (2010). Recovery of cobalt and lithium from spent lithium ion batteries using organic citric acid as leachant. *J. Hazard. Mater.* 176, 288–293. <https://doi.org/10.1016/j.jhazmat.2009.11.026>
- Lin, C., Wenjie, C., Xiaofeng, H., Duchao, Z., Weifeng, L., & Tianzu, Y. (2024). Efficient processing rare earth polishing powder solid waste by thiourea-H<sub>2</sub>SO<sub>4</sub> system: process optimization and thiourea decomposition effect. *Process. Saf. Environ. Prot.* 181, 53–63. <https://doi.org/10.1016/j.psep.2023.11.011>
- 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>
- Liu, P., Zhao, S., Xie, N., Yang, L., Wang, Q., Wen, Y., Chen, H., & Tang, Y. (2023). Green Approach for Rare Earth Element (LTJ) Recovery from Coal Fly ash. *Environ. Sci. Tech-nol.* 57(13), 5414–5423. <https://doi.org/10.1021/acs.est.2c09273>
- Liu, Q., Tu, T., Guo, H., Cheng, H., & Wang, X. (2020). High-efficiency simultaneous extraction of rare earth elements and iron from NdFeB waste by oxalic acid leaching. *Journal of Rare Earths*. 39(3), 323–330. <https://doi.org/10.1016/j.jre.2020.04.020>
- Manurung, H., Rosita, W., Bendiyasa, I. M., Prasetya, A., Anggara, F., Astuti, W., Djuanda, D. R., & Petrus, H. T. B. M. (2020). Recovery of rare earth

- elements and yttrium from non-magnetic coal fly ash using acetic acid solution. *J Metal Indonesia*. 42(1), 35–42. <https://doi.org/10.32423/jmi.2020.v42.35-42>
- Maryanto, S., Rachmansjah, Sihombing, T., dan Wiryo Sujono, S. (2005). Sedimentologi Batuan Pembawa Batubara Formasi Lati di Lintasan Lati, Berau, Kalimantan Timur. *Jurnal Sumber Daya Geologi*. 15(4), 33–48.
- McDonald, R. G., & Whittington, B. I. (2008). Atmospheric acid leaching of nickel laterites review. Part II. Chloride and bio-technologies. *Hydrometallurgy* 91, 56–69. <https://doi.org/10.1016/j.hydromet.2007.11.010>
- Nascimento, M., Lemos, F. de A., Guimarães, R., Sousa, C. A. de, & Lopes, P. R. S. (2019). Modeling of LTJ and Fe Extraction from a Concentrate from Araxá (Brazil). *Minerals*, 9(7), 451. <https://doi.org/10.3390/min9070451>
- Nugroho, N. D., Rosita, W., Perdana, I., Bendiyasa, I. M., Mufakhir, F. R., Astuti, W. (2019). Iron bearing oxide minerals separation from rare earth elements (LTJ) rich coal fly ash. *IOP Conf. Series: Materials Science and Engineering*, 478, 012026. <https://doi.org/10.1088/1757-899X/478/1/012026>
- Nurkhamim. (2010). Pemetaan Sebaran Unsur Pb Menggunakan Pendekatan Matematis, JIK TekMin, 23(3), 35–43. [http://eprints.upnyk.ac.id/34130/1/2010\\_JTM%20UPNVY%20No.%2023\\_Pemetaan%20Sebaran%20Unsur%20Pb%20menggunakan%20pendekatan%20matematis\\_NURKHAMIM\\_Merged\\_next%20e-print.pdf](http://eprints.upnyk.ac.id/34130/1/2010_JTM%20UPNVY%20No.%2023_Pemetaan%20Sebaran%20Unsur%20Pb%20menggunakan%20pendekatan%20matematis_NURKHAMIM_Merged_next%20e-print.pdf)
- Nurkhamim., Wardani, I, R., Poertranto, D, W, A., & Purwanta, J. (2023). Pemanfaatan Batubara dan Limbah Abu Batubara. LPPM Universitas Pembangunan Nasional “Veteran” Yogyakarta. [http://eprints.upnyk.ac.id/41885/1/BUKU%20LENGKAP\\_Pemanfaatan%20Batubara%20dan%20Limbah%20Abu%20Batubara.pdf](http://eprints.upnyk.ac.id/41885/1/BUKU%20LENGKAP_Pemanfaatan%20Batubara%20dan%20Limbah%20Abu%20Batubara.pdf)
- O'Driscoll, M. (1988). Rare earths enter the dragon. *Industrial Minerals*, 254, 21–55
- Pan, J., Hassas, B. V., Rezaee, M., Zhou, C., & Pisupati, S. V. (2020a). Recovery of Rare earth elements from coal fly ash through sequential chemical roasting, water leaching, and acid leaching processes. *Journal of Cleaner Production*, 124725. <https://doi.org/10.1016/j.jclepro.2020.124725>
- Pan, J., Nie, T., Vaziri Hassas, B., Rezaee, M., Wen, Z., & Zhou, C. (2020b). 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>

- Pan, J., Zhou, C., Tang, M., Cao, S., Liu, C., Zhang, N., Wen, M., Luo, Y., Hu, T., & Ji, W. (2019). Study on the modes of occurrence of Rare earth elements in coal fly ash by statistics and a sequential chemical extraction procedure. *Fuel*, 237, 555–565. <https://doi.org/10.1016/j.fuel.2018.09.139>
- Peiravi, M., Ackah, L., Guru, R., Mohanty, M., & Liu, J. (2017). Chemical extraction of rare earth elements from coal ash. *Minerals and Metallurgical Processing*, 34, 170–177. <https://doi.org/10.19150/mmp.7856>
- Pemerintah Republik Indonesia. (2003). Peraturan Pemerintah Republik Indonesia Nomor 45 Tahun 2003 tentang Perubahan Atas Keputusan Presiden Republik Indonesia Nomor 13 Tahun 2000. Lembaran Negara Republik Indonesia Tahun 2003 Nomor 45.
- Rachmansjah, WiryoSujono, S., Sihombing, T., & Maryanto, S. (2003). Stratigrafi dan Sedimentologi Cekungan Batubara Tarakan, Kalimantan Timur. Laporan Teknis Intern, Pusat Penelitian dan Pengembangan Geologi, Bandung.
- Raclavska, H., Raclavsky, K., & Matysek, D. (2009). Colour measurement as a proxy method for estimation of changes in phase and chemical composition of fly ash formed by combustion of coal. *Fuel*, 88, 2247–2254. <https://doi.org/10.1016/j.fuel.2009.04.033>
- Rao, K. A., Serajuddin, M., RamaDevi, G., Thakurta, S. G., & Sreenivas, T. (2021). On the characterization and leaching of rare earths from a coal fly ash of Indian origin. *Separation Science and Technology*, 56(3), 541–557. <https://doi.org/10.1080/01496395.2020.1718705>
- Reisdörfer, G., Bertuol, D., & Tanabe, E. H. (2019). Recovery of neodymium from the magnets of hard disk drives using organic acids. *Miner. Eng.*, 143, 105938. <https://doi.org/10.1016/j.mineng.2019.105938>
- Rosita, W., Bendiyasa, I.M., Perdana, I., & Anggara, F.Y. (2020a). Experimental Study of Rare Earth Element Enrichment from Indonesian Coal Fly ash: Alkaline Leaching. *Key Engineering Materials*, 840, 514–519. <https://doi.org/10.4028/www.scientific.net/KEM.840.514>
- Rosita, W., Besari, D. A. A., Bendiyasa, I. M., Perdana, I., Anggara, F., Petrus, H. T. B. M. (2020b). Potency of Rare Earth Elements and Yttrium in Indonesia Coal Ash. *Key Engineering Materials*. 849, 102–107. <https://doi.org/10.4028/www.scientific.net/kem.849.102>
- 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(5), 103575. <https://doi.org/10.1016/j.jece.2019.103575>

- Rosita, W., Perdana, I., Bendiyasa, I. M., Anggara, F., Petrus, H. T. B. M., Prasetya, A., & Rodliyah, I. (2024). Sequential alkaline-organic acid leaching process to enhance the recovery of Rare earth elements from Indonesian coal fly ash. *Journal of Rare earths*, 42(7), 1366–1374. <https://doi.org/10.1016/j.jre.2023.09.001>
- 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. In World of Coal Ash (WOMCA) Conference. University of Kentucky Center for Applied Energy Research, Lexington, KY, 103
- Sahri, A. A. (2017). Proses Pengayaan Rare Earth Element pada Batubara di Daerah Banko, Tanjung enim, Sumatra Selatan. Universitas Gadjah Mada, Yogyakarta
- Sattar, R., Ilyas, S., Bhatti, H. N., & Ghaffar, A. (2019). Resource recovery of critically-rare metals by hydrometallurgical recycling of spent lithium ion batteries. *Sep. Purif. Technol.* 209, 725–733. <https://doi.org/10.1016/j.seppur.2018.09.019>
- Schoenitz, M., & Navrotsky, A. (1999). Enthalpy of formation of katoite  $\text{Ca}_3\text{Al}_2[(\text{OH})_4]_3$ : Energetics of the hydrogarnet substitution. *American Mineralogist*, 84(3), 389–391. <https://doi.org/10.2138/am-1999-0323>
- Seidel, A., & Zimmels, Y. (1998). Mechanism and kinetics of aluminum and iron leaching from coal fly ash by sulfuric acid. *Chemical Engineering Science*, 53(19), 3835–3852. [https://doi.org/10.1016/S0009-2509\(98\)00201-2](https://doi.org/10.1016/S0009-2509(98)00201-2)
- Seidel, A., Sluszny, A., Shelef, G., & Zimmels, Y. (1999). Self inhibition of aluminum leaching from coal fly ash by sulfuric acid. *Chem. Eng. J.* 72, 195–207. [https://doi.org/10.1016/S1385-8947\(99\)00006-6](https://doi.org/10.1016/S1385-8947(99)00006-6)
- Seredin, V. V., & Dai, S. (2012). Coal deposits as potential alternative sources for lanthanides and yttrium. *International Journal of Coal Geology*, 94, 67–93. <https://doi.org/10.1016/j.coal.2011.11.001>
- Situmorang, R. L., & Burhan, G. (2011). Peta Geologi Bersistem Indonesia lembar Tanjung Redeb 1918, Kalimantan. Sekala 1:250.000. Puslitbang Geologi. Bandung
- Suganal., Datin, F., Umar., & Mamby, H. E. (2018). Identification of Occurrence of Rare Earth Metals in Coal Ash from Ombilin Electric Power Generation Plant, West Sumater. *Jurnal Teknologi Mineral dan Batubara*, 14(2), 111–125. <https://doi.org/10.30556/jtmb.Vol14.No2.2018.395>
- Suwarna, N., & Hermanto, B. (2007). Berau Coal in East Kalimantan: Its Petrographics Characteristics and Depositional Environment. *Indonesian Journal of Geology*, 2(4), 191-206.

- Sworski, T. J., Mahlman, H. A., & Matthews, R. W. (1971). Reduction of cerium(IV) by hydrogen peroxide. Dependence of reaction rate on Hammett's acidity function. *J. Phys. Chem.* 75(2), 250–255. <https://doi.org/10.1021/j100672a012>
- Tambara, T. N. (2017). Pengayaan Rare Earth Element pada Batubara di Daerah Tanjung Enim, Sumatera Selatan. Universitas Gadjah Mada, Yogyakarta.
- Tang, H., Shuai, W., Wang, X., & Liu, Y. (2017). Extraction of rare earth elements from a contaminated cropland soil using nitric acid, citric acid, and EDTA. *Environ. Technol. (United Kingdom)* 38, 1980–1986. <https://doi.org/10.1080/09593330.2016.1244563>
- Tang, M., Zhou, C., Pan, J., Zhang, N., Liu, C., Cao, S., Hu, T., & Ji, W. (2019a). Study on extraction of Rare earth elements from coal fly ash through alkali fusion – Acid leaching. *Minerals Engineering*, 136, 36–42. <https://doi.org/10.1016/j.mineng.2019.01.027>
- Temga, J. P., Sababa, E., Mamdem, L. E., Ngo Bijeck, M. L., Tamfuh Azinwi, P., Tehna, N., Zo'o Zame, P., Onana, V. L., Nguetnkam, J. P., Bitom, L. D., & Ndijgui, P. (2021). Rare earth elements in tropical soils, Cameroon soils (Central Africa). *Geoderma Regional*, 25, 1-25
- Tuan, L. Q., Thenepalli, T., Chilakala, R., Vu, H. H. T., Ahn, J. W., & Kim, J. (2019). Leaching Characteristics of Low Concentration Rare Earth Elements in Korean (Samcheok) CFBC Bottom Ash Samples. *Sustainability*, 11(9), 2562. <https://doi.org/10.3390/su11092562>
- U.S. Geological Survey. (2024). Mineral commodity summaries 2024: U.S. Geological Survey, 212. <https://doi.org/10.3133/mcs2024>
- Valeev, D., Kunilova, I., Alpatov, A., Varnavskaya, A., & Ju, D., (2019). Magnetite and carbon extraction from coal fly ash using magnetic separation and flotation methods. *Minerals*. 9, 5–15. <https://doi.org/10.3390/min9050320>
- Valeev, D., Mikhailova, A., & Atmadzhidi, A. (2018). Kinetics of iron extraction from coal fly ash by hydrochloric acid leaching. *Metals (Basel)*. 8, 533. <https://doi.org/10.3390/met8070533>
- Vargas, L. E., Rojas-Reyes, N. R., & Ocampo-Carmona, L. M. (2023). Recovery of light Rare earth elements, cerium, lanthanum, and neodymium from alluvial gold mining waste from the Bagre-Nechí mining district in Colombia using acid leaching, oxalate precipitation and calcination. *Hydrometallurgy*. 216, 106009. <https://doi.org/10.1016/j.hydromet.2022.106009>
- 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. *Fuel*, 86(10–11), 1490–1512.  
<https://doi.org/10.1016/j.fuel.2006.11.020>
- Verma, A., Corbin, D. R., Shiflett, M. B. (2021). Lithium and cobalt recovery for lithium-ion battery recycle using an improved oxalate process with hydrogen peroxide. *Hydrometallurgy*, 203, 105694.  
<https://doi.org/10.1016/j.hydromet.2021.105694>
- Virdhian, S., & Afrilindia, E. (2014). Karakterisasi Mineral Tanah Jarang Ikutan Timah dan Potensi Pengembangan Industri Berbasis Unsur Tanah Jarang. *Jurnal Metal Indoensia*, 36(2), 61–69.  
<http://dx.doi.org/10.32423/jmi.2014.v36.61-69>
- Wang, R., Zhai, Y., Ning, Z., & Ma, P. (2014). Kinetics of SiO<sub>2</sub> Leaching from Al<sub>2</sub>O<sub>3</sub> Extracted Slag of Fly ash with Sodium Hydroxide Solution. *Transactions of Nonferrous Metals Society of China*. 24(6), 1928–1936.  
[https://doi.org/10.1016/S1003-6326\(14\)63273-8](https://doi.org/10.1016/S1003-6326(14)63273-8)
- Wang, Y., Ziemkiewicz, P., & Noble, A. (2022). A Hybrid Experimental and Theoretical Approach to Optimize Recovery of Rare Earth Elements from Acid Mine Drainage Precipitates by Oxalic Acid Precipitation. *Minerals*, 12(2), 236. <https://doi.org/10.3390/min12020236>
- Wang, Z., Dai, S., Zou, J., French, D., & Graham, I. 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*, 203, 1–14.  
<https://doi.org/10.1016/j.coal.2019.01.001>
- Ward, C., Heidrich, C., & Yeatman, O. (2014). *Coal Combustion Products Handbook*: Second Edition. HBM Group
- Ward, C. R. (2016). Analysis, origin and significance of mineral matter in coal: an updated review. *Int. J. Coal Geol.* 165, 1–27.  
<https://doi.org/10.1016/j.coal.2016.07.014>
- Wen, Z., Zhou, C., Pan, J., Cao, S., Hu, T., Ji, W., Nie, T. (2020). Recovery of rare-earth elements from coal fly ash via enhanced leaching. *Int. J. Coal Prep. Util.* 42(7), 2041–2055. <https://doi.org/10.1080/19392699.2020.1790537>
- Wilson, J. D. (2018). Whatever happened to the rare earths weapon? Critical materials and international security in Asia. *Asian Secur.* 14(3), 358–373.  
<https://doi.org/10.1080/14799855.2017.1397977>
- Xie, G., Guan, Q., Zhou, F., Yu, W., Yin, Z., Tang, H., Zhang, Z., & Chi, R. (2023). A Critical Review of the Enhanced Recovery of Rare Earth Elements from Phosphogypsum. *Molecules*, 28(17), 6284.  
<https://doi.org/10.3390/molecules28176284>

- Zabiszak, M., Nowak, M., Taras-Goslinska, K., Kaczmarek, M.T., Hnatejko, Z., & Jastrzab, R. (2018). Carboxyl groups of citric acid in the process of complex formation with bivalent and trivalent metal ions in biological systems. *J. Inorg. Biochem.* 182, 37–47. <https://doi.org/10.1016/j.jinorgbio.2018.01.017>
- Zacco, A., Borgese, L., Gianoncelli, A., Struis, R. P. W. J., Depero, L. E., & Bontempi, E. (2014). Review of fly ash inertisation treatments and recycling. In *Environmental Chemistry Letters*, 12(1), 153–175. <https://doi.org/10.1007/s10311-014-0454-6>
- Zhang, W., Groppo, J., & Honaker, R. (2015). Ash beneficiation for LTJ recovery, in: World of Coal Ash (WOCA) Conference. University of Kentucky Center for Applied Energy Research, Nashville, TN.
- Zhang, W., Noble, A., Yang, X., & Honaker, R. (2020). A Comprehensive Review of Rare Earth Elements Recovery from Coal-Related Materials. *Minerals*, 10(5), 451. <https://doi.org/10.3390/min10050451>
- Zhang, Z., Allen, L., Podder, P., FLTJ, M. L., & Sarswat, P. K. (2021). Recovery and Enhanced Upgrading of Rare Earth Elements from Coal-Based Resources: Bioleaching and Precipitation. *Minerals*, 11(5), 484. <https://doi.org/10.3390/min11050484>
- Zhou, B., Li, Z., & Chen, C. (2017). Global Potential of Rare Earth Resources and Rare Earth Demand from Clean Technologies. *Minerals*, 7(11), 203. <https://doi.org/10.3390/min7110203>
- Zhou, R. S., Song, J. F., Yang, Q. F., Xu, X. Y., Xu, J. Q., & Wang, T. G. (2008). Syntheses, structures and magnetic properties of a series of 2D and 3D lanthanide complexes 121 constructed by citric ligand. *J. Mol. Struct.* 877(1-3), 115–122. <https://doi.org/10.1016/j.molstruc.2007.07.027>