

REFERENCES

- Abdullah, M. H., Rashid, A. S. A., Anuar, U. H. M., Marto, A., & Abuelgasim, R. (2019). Bottom ash utilization: A review on engineering applications and environmental aspects. *IOP Conference Series: Materials Science and Engineering*, 527, 012006. <https://doi.org/10.1088/1757-899X/527/1/012006>.
- Abdulmatin, A., Tangchirapat, W., & Jaturapitakkul, C. (2018). An investigation of bottom ash as a pozzolanic material. *Construction and Building Materials*, 186, 155 - 162. <https://doi.org/10.1016/j.conbuildmat.2018.07.101>.
- Abidin, N. E. Z., Ibrahim, M. H. W., Jamaluddin, N., Kamaruddin, K., & Hamzah, A. F. (2014). The effect of bottom ash on fresh characteristic, compressive strength and water absorption of self-compacting concrete. *Applied Mechanics and Materials*, 660, 145 - 151.
- Abo-Qudais, S. (2005). Effect of concrete mixing parameters on propagation of ultrasonic waves. *Construction and Building Materials*, 19(4), 257–263.
- Abubakar, A. U., & Baharudin, K. S. (2012). Potential use of Malaysian thermal power plants coal bottom ash in construction. *International Journal of Sustainable Construction Engineering & Technology*, 3(2), 25-37.
- Abuelgasim, R., Rashid, A. S. A., Bouassida, M., Shien, N., & Abdullah, M. H. (2020). Geotechnical characteristics of Tanjung Bin coal bottom ash. *IOP Conference Series: Materials Science and Engineering*, 932, 012055. <https://doi.org/10.1088/1757-899X/932/1/012055>.
- ACAA. (2010). *2009 Coal Combustion Product (CCP) production & use survey report*.

- Aggarwal, P., Aggarwal, Y., & Gupta, S. M. (2007). Effect of bottom ash as replacement of fine aggregates in concrete. *Asian Journal of Civil Engineering*, 8(1), 49–62.
- Aggarwal, Y., & Siddique, R. (2014). Microstructure and properties of concrete using bottom ash and waste foundry sand as partial replacement of fine aggregates. *Construction and Building Materials*, 54, 210–223.
- Al-Badran, Y., & Schanz, T. (2014). Modelling the compaction curve of fine-grained soils. *Soils Foundation*, 54(3), 426–438.
- Anderson, D. A., Usmen, M., & Moulton, L. K. (1976). Use of power plant aggregate in bituminous construction. *Transportation Research Record* 595, 18-24.
- Andrade, L. B., Rocha, J. C., & M. Cheriaf, M. (2009). Influence of coal bottom ash as fine aggregate on fresh properties of concrete. *Construction and Building Material*, 23(2), 609–614.
- Antoni, Klarens, K., Indranata, M., Al Jamali, L., & Hardjito, D. (2017). The use of bottom ash for replacing fine aggregate in concrete paving blocks. *MATEC Web of Conferences*, 138, 01005.
- Arenas, C., Leiva, C., Vilches, L. F., & Cifuentes, H. (2013). Use of co-combustion bottom ash to design an acoustic absorbing material for highway noise barriers. *Waste Management*, 33(2013), 2316–2321.
- Argiz, C., Moragues, A., & Menéndez, E. (2018). Use of ground coal bottom ash as cement constituent in concretes exposed to chloride environments. *Journal of Cleaner Production*, 170, 25–33.

- Argiz, C., Sanjuan, M. A., & Menendez, E. (2017). Coal bottom ash for portland cement production, *Advanced in Material Science and Engineering*, 2017, 1–7, doi: 10.1155/2017/6068286.
- Arvelo, A. (2019). Effects of the soil properties on the maximum dry density obtained from the standard Proctor test. *MSc Dissertation, University of Central Florida, Orlando, Florida*.
- Awang, Abd. R., Marto, A., & Makhtar, A. M. (2012). Morphological and Strength Properties of Tanjung Bin Coal Ash Mixtures for applied in Geotechnical Engineering Work. *International Journal on Advanced Science, Engineering and Information Technology*, 2(2), 55-62.
- Ayala, J., & Fernandez, B. (2016). A case study of landfill leachate using coal bottom ash for the removal of Cd^{2+} , Zn^{2+} and Ni^{2+} . *Metals - Open Access Metallurgy Journal*, 6(12).
- Aydin, E. (2016). Novel coal bottom ash waste composites for sustainable construction. *Construction and Building Materials*, 124, 582–588.
- Ayob, A., Zahid, M. Z. A. M., Zaki, M. F. M., Hamid, S. H. A., Yussuf, M. A. M., & Yunus, A. N. M. (2014). Physical, morphological and strength properties of Jana Manjung coal ash mixture for geotechnical applications. *4th International Malaysia-Ireland Joint Symposium on Engineering, Science and Business*, <https://doi.org/10.13140/2.1.1126.5921>.
- Azimi-Pour, M., Eskandari-Naddaf, H., & Pakzad, A. (2020). Linear and non-linear SVM prediction for fresh properties and compressive strength of high volume fly ash self-compacting concrete. *Construction and Building Materials*, 230.

- Baba, A., & Kaya, A. (2004). Leaching characteristics of solid wastes from thermal power plants of western Turkey and comparison of toxicity methodologies. *Journal of Environmental Management*, 73(2004), 199–207.
- Baite, E., Messan, A., Hannawi, K., Tsobnang, F., & Prince, W. (2016). Physical and transfer properties of mortar containing coal bottom ash aggregates from Tefereyre (Niger). *Construction and Building Materials*, 125, 919–926.
- Balachowski, L., & Sikora, Z. (2013). Mechanical properties of bottom ash – dredged material mixtures in laboratory tests. *Studia Geotechnica et Mechanica*, 35(3), 3–11.
- Bartonova, L., Klika, Z., and Spears, D. A. (2007). Characterization of unburned carbon from ash after bituminous coal and lignite combustion in CFBs. *Fuel*, 86(3), 455-463.
- Benson, C. H., & Bradshaw, S. (2011). User guideline for coal bottom ash and boiler slag in green infrastructure construction. *Recycled Materials Resource Center Report, University of Wisconsin-Madison, USA*.
- Bera, A. K., Ghosh, A., & Ghosh, A. (2007). Compaction Characteristics of Pond Ash. *Journal of Materials in Civil Engineering*, 19(4), 349–357. [https://doi.org/10.1061/\(ASCE\)0899-1561\(2007\)19:4\(349\)](https://doi.org/10.1061/(ASCE)0899-1561(2007)19:4(349)).
- Bezama, A., & Agamuthu, P. (2019). Addressing the big issues in waste management. *Waste Management & Research*, 37(1), 1–3.
- Bhangare, R. C., Ajmal, P. Y., Sahu, S. K., Pandit, G. G., & Puranik, V. D. (2011). Distribution of trace elements in coal and combustion residues from five

- thermal power plants in India. *International Journal of Coal Geology*, 86, 349–356.
- Cadersa, A. S., Seeborun, A. K., & Yuk, A. C. C. (2014). Use of coal bottom ash as mechanical stabiliser in subgrade soil. *Journal of Engineering*, 2014, 1-6.
- Carrasco, B., Cruz, N., Terrados, J., Corpas, F. A., & Pérez, L. (2014). An evaluation of bottom ash from plant biomass as a replacement for cement in building blocks. *Fuel*, 118, 272–280.
- Chelberg, M. B. S. (2019). The effect of fly ash chemical composition on compressive strength of fly ash portland cement concrete. *MSc Dissertation, The Ohio State University*.
- Chouhan, G. S., Kumar, S., Mohapatra, S. K., & Kumar, K. (2017). Comprehensive characterization of grounded bottom ash from Indian thermal power plant. *Journal of Residuals Science and Technology*, 14(1), 1-10.
- Chrishanthi, J. A. C. (2019). Possible use of bottom ash in embankment construction. *MSc Dissertation, University of Moratuwa, Sri Lanka*.
- Clemente, A. S., Werner, C., Maguas, C., Cabral, M. S., Martins-Loucao, M. A., & Correia, O. (2004). Restoration of a limestone quarry: Effect of soil amendments on the establishment of native mediterranean sclerophyllous shrubs. *Restoration Ecology*, 12(1), 20–28. <https://doi.org/10.1111/j.1061-2971.2004.00256.x>.

- Consoli, N. C., Heineck, K. S., Coop, M. R., Fonseca, A. V., & Ferreira, C. (2007). Coal bottom ash as a geomaterial: Influence of particle morphology on the behaviour of granular materials. *Soils and Foundations*, 47(2), 361 – 373.
- Cropaia. (2020). Available at: <https://www.cropaia.com/blog/electrical-conductivity/> (Accessed: 26 September 2020).
- Das, S. K., & Yudhbir. (2006). Geotechnical properties of low calcium and high calcium fly Ash. *Geotechnical & Geological Engineering*, 24, 249–263. <https://doi.org/10.1007/s10706-004-5722-y>.
- Das, S. K., & Sabat, A. K. (2008). Using neural networks for prediction of some properties of fly ash. *Electronic Journal of Geotechnical Engineering*, 13(D).
- Das, S.K. and Yudhbir. (2006). A simplified model for prediction of pozzolanic characteristics of fly ash, based on chemical composition. *Cement and Concrete Research*, 36(10), 1827-1832.
- Dassanayake, D. M. S. P., & Nanayakkara, S. M. A. (2018). Development of geopolymer with coal fired boiler ash. *4th International Multidisciplinary Engineering Research Conference (MERCCon 2018), Moratuwa*, 356–361. <https://doi.org/10.1109/MERCCon.2018.8421910>.
- De, L.C. (2017). Lawn Grasses – A Review. *International Journal of Horticulure*, 7, 82 -94.
- Dissanayake, T. B. C. H., Senanayake, S. M. C. U., & Nasvi, M. C. M. (2017). Comparison of the stabilization behaviour of fly ash and bottom ash treated expansive soil. *Engineer: Journal of the Institution of Engineers, Sri Lanka*, 50(1), 11-19, doi: 10.4038/engineer.v50i1.7240.

- Djokovic, K., Rakic, D., & Ljubojev, M. (2013). Estimation of soil compaction parameters based on the Atterberg limits. *Mining and Metallurgy Engineering Bor*, 4, 1–16. <https://doi.org/10.5937/mmeb1304001D>.
- Dungca, J. R., & Jao, J. A. L. (2017). Strength and permeability characteristics of road base materials blended with fly ash and bottom ash. *International Journal of GEOMATE*, 12(31). <https://doi.org/10.21660/2017.31.6508>.
- Elbisy, M. S. (2015). Support vector machine and regression analysis to predict the field hydraulic conductivity of sandy soil. *KSCE Journal of Civil Engineering*, 19(7), 2307-2316.
- Erandi, N. G. N., Sakunthala, W. C., & Udamulla, K. K. M. L. A. (2013). Use of bottom ash as fine aggregate in manufacturing concrete paving blocks. *Proceeding 2nd International Symposium on Advances in Civil and Environmental Engineering Practices for Sustainable Development*, 69–74.
- Geetha, S. & Ramamurthy, K. (2011). Properties of sintered low calcium bottom ash aggregate with clay binders. *Construction and Building Materials*, 25, 2002–2013. doi:10.1016/j.conbuildmat.2010.11.051.
- Ghadzali, N. S., Wan Ibrahim, M. H., Mohd Zuki, S. S., Hisyam Sani, M. S., & Mohammed Al-Fasih, M. Y. (2020). Material characterization and optimum usage of coal bottom ash (CBA) as sand replacement against concrete properties. *International Journal of Integrated Engineering*, 12(9), 9-17.
- Gimhan, P. G. S., Disanayaka, J. P. B., & Nasvi, M. C. M. (2018). Geotechnical engineering properties of fly ash and bottom ash: Use as civil engineering

- construction material. *Engineer: Journal of the Institution of Engineers, Sri Lanka*, 51(1), 49. <https://doi.org/10.4038/engineer.v51i1.7287>.
- Głuchowski, A., Gabryś, K., Soból, E., Šadzevičius, R., & Sas, W. (2020). Geotechnical properties of anthropogenic soils in road engineering. *Sustainability*, 12, 4843. <https://doi.org/10.3390/su12124843>.
- Gorman, J. M., Sencindiver, J. C., Horvath, D. J., Singh, R. N. & Keefer, R. F. (2000). Erodibility of fly ash used as a topsoil substitute in mineland reclamation, *Journal of Environmental Quality*, 29, 805-811.
- Goudar, S. K., Shivaprasad, K. N., & Das, B. B. (2019). Mechanical properties of fiber reinforced concrete using coal-bottom ash as replacement of fine aggregate. *In: Lecture Notes in Civil Engineering. Springer*, 863-872. https://doi.org/10.1007/978-981-13-3317-0_77.
- Han, M. C., Han, D., & J.-K. Shin, J. K. Use of bottom ash and stone dust to make lightweight aggregate. *Construction and Building Materials*, 99, 192–199.
- Han, Z., Li, J., Gao, P., Huang, B., Ni, J., & Chaofu Wei, C. (2020). Determining the shear strength and permeability of soils for engineering of new paddy field construction in a hilly mountainous region of southwestern China. *International Journal of Environmental Research and Public Health*, 17(5).
- Hanjitsuwan, S., Phoo-ngernkham, T., Damrongwiriyanupap, N. (2017). Comparative study using Portland cement and calcium carbide residue as a promoter in bottom ash geopolymer mortar. *Construction and Building Materials*, 133, 128 - 134. <https://doi.org/10.1016/j.conbuildmat.2016.12.046>.

- Hannan, N. I. R. R., Shahidan, S., Ali, N., & Maarof, M. Z. (2017). A comprehensive review on the properties of coal bottom ash in concrete as sound absorption material. *MATEC Web of Conferences*, 103(01005).
- Harris, D., Heidrich, C., & Feuerborn, J. (2019). Global aspects on coal combustion products. *VGB Power Tech 10 (2020)*, 25-33.
- Hashemi, S. S. G., Mahmud, H. B., Djobo, J. N. Y., Tan, C. G., Ang, B. C., & Ranjbar, N. (2018). Microstructural characterization and mechanical properties of bottom ash mortar. *Journal of Cleaner Production*, 170, 797–804.
- Havanagi, V. G., Sinha, A. K., & Mathur, S. (2011). Design and stability analysis of pond ash railway embankment. *Geotechnical Engineering for Disaster Mitigation and Rehabilitation and Highway Engineering 2011*, 349–355. https://doi.org/10.1142/9789814365161_0041.
- Heidrich, C., Feuerborn, J., & Weir, A. (2013). Coal combustion products – A global perspective. *VGB Power Tech 93(12)*, 46-52.
- Hong, S., Kim, H. (2019). Robust synthesis of coal bottom ash-based geopolymers using additional microwave heating and curing for high compressive strength properties. *Korean Journal of Chemical Engineering*, 36, 1164–1171.
- Hosada, N., Shinozaki, S., & Nagataki, S. (1998). Mechanical, physical and chemical properties of coal ash in Japan. *Proc., International Conference on Fly Ash Disposal and Utilisation, Central Board of Irrigation and Power, New Delhi, II(VIII)*, 46–54.

- Huang, W. (1990). The use of bottom ash in highway embankments, subgrades, and subbases. *Publication FHWA/IN/JHRP-90/0, Indiana Department of Transportation and Purdue University, West Lafayette, Indiana.*
- Huggins, F., & Goodarzi, F. (2009). Environmental assessment of elements and polyaromatic hydrocarbons emitted from a Canadian coal-fired power plant. *International Journal of Coal Geology, 77*(2009), 282–288.
- Ibrahim, A. H., Choong, K. K., Megat Johari, M. A., Md Noor, S. I., Zainal, N. L., & Ariffin, K. S. (2015). Effects of coal bottom ash on the compressive strength of portland cement mortar. *Applied Mechanics and Materials, 802*, 149–154.
- Ismail, K. N., Hussin, K., & Idris, M. S. (2007). Physical, chemical & mineralogical properties of fly ash. *Journal of Nuclear and Related Technology, 4*, 47 - 51.
- Jackson, D. R., Garrett, B. C., & Bishop, T. A. (1984). Comparison of batch and column methods for assessing leachability of hazardous waste. *Environmental Science and Technology, 18*, 668-673.
- Jang, Y. I. (2010). A study on the mechanical properties and application of porous concrete using bottom ash aggregate and new-material for performance improvement. *MSc Dissertation, Chungnam National University.*
- Jayanthi, M. (2007). Engineering aspects of aqua farm design for sustainability of environment and aquaculture. *Indian Journal of Fisheries, 54*(1), 59 – 65.
- Jayaranjan, M. L. D., Hullebusch, E. D., & Annachhatre, A. P. (2014). Reuse options for coal fired power plant bottom ash and fly ash. *Reviews in Environmental Science and Bio/Technology, 13*(4), 467–486. <https://doi.org/10.1007/s11157-014-9336-4>.

- Jeon, J. H., Son, Y. H., Kim, D. G., & Kim, T. J. (2020). Estimation of Life Cycle CO₂ emissions using oyster shells and bottom ash as materials for soil-mixing and a drainage layer. *Journal of Cleaner Production*, 270.
- Jinwoo, An., Kim, J., Golestani, B., Tasneem, K., Muhit, B. A., Nam, B., & Behzadan, A. (2014). Evaluating the use of waste-to-energy Bottom ash as Road construction materials. *Contract No.: BDK78-977-20. Office of Materials, State of Florida, Department of Transportation, 605 Suwannee Street, MS30, Tallahassee, FL 32399-0450.*
- Jones, K. B., Ruppert, L. F., & Swanson, S. M. (2012). Leaching of elements from bottom ash, economizer fly ash, and fly ash from two coal-fired power plants. *International Journal of Coal Geology*, 94, 337–348.
- Jorat, M. E., Marto, A., Namazi, E., & Amin, M. F. M. (2011). Engineering characteristics of kaolin mixed with various percentages of bottom ash. *Electronic Journal of Geotechnical Engineering*, 16(H), 841–850.
- Jyothirmayi, K. H., Gnanananda, T., & Suresh. (2015). Prediction of compaction characteristics of soil using plastic limit. *International Journal of Research in Engineering and Technology*, 04(06), 253–256.
- Kadir, A. A., & Hassan, M. I. H. (2015). Leachability of self-compacting concrete (SCC) incorporated with fly ash and bottom ash by using synthetic precipitation leaching procedure (SPLP). *Applied Mechanics and Materials*, 773-774, 1375-1379.

- Kaniraj, S. R., & Havanagi, V. G. (2001). Correlation analysis of laboratory compaction of fly ashes. *Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management*, 5(1), 25–32.
- Kayabal, K., & G. Bulus, G. (2000). The usability of bottom ash as an engineering material when amended with different matrices. *Engineering Geology*, 56(3–4), 293-303.
- Kierczak, J., & Chudy, K. (2014). Mineralogical, chemical, and leaching characteristics of coal combustion bottom ash from a power plant located in northern Poland. *Polish Journal of Environmental Studies*, 23(5), 1627-1635.
- Kim, B., Prezzi, M., & Salgado, R. (2005). Geotechnical properties of fly and bottom ash mixtures for use in highway embankments. *Journal of Geotechnical and Geoenvironmental Engineering*, 131(7), 914–924.
- Kim, B., Yoon, S. and Balunaini, U. (2006). Determination of ash mixture properties and construction of test embankment - Part A. *Purdue University, West Lafayette, Indiana*.
- Kim, H. K. (2015). Utilization of sieved and ground coal bottom ash powders as a coarse binder in high-strength mortar to improve workability. *Construction and Building Materials*, 91, 57–64.
- Kim, H. K., & Lee, H. K. (2015). Coal bottom ash in field of civil engineering: A review of advanced applications and environmental considerations. *KSCE Journal of Civil Engineering*, 19(6), 1802-1818.

- Kirthika, S. K., Surya, M., & Singh, S. K. (2019). Effect of clay in alternative fine aggregates on performance of concrete. *Construction and Building Materials*, 228.
- Kisku, G. C., Yadav, S., Sharma, R. K., & Negi, M. P. S. (2012). Potential environmental pollution hazards by coal based power plant at Jhansi (UP) India. *Environmental Earth Sciences*, 67, 2109–2120.
- Kolay, P., & Kismoor, T. (2009). Geotechnical characterization of coal ashes from Sarawak for bulk utilization. *The Journal of Solid Waste Technology and Management*, 35(2), 78–87. <https://doi.org/10.5276/JSWTM.2009.78>.
- Kumar, D. (2014). Compaction characteristics of bottom ash. *MTech Dual Degree Dissertation, National institute of technology Rourkela- 769008, India*.
- Kumar, D., Kumar, N., & Gupta, A. (2014). Geotechnical properties of fly ash and bottom ash mixtures in different proportions. *International Journal of Science*, 3(9), 1487-1494.
- Kurama, H., Topçu, I. B., & Karakurt, C. (2009). Properties of the autoclaved aerated concrete produced from coal bottom ash. *Journal of Materials Processing Technology*, 209(2), 767–773.
- Lee, T. (2011). Leaching characteristics of bottom ash from coal fired electric generating plants, and waste tire; individually and mixtures when used as construction site fill materials, *Waste Management*, 31(2), 246 – 252.
- Lehrsch, G. A., & Baker, D. E. (1989). Fly ash erodibility, *Journal of Soil and Water Conservation*, 44(6).

- Levandowski, J., & Kalkreuth, W. (2009). Chemical and petrographical characterization of feed coal, fly ash and bottom ash from the Figueira power plant, Parana, Brazil. *International Journal of Coal Geology*, 77(3-4), 269-281.
- Libasse, S., Siham, K. B., Olivier, B., Gerard, M. & Fabrice, B. (2018). Experimental estimation of the elastic modulus of non-hazardous waste incineration bottom ash aggregates by indentation tests - microanalysis of particles by scanning electron microscopy. *Advanced Materials Research*, 1145, 80-84.
- Lin, C. L., Weng, M. C., & Chang, C. H. (2012). Effect of incinerator bottom-ash composition on the mechanical behaviour of backfill material. *Journal of Environmental Management*, 113(2012), 377–382.
- Lovell, C. W., Huang, W. H., & Lovell, J. E. (1991). Bottom Ash as a Highway Material. *The 70th Annual Meeting of the Transportation Research Board, Washington, D.C*, 106–116.
- Luna, Y., Arenas, C. G., Cornejo, A., Leiva, C., Vilches, L. F., & Pereira, C. F. (2014). Recycling by-products from coal-fired power stations into different construction materials. *International Journal of Energy and Environmental Engineering*, 5(4), 387–397.
- Majhi, R. K., & Nayak, A. N. (2019). Properties of concrete incorporating coal fly ash and coal bottom ash. *Journal of the Institution of Engineers India: Series A*, 100(3), 459–469.
- Maliki, A. I. F., Shahidan, S., Ali, N., Ramzi Hannan, N. I. R., Zuki, S. S, Ibrahim, M. W., Azmi, M.A., & Rahim, M. A. (2017). Compressive and tensile strength for

concrete containing coal bottom ash. *IOP Conference Series Materials Science and Engineering*, 271(1)

Mandal, A. K., Paramkusam, B. R., & Sinha, O. P. (2018). Fluidized bed combustion bottom ash: A better and alternative geo-material resource for construction. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 36(4), 351–360. <https://doi.org/10.1177/0734242X18761561>.

Mandal, A. K., & Sinha, O. P. (2014). Review on current research status on bottom ash: An indian prospective. *Journal of Institution of Engineers (India): Series A*, 95, 277–297.

Maneeintr, K., Tran, T., & Kaewmaneevan, W. (2019). Bottom-ash waste management for soil improvement in Saraburi province, Thailand. *Materials Science Forum*, 947, 114 - 118.

Mangi, S. A., Ibrahim, M. H. W., Jamaluddin, N., Arshad, M. F., Memon, S. A., & Shahidan, S. (2019a). Effects of grinding process on the properties of the coal bottom ash and cement paste. *Journal of Engineering and Technological Sciences*, 51(1), 1-13. <https://doi.org/10.5614/j.eng.technol.sci.2019.51.1.1>.

Mangi, S. A., Ibrahim, M. H. W., Jamaluddin, N., Arshad, M. F., Memon, S. A., Shahidan, S., & Putra Jaya, R. (2019b). Coal bottom ash as a sustainable supplementary cementitious material for the concrete exposed to seawater. *In: 5th International Conference on Energy, Environment and Sustainable Development, Mehran University of Engineering and Technology Jamshoro, Pakistan*, 1-8.

- Mangi, S. A., Ibrahim, M. H. W., Jamaluddin, N., Arshad, M. F., & Putra Jaya, R. (2019c). Short-term effects of sulphate and chloride on the concrete containing coal bottom ash as supplementary cementitious material. *Engineering Science and Technology* 22(2), 515–522.
- Mangi, S. A., Ibrahim, M. H. W., Jamaluddin, N., Shahidan, S., Arshad, M. F., Memon, S. A., Jaya, R. P., Mudjanarko, S. W., & Setiawan, M. I. (2018). Influence of ground coal bottom ash on the properties of concrete. *International Journal of Sustainable Construction Engineering & Technology*, 9(2), 6 - 34. <https://doi.org/10.30880/ijscet.2018.09.02.003>.
- Marto, A., Hassan, M. A., Makhtar, A. M., & Othman, B. A. (2013). Shear strength improvement of soft clay mixed with Tanjung Bin coal ash. *APCBEE Procedia*, 5, 116–122.
- Marto, A., Hasan, M., Hyodo, M., & Makhtar, A. M. (2012). Shear strength parameters and consolidation of clay reinforced with single and group bottom ash columns. *Arabian Journal for Science and Engineering*, 39(4), 2641–2654.
- Marto, A., Kassim, K. A., Makhtar, A. M., Wei, L. F., & Lim, Y. S. (2010). Engineering characteristics of Tanjung Bin coal ash. *Electronic Journal of Geotechnical Engineering*, 15, 1117 – 1129.
- Marto, A. & Tan, C. S. (2016). Properties of coal bottom ash from power plants in malaysia and its suitability as geotechnical engineering material. *Jurnal Teknologi*, 78(8), 1–10.
- Maschowski, C., Zangna, M. C., Trouve, G., & Giere, R. (2016). Bottom ash of trees from Cameroon as fertilizer. *Applied Geochemistry*, 72(2016), 88 – 96.

- Matsumoto, S., Ogata, S., Shimada, H., Sasaoka, T., Kusuma, G. J., & Gautama, R. S. (2016). Application of coal ash to postmine land for prevention of soil erosion in coal mine in Indonesia: Utilization of fly ash and bottom ash. *Advances in Materials Science and Engineering*, 2016, 1–8.
- Menéndez, E., Álvaro, A. M., Hernández, M. T., & Parra, J. L. (2014). New methodology for assessing the environmental burden of cement mortars with partial replacement of coal bottom ash and fly ash. *Journal of Environmental Management*, 133, 275–283.
- Ministry of Power. (n.d.). Retrieved August 20, 2021, from http://powermin.gov.lk/english/?page_id=1517
- Moreno, N., Querol, X., Andres, J. M., Stanton, K., Towler, M., Nugteren, H., Jurkovicova, M. J., & Jones, R. (2005). Physico-chemical characteristics of European pulverized coal combustion fly ashes. *Fuel*, 84(11), 1351 – 1363.
- Moulton, L. K. (1973). Bottom ash and boiler slag. *Proceedings of the Third International Ash Utilization Symposium, U.S. Bureau of Mines, Information Circular No. 8640, Washington, DC*.
- Muhardi, A., Marto, A., Kassim, K., Makhtar, A. M., Wei, L. F., & Lim, Y. S. (2010). Engineering characteristics of Tanjung Bin coal ash. *Electronic Journal of Geotechnical Engineering*, 15, 1117–1129.
- Mujtaba, H., Farooq, K., Sivakugan, N., & Das, B. M. (2013). Correlation between gradational parameters and compaction characteristics of sandy soils. *International Journal of Geotechnical Engineering*, 7(4), 395–401. <https://doi.org/10.1179/1938636213Z.00000000045>.

- Naganathan, S., Mohamed, A. Y. O., & Mustapha, K. N. (2011). Development of brick using thermal power plant bottom ash and fly ash. *Asian Journal of Civil Engineering (Building and Housing)*, 13(1), 275 - 287.
- Naganathan, S., Mohamed, A. Y. O., & Mustapha, K. N. (2015). Performance of bricks made using fly ash and bottom ash. *Construction and Building Materials*, 96, 576 - 580. <https://doi.org/10.1016/j.conbuildmat.2015.08.068>.
- Naipal, V., Reick, C., Pongratz, J., & Van Oost, K. (2015). Improving the global applicability of the RUSLE model – adjustment of the topographical and rainfall erosivity factors. *Geoscientific Model Development Discussions* 8(8), 2991-3035.
- Nakagawa, M., Kehelpannala, K. V. W., Manabe, T., Ranaweera, L., & Nasu, A. (2017). Kaolin deposit at Meetiyaogoda, southwestern, Sri Lanka. *The Clay Science Society of Japan*. https://doi.org/10.11362/jcssjclayscience.21.2_29.
- Neina, D. (2019). The role of soil pH in plant nutrition and soil remediation. *Applied and Environmental Soil Science*, 2019, ID 5794869.
- Nu, N. T., Son, B. T., & Ngoe, D. M. 2019. An experimental study of reusing coal ash for base course of road pavement in Viet Nam. *Electronic Journal of Geotechnical Engineering*, 24, 945-960.
- Omar, M., Shanableh, A., Mughieda, O., Arab, M., Zeiada, W., & Al-Ruzouq, R. (2018). Advanced mathematical models and their comparison to predict compaction properties of fine-grained soils from various physical properties. *Soils and Foundations*, 58(6), 1383–1399.

- Onprom, P., Chaimoon, K., & Cheerarot, R. (2015). Influence of bottom ash replacements as fine aggregate on the property of cellular concrete with various foam contents. *Advances in Materials Science and Engineering*, 2015, 1–11.
- Palumbo, A. V., Tarver, J. R., Fagan, L. A., McNeilly, M. S., Ruther, R., & Amonette, J. E. (2005). Potential for metal leaching and toxicity from fly ash applied for increasing carbon sequestration in soil. *World of Coal Ash (WOCA)*, Lexington, Kentucky, USA.
- Pandian, N. (2004). Fly ash characterization with reference to geotechnical applications. *Journal of the Indian Institute of Science*, 84(6), 189–216, 2004
- Pando, M. A., Swan, R. H. Jr., Park, Y., & Sheridan, S. (2014). Experimental study of bottom coal ash-geogrid interaction. *Geo-Congress 2014 Technical Papers*, 316–325. <https://doi.org/10.1061/9780784413272.031>.
- Pant, A., Datta, M., & Ramana, G. V. (2019). Bottom ash as a backfill material in reinforced soil structures. *Geotextiles and Geomembranes*, 47(4), 514–521. <https://doi.org/10.1016/j.geotexmem.2019.01.018>.
- Park, J. H., Edraki, M., Mulligan, D., & Jang, H. S. (2014). The application of coal combustion by-products in mine site rehabilitation. *Journal of Cleaner Production* 84(1), 761-772.
- Park, S. B., Jang, Y. I., Lee, J., & Lee, B. J. (2009a). An experimental study on the hazard assessment and mechanical properties of porous concrete utilizing coal bottom ash coarse aggregate in Korea. *Journal of Hazardous Materials*, 166(1), 348-355.

- Pathirana, K. P. P., Asmer, T. M., Fahim S. M., & Hyther, A. L. A. (2009). Estimation of rainfall induced soil erosion: An experimental study. *Engineer: Journal of the Institution of Engineers, Sri Lanka*, 42(1), 1-10.
- Pires, M., & Querol, X. (2004). Characterization of Candiota (South Brazil) coal and combustion by-product. *International Journal of Coal Geology*, 60(1), 57 – 72.
- Poykio, R., Manskinen, K., Nurmesniemi, H., & Dahl, O. (2011). Comparison of trace elements in bottom ash and fly ash from a large-sized (77 MW) multi-fuel boiler at the power plant of a fluting board mill, Finland. *Energy Exploration & Exploitation*, 29(3), 217–234.
- Pyo, S., Koh, T., Tafesse, M., Kim, H. K. (2019). Chloride-induced corrosion of steel fiber near the surface of ultra-high performance concrete and its effect on flexural behavior with various thickness. *Construction and Building Materials*, 224, 206 - 213. <https://doi.org/10.1016/j.conbuildmat.2019.07.063>.
- Rafieizonooz, M., Salim, M. R., Mirza, J., Hussin, M. W., Salmiati, Rawid Khan, Khankhaje, E. (2017). Toxicity characteristics and durability of concrete containing coal ash as substitute for cement and river sand. *Construction and Building Materials*, 143, 234–246.
- Ram, L. C., & Masto, R. E. (2010). An appraisal of the potential use of fly ash for reclaiming coal mine spoil. *Journal of environmental management*, 91(3), 603-17.
- Ramme, B., & Tharaniyil, M. P. (2004). Coal Combustion Products Utilization Handbook.

- Ramzi, N. I. R., Shahidan, S., Maarof, M. Z., & Ali, N. (2016). Physical and chemical properties of coal bottom ash (CBA) from Tanjung Bin power plant. *IOP Conference Series: Materials Science and Engineering*, 160(1).
- Ranasinghe, M. (1996). Mine restoration bond for clay mining and its impact on the prices of building materials in Sri Lanka. *Construction Management and Economics*, 14(2), 165–174. <https://doi.org/10.1080/014461996373601>.
- Rani, R., & Jain, M. K. (2017). Effect of bottom ash at different ratios on hydraulic transportation of fly ash during mine fill. *Powder Technology*, 315, 309–317. <https://doi.org/10.1016/j.powtec.2017.04.025>.
- Reddy, C. S., Mohanty, S., & Shaik, R. (2018). Physical, chemical and geotechnical characterization of fly ash, bottom ash and municipal solid waste from Telangana State in India. *International Journal of Geo-Engineering*, 9(1), 1-23. <https://doi.org/10.1186/s40703-018-0093-z>.
- Renaud, K. M. (2018). The mineral industry of Sri Lanka. *US Geological Survey, USA*.
- Rogbeck, R., & Knutz, A. (1996). Coal bottom ash as light fill material in construction. *Waste Management*, 16(1–3), 125–128.
- Sabat, A. K. (2015). Prediction of maximum dry density and specific gravity of fly ash using support vector machine. *Electronic Journal of Geotechnical Engineering*, 20(1), 155-166.
- Sadon, S. N., Beddu, S., Naganathan, S., Kamal, N. L. M., & Hassan, H. (2017). Coal bottom ash as sustainable material in concrete - A review. *Indian Journal of Science and Technology*, 10(36), 1–10.

- Sani, M. S. H. M., Muftah, F., & Muda, Z. (2010). The properties of special concrete using washed bottom ash (WBA) as partial sand replacement. *International Journal of Sustainable Construction Engineering and Technology*, 1(2), 65-76.
- Senaratna, A. U., Weerasinghe, W. P. N., De Silva, S., & De Silva, S. (2013). Utilization of bottom ash as a construction material. *Special Session on Construction Materials & Systems, 4th International Conference on Structural Engineering and Construction Management 2013, Kandy, Sri Lanka*, 82-93.
- Sengupta, D. & Agrahari, S. (2017). Modelling Trends in Solid and Hazardous Waste Management. *Springer*, ISBN : 978-981-10-2409-2.
- Sharma, H. D., Dukes, M., & Olsen, D. M. (1991). Field measurements of dynamic moduli and poisson's ratios of refuse and underlying soils at a landfill site. *International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts*, 28.
- Siddique, R., Aggarwal, P., & Aggarwal, Y. (2012). Influence of water/powder ratio on strength properties of self-compacting concrete containing coal fly ash and bottom ash. *Construction and Building Materials*, 29, 73–81. doi:10.1016/j.conbuildmat.2011.10.035.
- Sihag, P., Singh, B., & Gautam, S. (2018). Evaluation of the impact of fly ash on infiltration characteristics using different soft computing techniques. *Applied Water Sciences*, 8(187).
- Singh, G., Kumar, S., Mohapatra, S. K., & Kumar, K. (2017). Comprehensive characterization of grounded bottom ash from Indian thermal power plant. *Journal of Residuals Science and Technology*, 14(1), 1 – 10.

- Singh, M. & Siddique, R. (2015). Properties of concrete containing high volumes of coal bottom ash as fine aggregate. *Journal of Cleaner Production*, 91, 269–278.
- Singh, M. & Siddique, R. (2014b). Strength properties and micro-structural properties of concrete containing coal bottom ash as partial replacement of fine aggregate. *Construction and Building Materials*, 50, 246 - 256.
- Singh, M., Siddique, R., Karim, A. M., & Belarbi, R. (2016). Durability properties of concrete made with high volumes of low-calcium coal bottom ash as a replacement of two types of sand. *Journal of Materials in Civil Engineering*, 28, 04015175.
- Singh, N., Mithulraj, M., & Arya, S. (2019). Utilization of coal bottom ash in recycled concrete aggregates based self-compacting concrete blended with metakaolin. *Resources Conservation and Recycling*, 144, 240–251.
- Singh, N., Shehnazdeep, & Bhardwaj, A. (2020). Reviewing the role of coal bottom ash as an alternative of cement. *Construction and Building Materials*, 233, 117276. <https://doi.org/10.1016/j.conbuildmat.2019.117276>.
- Sivakumar, D., Ammaippan, M., Anand, R., & Lavanya, V. (2014). Importance of bottom ash in preventing soil failure. *Journal of Chemical and Pharmaceutical Science*, 8(4), 836-840.
- Slavik, R., Bednarik, V., Vondruska, M., & Nemeč, A. (2008). Preparation of geopolymer from fluidized bed combustion bottom ash. *Journal of Material Processing Technology*, 200, 265–270.

- Soofinajafi, M., Shafigh, P., Akashah, F. W., & H. Bin Mahmud, H. (2016). Mechanical properties of high strength concrete containing coal bottom ash and oil-palm boiler clinker as fine aggregates', *MATEC Web Conferences*, 66.
- Soti, P., Jayachandran, K., Koptur, S., & Volin, J. (2015). Effect of soil pH on growth, nutrient uptake, and mycorrhizal colonization in exotic invasive *Lygodium microphyllum*. *Plant Ecology*, 216.
- Sou, W., Chu, A., & Chiueh, P. (2016). Sustainability assessment and prioritisation of bottom ash management in Macao. *Waste Management & Research*, 34(12), 1275–1282. <https://doi.org/10.1177/0734242X16665914>
- Sultana, S., Ahsan, S., Tanvir, S., Haque, N., Alam, F., & Yellishetty, M. (2021). Coal fly ash utilisation and environmental impact. In: *Jyothi R.K., Parhi P.K. (Eds) Clean Coal Technologies. Springer, Cham*, 381–402.
- Sushil, S., & Batra, V. S. (2006). Analysis of fly ash heavy metal content and disposal in three thermal power plants in India. *Fuel*, 85, 2676–2679.
- Suthar, M. (2019). Applying several machine learning approaches for prediction of unconfined compressive strength of stabilized pond ashes. *Neural Computing and Applications* 32(6), 9019-9028.
- Swine, D. J. (2000). Why trace elements are important. *Fuel Processing Technology* 65(1), 21-33.
- Takao, T., Kenji, N., Masateru, N., Jinmei, L., & Tatsuhiko, S. 2007. Leaching test of coal fly ash for the landfill. In *Ash facility management I, World Coal Ash Utilization (WOCA) Conference., Lexington, KY, USA*.

- Tanyu, B. F., Kim, W., Edil, T. B., & Benson, C. H. (2005). Development of methodology to include structural contribution of alternatives working platforms in pavement designs. *Transportation Research Record, No. 1936*.
- Taoufiq, L., Laamyem, A., Essediqi, E., Monkade, M., & Zradba, A. (2018). Recycling coal fly ash and coal bottom ash from Moroccan thermal power plant in concrete manufacturing. *Journal of Materials and Environmental Sciences, 9*(4), 1312-1317.
- Terzaghi, K., & Peck, R. B. (1967). *Soil mechanics in engineering practice*, 2nd Edition, John Wiley & Sons, New York.
- Thapliyal, A., & Malik, A. (2006). Application of fly ash in reclamation of wastelands through plantations and floriculture. *Ornamental and Plant Biotechnology, Global Science Books, III*, 287-297.
- The ash and tears of Norochcholai/ Sri Lanka. (n.d.). Retrieved from January 12, 2021, from <https://www.google.com/url?sa=i&url=https%3A%2F%2Fsrilankatwo.wordpress.com>.
- Thi, N. N., Hong, T. P., & Truong, S. (2019). Utilizing coal bottom ash from thermal power plants in Vietnam as partial replacement of aggregates in concrete pavement. *The Journal of Engineering, 2019*, 1-11.
- Tiwari, S. K., & Ghiya, A. (2013). Strength behavior of compacted fly Ash, bottom ash and their combinations. *Electronic Journal of Geotechnical Engineering, 18*, 1085-1106.

- Toms, T., & Philip, J. G. (2013). Prediction of compaction characteristics from Atterberg limits and specific gravity for Kuttanad soil. *International Journal of Science and Research*, 5(8), 1146-1149.
- Topçu, I. B., Toprak, M. U., & Uygunoğlu, T. (2014). Durability and microstructure characteristics of alkali activated coal bottom ash geopolymer cement. *Journal of Cleaner Production*, 81, 211–217.
- Torkittikul, P., Nochaiya, T., Wongkeo, W., & Chaipanich, A. (2017). Utilization of coal bottom ash to improve thermal insulation of construction material. *Journal of Material Cycles and Waste Management*, 19, 305 - 317. <https://doi.org/10.1007/s10163-015-0419-2>.
- Tuntisukrarom, K., & Cheerarot, R. (2020). Prediction of compressive strength behavior of ground bottom ash concrete by an artificial neural network. *Advances in Materials Science and Engineering*, 2020, 1–16. <https://doi.org/10.1155/2020/2608231>.
- Twardowska, I., & Stefaniak, S. (2006). Coal and coal combustion products: Prospects for future and environmental issues. *In Coal Combustion Byproducts and Environmental Issues*. Springer, New York.
- Ukwattage, N. L., Ranjith, P. G., & Bouazza, M. (2013). The use of coal combustion fly ash as a soil amendment in agricultural lands (with comments on its potential to improve food security and sequester carbon). *Fuel*, 109, 400–408.
- Ullah, A., Kassim, A., Abbil, A., Matusin, S., Rashid, A. S. A., Yunus, N. Z. M., & Abuelgasim, R. (2020). Evaluation of coal bottom ash properties and its

- applicability as engineering material. *IOP Conference Series: Earth and Environmental Science*, 498, 012044.
- U.S. Geological Survey. 2021. Mineral commodity summaries 2021: *U.S. Geological Survey*, <https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf>.
- Vassilev, S. V., Vassilev, C. G., Karayigit, A. I., Bulut, Y., Alastuey, A., & Querol, X. (2005). Phase–mineral and chemical composition of composite samples from feed coals, bottom ashes and fly ashes at the Soma power station, Turkey. *International Journal of Coal Geology*, 61(1-2), 35– 63.
- Verma, A. S., Suri, N. M., & Kant, S. (2017). Applications of bauxite residue: A mini-review. *Waste Management & Research*, 35(10), 999–1012. <https://doi.org/10.1177/0734242X17720290>.
- Vories, K. C. (2005). Placement of coal combustion by-products at Surface Mining Control and Reclamation Act (SMCRA) mines: a short history of OSM technical efforts and responses to environmental concerns. *In: Proceedings of 2005 National Meeting of the American Society of Mining and Reclamation, Breckenridge, USA*, 1215-1228.
- Vuppaladadiyam, S. S. V., Baig, Z. T., Soomro, A. F., & Vuppaladadiyam, A. K. (2019). Characterisation of overburden waste and industrial waste products for coal mine rehabilitation. *International Journal of Mining, Reclamation and Environment*, 33(8), 517-526.
- Wang, D., & Sweigard, R. J. (1996). Characterisation of fly ash and bottom ash from a coal-fired power plant. *International Journal of Surface Mining, Reclamation and Environment*, 10(4), 181–186.

- Wearing, C., Birch, C. J., & Nairn, J. D. (2008). An assessment of Tarong bottom ash for use on agricultural soils. *Developments in Chemical Engineering and Mineral Processing*, 12(5–6), 531–543.
- Wilschefski S.C. and Baxter M.R. 2019. Inductively coupled plasma mass spectrometry: Introduction to analytical aspects. *Clinical Biochemist Review*, 40(3), 115–133.
- Wyrzykowski, M., Ghourchian, S., Sinthupinyo, S., Chitvoranund, N., Chintana, T., & Lura, P. (2016). Internal curing of high performance mortars with bottom ash. *Cement and Concrete Composites*, 71, 1–9.
- Xie, T., & Ozbakkaloglu, T. (2015). Behavior of low-calcium fly and bottom ash-based geopolymer concrete cured at ambient temperature. *Ceramics International*, 41(4), 5945–5958.
- Yoon, J. Y., Lee, J. Y., & Kim, J. (2019). Use of raw-state bottom ash for aggregates in construction materials. *Journal of Material Cycles and Waste Management*, 21, 838–849.
- Yeon, K., & Kim, Y. (2011). The engineering characteristics of fly-ash and bottom-ash soil mixtures. *Scientific Research and Essays*, 6(24), 5224-5234.
- Yuksel, I., & Genc, A. (2007). Properties of concrete containing non-ground ash and slag as fine aggregate. *ACI materials journal*, 104(4), 397 – 403.
- Zhang, B., & C. S. Poon, C. S. (2015). Use of furnace bottom ash for producing lightweight aggregate concrete with thermal insulation properties. *Journal of Cleaner Production*, 99, 94 – 100.