INDONESIAN MINING JOURNAL

pISSN 0854 – 9931; eISSN 2527 – 8797 **Volume 27, No. 1, April 2024**

Abstract Index

DOI: 10.30556/imj.Vol27.No1.2024.1531

Prastowo, Rizqi; Purnomo, Hendro; Firmansyah, Firhad; and Ipmawan, Vico L. (Mining Engineering Department, University of National Development 'Veteran' Yogyakarta; Department of Physics, Institut Teknologi Sumatera)

Artificial Neural Network Evaluation and Prediction of Blast-Induced Peak Particle Velocity - A Case Study of Limestone Mining

Penilaian dan Prediksi Jaringan Syaraf Tiruan Terhadap Kecepatan Partikel yang Diinduksi Peledakan - Studi Kasus Penambangan Batugamping

IMJ, Vol. 27, No. 1, April 2024,
P. 1-9

In recent decades, generation of ground vibrations results from blasting activities in mining sector has been identified as a significant cause of extensive harm to nearby structures, vegetation, and individuals. Hence, it is imperative to closely monitor and accurately forecast the uncertain levels of vibration, and implement the appropriate steps to mitigate their potentially harmful impact. The objective of this study was to establish a correlation between the peak particle velocity and the various parameters that influence it. This study employed the deployment of the artificial neural network approach to assess and forecast the uncertain ground vibrations. In this study, a multilayer perception neural network with three layers and a feed-forward back-propagation architecture was employed. The network consisted of five input parameters, namely the distance from the blast face, maximum charge per delay, spacing, burden, and depth hole. The output of interest was the peak particle velocity. The neural network was trained using the Levenberg–Marquardt algorithm, and the training dataset comprised 29 experimental records and blast event data obtained from the limestone mine in Indonesia. In order to assess the effectiveness and the precision of the artificial neural network model that was created, a total of four conventional predictor models were utilized. These models were proposed by reputable sources such as the US Bureau of Mines, Ambraseys–Hendron, Langefors–Kihlstrom, and the Bureau of Indian Standards. The results collected from the demonstrate study show that the artificial neural network model suggested in this research has the ability to provide more precise estimations of ground vibrations in comparison to existing conventional prediction models. The artificial neural network model yielded a coefficient of determination (R2) of 0.9332 and a root mean square error (RMSE) of 0.4763.

Keywords: peak particle velocity, blast-induced ground vibration, artificial neural network, conventional predictors

DOI: 10.30556/imj.Vol27.No1.2024.1497

Handayana, Raden H.; Pratama, Panji; Lubis, Jihan F. and Salahudin, Sani (Indonesia Blasting Engineers Society; Hanwha Mining Service Indonesia)

Operating Cost Comparison Surface Miner and Drill & Blast

Perbandingan Biaya Operasional Surface Miner dan Pengeboran & Peledakan

IMJ, Vol. 27, No. 1, April 2024,
P. 11-18

The method of rock breakage is commonly blasting. A few mining companies in Indonesia with facilities near community residences use alternative methods to breaking rock; one of them is using a surface miner. Aspects considered when choosing the method include economic aspects, especially operating costs. In this study case, the size of material that can continue on the next process is ≤ 400 mm; material from surface miner production is at the target; on blasting results, the fragmentation above the target is reduced using a hydraulic breaker; the initiating systems use an electronic detonator (HEBS II) and a non-electric detonator. This difference will affect the cost of the drill and blast. Based on calculated project data, surface miner operating costs are more costly, with an operating cost per ton of USD 1.16 compared with drill and blast methods including hydraulic breaker costs on the initiation system using an electronic detonator (HEBS II) of USD 0.88 per ton and non-electric operating costs of USD 0.83 per ton.

Keywords: operating cost, surface miner, fragmentation, drill and blast, initiation system

DOI: 10.30556/imj.Vol27.No1.2024.1505

Wibowo, Yudha G.; Tsabitah, Natasya; Pratiwi, Cantika P.; Nur'aini, Herlina; Irene, Rilis; Syahnur, Mirza T.; Al-Azizah, Putri S.; Yudhoyono, Aryo; Wijaya, Candra; Lululangi, Bonifasius R. G.; Cahyani, Kholivia; Oktantiyo S., Dody and Maryani, Anis T. (1Department of Mining Engineering, Institut Teknologi Sumatera; Postgraduate Program of Environmental Science, Universitas Jambi)

Mini Review of Adsorption Method Using Conventional Materials for Acid Mine Drainage Treatment

Tinjauan Singkat Tentang Metode Adsorpsi Menggunakan Bahan Konvensional untuk Pengolahan Air Asam Tambang

IMJ, Vol. 27, No. 1, April 2024,
P. 19-37

Acid mine drainage (AMD) is a highly dangerous form of water pollution results from coal mining activities. AMD is characterized by its high concentration of heavy metals and low pH levels, which have been linked to various health problems, including skin disease, cancer, and poisoning. This paper presents a comprehensive review

of the available information on the AMD and its alternative low-cost treatment methods. One such method is adsorption, an eco-friendly and cost-effective approach to treating the AMD. This review draws on 99 published papers as the sources that provide a comprehensive overview of the AMD sources and problems worldwide. This study explores the potential of conventional materials, such as activated carbon, biochar, and other materials for treating the AMD. A special section on conventional materials is well-detailed and provides valuable insights into their effectiveness. It is essential to explore the alternative treatment methods that are both environmentally friendly and cost-effective. This review provides valuable insights in this regard. By using the low-cost and sustainable methods, we can effectively treat AMD and reduce its impact on the environment and human health.

Keywords: acid mine drainage, adsorption, activated carbon, biochar, conventional materials

DOI: 10.30556/imj.Vol27.No1.2024.1538
Sariman; Rochani, Siti; Saleh, Nuryadi; Wijayanti, Retno and Bianawati, Arum E. (Research Center for Mining Technology, Nano Material Research Organization, National Research and Innovation Agency; Testing Center for Mineral and Coal *tek*MIRA; Research Center for Geological Resources, Research Organization for Earth Sciences and Maritime)

Recovery of Iron Mineral from Indonesian Bauxite Residue

Perolehan Mineral Besi dari Residu Bauksit Indonesia

IMJ, Vol. 27, No. 1, April 2024,
P. 39-51

Bauxite residue, a solid waste discharged during alumina extraction, is a hazardous material. Its disposal leads to a serious environmental issue although it contains valuable matter such as titanium, silica, rare earth elements, and high iron content (20-60%). This work aims to improve the recovery of iron content within the bauxite residue using three methods, namely direct magnetic separation, roasting followed by magnetic separation, and reduction followed by magnetic separation. Coal as a reductant and Na_2CO_3 and Na_2SO_3 as fluxes were used in the reduction process. The result of the study reveals that the direct magnetic separation produces iron concentrate with the Fe content of 53.69% and a recovery of 26.72%, while the roasting process at 900˚C and magnetic separation produces a concentrate of 54.57% Fe with a recovery of 37.33%. The best method was by reduction and magnetic separation process using 4% of Na_2CO_3 producing iron concentrates with a content of 63.53% Fe and recovery of 74.73%.

Keywords: acid mine drainage, adsorption, activated carbon, biochar, conventional materials

DOI: 10.30556/imj.Vol27.No1.2024.1533
Bahfie, Fathan;Manaf, Azwar; Astuti, Widi; Nurjaman, Fajar; Prasetyo, Erik; Susanti, Diah and Sipahutar, Wahyu S. (Research Center of Mining Technology National Research and Innovation Agency of Indonesia; Physic Departement, Faculty of Mathematics and Science - University of Indonesia; Department of Chemical Engineering - Norwegian University of Science and Technology; Metallurgical and Material Engineering Department - Faculty of Industrial Technology and Systems Engineering - Institut Teknologi Sepuluh Nopember; Material Department - Institut Teknologi Sumatra)

Effect of Thermal Upgrading with Various Reductants on Saprolitic Nickel Ore: A Preliminary Study

Dampak Peningkatan Panas dan Jenis Reduktan terhadap Saprolit: Studi Pendahuluan

IMJ, Vol. 27, No. 1, April 2024,
P. 53-62

Indonesia significantly contributes to the global electric vehicle battery market due to its substantial medium- and low-grade nickel reserves. This study utilized saprolitic nickel ore from Halmahera, Maluku, Indonesia. However, the research on saprolite needs some improvements due to its complex mineral composition, which affected on the roasting process significantly. Therefore, a thorough understanding of the properties of laterite ores is critically important, particularly concerning laterite pre-reduction processes. The ore was finely sieved to a particle size of less than 100 mesh and then heated at temperatures of 250, 900, and 1150°C with the variation of reductant (anthracite and palm kernel charcoal). Extensive mineralogical analysis was conducted using X-ray diffraction (XRD), X-ray fluorescence (XRF), and scanning electron microscopy with energy-dispersive spectroscopy (SEM-EDS). The analysis of saprolite showed that it contains about 1.82% nickel, 30.47% iron, 10-20% magnesium, 4.86% aluminum, and 8.1% silicon by weight. Its mineral composition is mainly 53.1% goethite, 38.3% lizardite, and 8.7% quartz. The study found that goethite in saprolite was transformed into hematite around 250°C. At 900°C, the forsterite was crystallized, and at 1150°C, the ferronickel was formed. The transformation of lizardite is important as it affected on nickel diffusion within the iron matrix, which impacted on the material's properties. A thermal upgrading method with reductants like anthracite and palm kernel charcoal was used at lower temperatures to enhance the properties of saprolite. These findings provided valuable insights into saprolite's mineralogical composition and behavior, potentially offering improvements in various industrial processes and applications.

Keywords: microstructure, phase transformation, reductant variation type, saprolite, thermal upgrading