

SARI

Bauksit merupakan bahan baku utama produksi alumina dan keberadaannya melimpah di Indonesia, khususnya di Kalimantan Barat. Pengolahan bauksit di wilayah ini umumnya menggunakan proses Bayer yang menghasilkan residu berupa *red mud*. Berbagai studi terkait pemanfaatan *red mud* telah dilakukan di Indonesia maupun di dunia, namun implementasinya masih belum optimal. Pemerintah terus mendorong peningkatan pemanfaatan limbah industri untuk mendukung konsep ekonomi sirkular. Oleh karena itu, *red mud* pada Lapangan X, Kalimantan Barat dianalisis untuk mengetahui karakteristik mineralogi, geokimia, dan sifat indeksinya, supaya dapat direkomendasikan pemanfaatannya berdasarkan karakteristiknya. Sampel *red mud* dikarakterisasi dengan metode *X-Ray Diffraction (XRD)* dan *Scanning Electron Microscope–Energy Dispersive Spectroscopy (SEM-EDS)* untuk mengetahui mineralogi *red mud*. Analisis *Inductive Couple Plasma–Atomic Emission Spectrometer (ICP-AES)* dan *Mass Spectrometer (ICP-MS)* digunakan untuk mengetahui karakteristik geokimia seperti oksida mayor, logam tanah jarang, dan unsur jejak pada sampel *red mud*. Analisis kadar air, berat jenis, berat isi, *Atterberg's Limit*, dan uji ukuran butir dilakukan untuk menentukan karakteristik sifat indeks *red mud*. Hasil penelitian menunjukkan bahwa *red mud* tersusun atas mineralogi berupa goetit, hematit, gibsit, kuarsa dan mineral lain seperti illit, pseudorutil. Secara geokimia, sampel *red mud* didominasi oleh senyawa berupa Fe_2O_3 (31,8–44,5%), yang diikuti oleh senyawa SiO_2 (12,4–25,8%), Al_2O_3 (14,85–19,8%), Na_2O (5,91–9,48%), serta TiO_2 (2,32–3,34%), serta unsur jejak berupa V, Cr, Zr, Sc. Sampel *red mud* memiliki karakteristik sifat indeks berupa kadar air 1,36–3,58%, massa jenis 1,334–1,707 g/cm^3 , berat jenis 1,894–2,563, berat isi 13,090–16,751 kN/m^3 , dan berat isi kering 12,638–18,732 kN/m^3 . Sampel *red mud* memiliki sifat keplastisan dominan rendah, serta termasuk dalam klasifikasi tanah *well graded sand with silt*. Berdasarkan karakteristik geokimia dan sifat indeksinya *red mud* Lapangan X, Kalimantan Barat dapat direkomendasikan pemanfaatannya di bidang industri semen, sedangkan pemanfaatan di industri lain masih memungkinkan namun memerlukan proses lebih lanjut agar memenuhi spesifikasi teknis.

Kata Kunci: *Red mud*, Mineralogi, Geokimia, Sifat Indeks, Rekomendasi Pemanfaatan

ABSTRACT

Bauxite is the primary raw material for alumina production and is abundantly available in Indonesia, particularly in West Kalimantan. The processing of bauxite in this region generally uses the Bayer process, which produces red mud as a residue. Various studies on the utilization of red mud have been conducted both in Indonesia and worldwide, but its practical implementation remains suboptimal. The government continues to encourage increased utilization of industrial waste to support the concept of a circular economy. Therefore, red mud from Field X, West Kalimantan was analyzed to determine its mineralogical, geochemical, and index properties, so that recommendations for its utilization can be made based on its characteristics. The red mud samples were characterized using X-Ray Diffraction (XRD) and Scanning Electron Microscope–Energy Dispersive Spectroscopy (SEM-EDS) to identify their mineralogical composition. Inductive Coupled Plasma–Atomic Emission Spectrometer (ICP-AES) and Mass Spectrometer (ICP-MS) analyses were conducted to determine geochemical characteristics, including major oxides, rare earth elements, and trace elements. Analyses of moisture content, specific gravity, unit weight, Atterberg Limits, and grain-size distribution were performed to determine the index properties of the red mud. The results show that the red mud is composed of minerals such as goethite, hematite, gibbsite, quartz, and other minerals including illite and pseudorutile. Geochemically, the samples are dominated by Fe_2O_3 (31,8–44,5%), followed by SiO_2 (12,4–25,8%), Al_2O_3 (14,85–19,8%), Na_2O (5,91–9,48%), and TiO_2 (2,32–3,34%), as well as trace elements such as V, Cr, Zr, and Sc. The red mud samples exhibit index properties including moisture content of 1.36–3.58%, density of 1,334–1,707 g/cm^3 , specific gravity of 1,894–2,563, unit weight of 13,090–16,751 kN/m^3 , and dry unit weight of 12,638–18,732 kN/m^3 . The samples show predominantly low plasticity and are classified as well-graded sand with silt. Based on the geochemical and index characteristics, the red mud from Field X, West Kalimantan is recommended for utilization in the cement industry, while applications in other industries remain possible but require further processing to meet technical specifications.

Keywords: Red mud, Mineralogy, Geochemistry, Index Properties, Utilization Recommendations