

SARI

Bauksit merupakan bahan baku pembuatan aluminium oksida yang dari tahun ke tahunnya mengalami peningkatan produksi, yakni sebesar 11,8% dari tahun 2021 ke 2022. Dalam ekstraksi bijih bauksit, dihasilkan limbah berupa sedimen residu dan *Red Mud*. Dengan minimnya studi mengenai residu bauksit, upaya pemanfaatan kembali sedimen residu dianjurkan untuk dapat meminimalisir produksi limbah dan mewujudkan *zero waste processing* dan pembangunan berkelanjutan. Dalam hal ini, sedimen residu pada Lapangan X, Kalimantan Barat dianalisis dengan tujuan memperoleh karakteristik mineralogi, geokimia, dan sifat indeksinya, supaya dapat menentukan rekomendasi pemanfaatan berdasarkan karakteristiknya. Sampel sedimen residu dikarakterisasi dengan metode *X-Ray Diffraction* (XRD) dan *Scanning Electron Microscope–Energy Dispersive Spectroscopy* (SEM-EDS) untuk mengetahui mineralogi sedimen residu dan bijih bauksit asalnya. Analisis *Inductive Couple Plasma–Atomic Emission Spectrometer* (ICP-AES) dan *Mass Spectrometer* (ICP-MS) digunakan untuk mengetahui karakteristik geokimia seperti oksida mayor, unsur jejak, dan logam tanah jarang pada sampel sedimen residu dan bijih bauksit. Analisis kadar air, berat jenis, berat isi, *Atterberg's Limit*, dan distribusi ukuran butir dilakukan untuk menentukan karakteristik sifat indeks sedimen residu. Hasil penelitian menunjukkan bahwa sedimen residu tersusun atas mineralogi berupa kaolinit, gipsit, goetit, kuarsa, hematit, dan rutil, dengan dominasi penyusun oksida mayor oleh SiO_2 (21,7–39%), Al_2O_3 (25,8–36,2%), Fe_2O_3 (17,3–24,6%), serta TiO_2 (1,16–2,23%), serta unsur jejak berupa Sc, V, Cr, Ga, dan Ge. Sampel sedimen residu memiliki karakteristik sifat indeks berupa kadar air 0,56–3,67%, massa jenis 1,03–1,69 g/cm³, berat jenis 1,58–2,15, berat isi 10,10–16,63 kN/m³, dan berat isi kering 9,77–16,22 kN/m³. Sampel sedimen residu memiliki sifat keplastisan dominan rendah-sedang, serta termasuk dalam klasifikasi tanah dominan *well graded sand with silt*, dan *well graded sand*. Berdasarkan katakteristik geokimia dan sifat indeks tersebut, sampel sedimen residu pada Lapangan X, Kalimantan Barat dapat direkomendasikan pemanfaatannya di bidang industri semen, genteng, bahan tahan api (refraktori), dan bahan perkerasan jalan.

Kata Kunci: Residu Bauksit, Mineralogi, Geokimia, Sifat Indeks, Rekomendasi Pemanfaatan

ABSTRACT

Bauxite is the raw material for producing aluminum oxide, and its production has increased year by year, with an 11,8% rise from 2021 to 2022. The extraction of bauxite ore produces waste in the form of residual sediment and red mud. Due to the limited number of studies on bauxite residue, efforts to reuse the residual sediment are encouraged in order to minimize waste production and achieve zero waste processing and sustainable development. In this regard, the residual sediment from Field X, West Kalimantan, was analyzed with the aim of determining its mineralogical, geochemical, and index property characteristics, in order to provide recommendations for its utilization based on these characteristics. Residual sediment samples were characterized using X-Ray Diffraction (XRD) and Scanning Electron Microscope–Energy Dispersive Spectroscopy (SEM-EDS) to identify the mineralogy of the residual sediment and its original bauxite ore. Inductive Coupled Plasma–Atomic Emission Spectrometer (ICP-AES) and Mass Spectrometer (ICP-MS) analyses were used to determine geochemical characteristics such as major oxides, trace elements, and rare earth elements in the residual sediment and bauxite ore samples. Analyses of moisture content, specific gravity, bulk density, Atterberg limits, and grain size distribution were conducted to determine the index properties of the residual sediment. The results showed that the residual sediment consists of minerals such as kaolinite, gibbsite, goethite, quartz, hematite, and rutile, with major oxide composition dominated by SiO_2 (21,7–39%), Al_2O_3 (25,8–36,2%), Fe_2O_3 (17,3–24,6%), and TiO_2 (1,16–2,23%), along with trace elements including Sc, V, Cr, Ga, and Ge. The residual sediment samples have index property characteristics including moisture content of 0,56–3,67%, specific gravity of 1,03–1,69 g/cm^3 , relative density of 1,58–2,15, bulk density of 10,10–16,63 kN/m^3 , and dry density of 9,77–16,22 kN/m^3 . The samples exhibit predominantly low to medium plasticity, and fall under the soil classifications of well-graded sand with silt and well-graded sand. Based on the geochemical and index property characteristics, the residual sediment samples from Field X, West Kalimantan are recommended for use in the cement, roof tile, refractory, and road pavement industries.

Keywords: Bauxite Residue, Mineralogy, Geochemistry, Index Properties, Utilization Recommendation