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Synthesis and Characterization of Metal Hydroxide Nano-Hybrid via Aluminum Salt Slag Recycling Method

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Abstract: Aluminum salt slag as a hazardous solid waste generated during aluminium production causes very serious environmental, safety, and public health risks due to its toxic nature. This work describes synthesis and characterization of metal hydroxide nano-hybrid (MHnH) using a three-step acid leaching-based process including acid leaching, co-precipitation, and aluminum removal stages. The leaching stage was carried out at 85 °C for 2 h using 5 M HCl. The co-precipitation stage was achieved using ammonia until the pH value of 5-6. To remove aluminium cations, the hydroxide precipitate was treated using 3 N NaOH. The characterization of the as-synthesized MHnH was performed using Fourier transform infrared (FTIR) spectroscopy, field emission scanning electron microscopy (FESEM), and energy dispersive X-ray (EDX) spectroscopy for chemical bonds, microstructural, and elemental analyses, respectively. All the characterization techniques confirmed that the as-synthesized hydroxide is in nano-scale with a major chemistry of Al, Fe, Ca, and Mg. The synthesized MHnH can be potentially used in adsorption separation processes. The recycling proposed in this study provides a new solution to overcome the detrimental impacts of aluminum salt slag dumped in lands.

Keywords: Aluminium salt slag, Waste recycling, Metal hydroxide, Nano-hybrid