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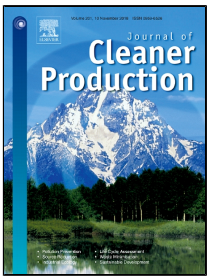

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Preparation and characterization of geopolymers based on a phosphoric-acid-activated electrolytic manganese dioxide residue

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Abstract: Electrolytic manganese dioxide residue (EMDR) is a type of industrial solid waste that contains many soluble heavy metal ions. To reduce the hazard to environment, EMDR was proposed as raw material to fabricate phosphoric-acid-activated geopolymers in the present work. Relevant characteristics of these materials such as the compressive strength, bulk density, crystalline components, microstructure, leaching characteristic, high temperature resistance and corrosion resistance were investigated in this work. The results showed that EMDR was highly reactive with phosphoric acid and could be cured to form geopolymer gel materials with compressive strength up to 96.3 MPa after curing for 2 days at 80 °C with river sand added as an aggregate. Based on the analysis of X-ray diffraction and microstructure, the high compressive strength was due to the amorphous reaction products of phosphoric acid and magnetite in EMDR. The results of the leaching test of the geopolymer samples from EMDR showed that the manganese stabilization efficiency was 95.4%, and other measured elemental concentrations were all within the limits of Integrated Wastewater Discharge Standard in China when the CaO to wet EMDR ratio was 0.10. In addition, the geopolymers from EMDR showed good resistance to high temperature and aggressive environment except strong acid. Therefore, the results obtained in this study reveal that this method for the fabrication of geopolymers is a promising way to recycle EMDR and other iron-rich industrial solid wastes.

Keywords: Geopolymer; Electrolytic manganese dioxide residue; Phosphoric acid; Magnetite; Solid waste