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Immobilization of Cr6+ in an urban and industrial soil from Mexico

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In Mexico, some areas are highly contaminated by heavy metals. Currently, there are more than 75,000 tons of untreated residues in the form of slags and sludges containing high concentrations of hexavalent chromium, Cr6+, in densely populated zones very near Mexico City. Capillary migration of Cr6+ and its concentration towards the surface at landfill or confinement sites is variable due to the presence of slowly soluble chromium salts and changes in meteorological conditions. Due to these phenomena, concentrations a few centimeters from the ground surface can vary from just a few parts per million to percentage levels that are many times greater than the concentration at the very confinement site. At these sites, chromate enrichment is evident at the subsoil surface or confinement areas as outcrops in the form of greenish-yellow stains extending along constructed walls and confinement installations or processing areas. This research describes the characteristics, formation mechanisms, and leaching of Cr6+ wastes that are contaminating a Mexican urban soil (Ballesteros et al, 2016). By means of a vitrification process, a method has been proposed that transforms Cr6+ to Cr3+ and achieves effective immobilization of this highly toxic industrial waste affecting an urban area. By various physicochemical techniques, such as XRD, DTA, and SEM/EDS, carrying out complete characterization of these new materials was possible. The final vitrified or glassy products of silicate composition lead to a glass ceramic material that is environmentally very stable, showing high chemical and mechanical stability where all Cr6+ was reduced to Cr3+ in the residual glass network, as well as other chromium oxidation states confined in the crystalline phases formed in the final glass-ceramic. The leaching tests on samples stabilized by vitrification have shown that the release of ions from the structure of these new materials was negligible, yielding values less than 0.5 mg/l with respect to current international and domestic environmental regulations.

References

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