

Assessment of Chromite Ore Processing Residue environmental: impact and remediation strategy

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Chromite Ore Processing Residue (COPR) is a high pH waste byproduct generated by roasting processes of chromite ore for the production of hexavalent chromium (Cr^{VI}) based products. The uncontrolled discharge and use landfill material represent a serious environmental hazard. The Ex-Stoppani Industrial Area (Italy), Site of National Interest, was strongly affected in the last 100 years by mineral processing and chromate chemical manufacturing. The discharge of millions of tons of COPRs in all the area caused severe problems of soils contamination and release of high quantities of Cr^{VI} in percolating water. Batch leaching tests and mineralogical characterisation of COPR, were used to investigate the leaching behaviour of Cr^{VI} and its relationship with the presence of un-reacted chromates and other potentially Cr^{VI} -bearing minerals. The leachates were analyzed for total Cr and Cr^{VI} ; the residues were submitted for XRPD analyses.

High concentrations of leached Cr^{VI} (0.40~400 mg l⁻¹), depending on COPR mineralogy and solution pH were found, in particular the pH decrease result in an increase of the leached Cr^{VI} due to Cr^{VI} bearing minerals destabilization.

Knowledge on the complex scenario of waste/water interaction and dissolution/reprecipitation processes represent the fundamental step to find an appropriate and sustainable remediation approach. An efficient and pristine maghemite nanoparticle (SAMNs) for the remediation of the high Cr^{VI} Stoppani groundwater is proposed. The high colloidal stability, the high removal efficiency (>90% of Cr^{VI} removal achieved); the opportunity to recover the bound Cr^{VI} and the recycle of SAMNs represent a crucial environmental and economical aspect for real in situ application of the nanomaterial.