



Iron and steel-making slags as an environmentally-beneficial resource; a UK perspective.

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The production of iron and steel has generated substantial volumes of slag as waste, with estimates of up to 384 million tonnes (Mt) of iron slag and 280 Mt of steel slag produced globally, to date. Whilst the majority of these by-products (approximately 70 %) have seen bulk re-use in a number of applications (e.g. as ballast in construction applications), a significant volume of slag has been disposed of in environmental settings, where the release of metal-rich alkaline leachates can cause enduring pollution. However, the mineralogical and physical properties of slags also offer opportunity for environmental benefits, namely; through sequestration of atmospheric carbon dioxide, by acting as stockpiles of critical raw materials, and in certain situations performing as incidental coastal defences.

Findings are presented from national-scale field investigations, laboratory experiments, and spatial data analyses, which aim to explore the resource potential of iron and steel slags in the United Kingdom (UK). Within the 236 Mt of slags disposed of in the UK environment, projected carbonation rates revealed a potential for uptake of 138 Mt CO₂ under enhanced weathering conditions. Notable masses of technologically-critical elements were also estimated within UK slags, with reserves in the region of 1.55 Mt of V₂O₅, 1.58 Mt of TiO₂, and 1.26 Mt of Cr₂O₃ estimated. Further to acting as a resource, in areas of coastal deposition, slag banks were observed to offer tidal protection. At a number of sites this allowed the development of nationally-significant ecological communities, whilst laboratory leaching experiments reveal a very low risk of chemical leaching in saline conditions. The integration of spatial analyses with chemical composition and leaching data can help to inform decisions on maximising resource potential whilst minimising the potential environmental risks associated with slag reworking.