A Cost Effective Alternative for Red Mud Rehabilitation

ANDREW W. BRAY[1]*, DOUGLAS I. STEWART[2], RONAN COURTNEY[3], WILLIAM M. MAYES[4], IAN T. BURKE[1]

[1]School of Earth and Environment and [2]School of Civil Engineering, University of Leeds, LS2 9JT, UK. (*correspondence: a.w.bray@leeds.ac.uk)
[3]Department of Life Sciences, University of Limerick, Ireland.
[4]Centre for Environmental and Marine Sciences, University of Hull, YO11 3AZ, UK.

Of the >100 million tonnes of alumina manufactured annually, approximately 100-200 million tonnes of bauxite residue (red mud) is produced as by-product. This red mud is disposed of in large land based bauxite residue disposal areas (BRDA). Freshly deposited raw red mud, when in contact with natural waters, produce highly alkaline and saline solutions. The main challenges around the legacy of BRDAs are (a) physical stability of red mud, (b) alkalinity (pH 11+) and salinity of pore water and leachates, and (c) mobilisation of trace metals (Al, V, and Cr). Here we present a unique study from a BRDA of three 17 year old plots, 2 of differing treatments (a combination of organic matter and gypsum) to a depth of 20 cm, and one untreated. Samples were taken at intervals to a maximum depth of 50 cm.

Initial results indicate that all plots developed an increased proportion of solids (~60%), compared to freshly deposited bauxite residue. Furthermore, the treated plots exhibit a decrease of 2.5 pH units at a given depth, compared to the untreated plot, giving the surface zone of the treated plots pH <8. Treated plots also displayed a 3-4 fold decrease in aqueous available sodium at all depths. Treatment also decreased the overall availability of trace metals Al, V, and Cr to 50 cm, compared to the untreated plot. It is worth noting that the positive effects of treatment extend well beyond the 20 cm deep treatment zone, and are evident by the lush vegetation growing on the surface.

In this presentation we will discuss the chemical processes reducing alkalinity and improving the physical stability of bauxite residue in the treated plots. We will also highlight how, at 1/10 the financial cost of traditional cap and cover remediation, these treatments may provide a cost effective and viable solution to BDRA closure and red mud rehabilitation.