

## Potential of coal mine waste rock for generating acid mine drainage

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### ARTICLE INFO

#### Article history:

Received 1 June 2015

Revised 5 October 2015

Accepted 20 October 2015

Available online xxxx

#### Keywords:

Coal mine waste rock

Acid mine drainage (AMD)

Weathering cells

Acid base accounting (ABA)

PHREEQC

### ABSTRACT

Acid mine drainage (AMD) due to the oxidation of sulphide bearing waste rock (WR) is a common environmental problem associated with coal extraction. Therefore, WRs from the Lakhra coal field in Pakistan, were studied to i) perform a mineralogical and chemical characterisation, ii) determine the AMD generating potential and iii) estimate the leachability of elements. The chemical and mineralogical composition was studied using ICP, XRF, XRD and SEM. Acid base accounting and weathering cell test determined the acid producing potential of WRs. Besides organic material, the WRs were composed of quartz, pyrite, kaolinite, hematite and gypsum with varying amounts of calcite, lime, malladerite, spangolite, franklinite and birnessite. The major elements Si, Al, Ca and Fe were in the range (wt.%) of 8–12, 6–9, 0.3–3 and 1–10, respectively, with high S concentrations (19.4–113.3 g/kg). Trace elements were in the range (mg/kg) As (0.3–8), Cd (0.2–0.4), Co (15–75), Cr (67–111), Cu (25–101), Hg (0.1–0.2), Ni (50–107), Pb (8–20) and Zn (75–135). The AMD potential of WRs ranged from –70 to –492 kg CaCO<sub>3</sub>/tonne. During the test period of 192 days, the pH of leachates from very acidic WRs was maintained from 1 to 2.5, whereas, the less acidic WRs produced leachates of mildly acidic (2.7) to neutral (7.3) pH. The leachates from very acidic WRs ranged in the element concentrations of Fe, SO<sub>4</sub><sup>2-</sup> and Al from mg/L to g/L and As, B, Co, Cu, Mn, Ni and Zn from µg/L to mg/L. However, the leachates from less acidic WRs contained all major elements in mg/L and trace elements in µg/L concentrations except for B and Mn that ranged from µg/L to mg/L. The results show that the studied WRs have mild to strong acid producing potential and have the capacity to deteriorate natural water quality significantly. Therefore, necessary preventive or/and acid neutralising measures are strongly suggested.

Abbreviations: ABA, Acid-base accounting; AMD, Acid mine drainage; AP, Acid producing potential; ARD, Acid rock drainage; CC, Continental crust; NP, Neutralisation potential; NNP, Net neutralisation potential; WR(s), Waste rock(s).

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<http://dx.doi.org/10.1016/j.jgeoexp.2015.10.014>  
0375-6742/© 2015 Published by Elsevier B.V.

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