

PYRITE OXIDATION IN A MINESPOIL ENVIRONMENT: A LYSIMETER STUDY

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Pyrite (FeS_2) oxidation in a minespoil environment was investigated. Two anoxic Texas lignite overburdens with different amounts of pyrite (Martin Lake 0.8% and Sandow 0.1%) were packed into 0.7m^3 lysimeters with three replications. The lysimeters were leached monthly with 63.5 mm of deionized rainwater for a total period of twelve months. Leachate was collected and analyzed for pH, soluble cations (Ca^{+2} , Mg^{+2} , Na^+ , K^+) and sulfate. Core samples were taken at three month intervals during the leaching period. The cores were sectioned into depth increments and analyzed for pH, extractable cations and sulfate.

Acid-base accounting revealed an excess of acid neutralizing potential in both materials. After twelve months of leaching, leachates from both materials were above a pH of 6.5. The Martin Lake material decreased from an initial pH of 8.3 to 6.5. The Sandow material decreased from an initial pH of 8.2 to 7.5. Potential acidity determinations indicate that 50% of the initial pyrite has oxidized from both materials. Therefore, the pyrite oxidized at an average rate of $11.1\text{ mg Kg}^{-1}\text{ day}^{-1}$ in the Martin Lake overburden material and $1.6\text{ mg Kg}^{-1}\text{ day}^{-1}$ in the Sandow overburden material during the 12 month study. The release of acidity through pyrite oxidation was sufficiently slow for the inherent neutralizing materials to consume the acidity as it was generated and maintain a moderate pH. The slow oxidation rate is attributed to low surface area pyrite particles of massive morphology. Silicate coatings on the surfaces of pyrite particles were observed by scanning electron microscopy and confirmed by energy dispersive x-ray analysis (EDAX). The major acid neutralizing constituent was indigenous dolomite. This was substantiated by chemical analyses, a steady efflux of Ca and Mg in the leachates, and a significant increase in extractable Ca and Mg with time in the spoil materials.

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