

Genesis of acid drainage pollution of an engineering construction in central China

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The acid mine drainage (AMD) is formed when a certain sulfide minerals in rocks exposed to oxidation conditions, and causes environmental pollution. The inducing of the AMD is not only by the mining process, but non-mining process, like in some engineering works during the construction of a railway tunnel in central China, where the waste rocks with low-grade pyrite were piled without any treatment also could release the AMD. In order to study the genesis of the AMD for the purpose of suggesting a reasonable remedial measure, the rocks, surface water, groundwater, soils and sediments samples were collected and the pH, mineral ions (sulfate, iron), in addition, heavy metals (copper, zinc, etc.) concentrations were tested. Moreover, the outdoor experiments were applied for the determination of water level recovery and infiltration rate using the double-ring method. In addition, a series of indoor experiments were conducted to investigate how rocks released acid liquid under 4 different oxidizing conditions.

The results indicated that the pollutants in the study area were mainly acids, salts and metal ions. The surface water was acidic (1.56~2.31pH), while the groundwater hasn't been contaminated. The pH (57%) of the sediment was lower than the reference as well as Fe, Mn, Cu, Zn, Cd, and SO_4^{2-} . The pollutants in soil were mainly concentrated at the surface layer (0~0.2m). The laboratory experiments results showed that one rock sample marked as R2 produced liquid of which pH value was much lower, and the concentrations of total Fe and SO_4^{2-} were higher than others. The concentration of the total Fe for the R2 was 70 times at the pH of 2.00 than 4.00 and 6.00, which revealed that the low pH value was the prerequisite of acidity formation. The oxygen and bacteria (isolated from the polluted surface water) reduced the pH value of leachate from 7.00 to 4.11, and produced Fe and SO_4^{2-} , but only oxygen in the condition, only SO_4^{2-} generated, while only bacteria or none of the two, every substrate seemed unchanged along the 77 days. So it was both of them made the spoil site to release AMD, oxygen was necessary, while the bacteria played the leading role. Therefore, more attention should be paid on the engineering work, as these rocks may produce acid water just like the mine.