

Geochemistry of Natural Radionuclides Associated with Acid Mine Drainage (AMD) in a Coal Mining Area in Southern Brazil

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Abstract : Coal is an important non-renewable energy source of and can be associated with radioactive elements. In Figueira city, Paraná state, Brazil, it was recorded high uranium activity near the coal mine that supplies a local thermoelectric power plant. In this context, the radon activity (Rn-222, produced by the Ra-226 decay in the U-238 natural series) was evaluated in groundwater, river water and effluents produced from the acid mine drainage in the coal reject dumps. The samples were collected in August 2013 and in February 2014 and analyzed at LABIDRO (Laboratory of Isotope and Hydrochemistry), UNESP, Rio Claro city, Brazil, using an alpha spectrometer (AlphaGuard) adjusted to evaluate the mean radon activity concentration in five cycles of 10 minutes. No radon activity concentration above 100 Bq.L⁻¹, which was a previous critic value established by the World Health Organization. The average radon activity concentration in groundwater was higher than in surface water and in effluent samples, possibly due to the accumulation of uranium and radium in the aquifer layers that favors the radon trapping. The lower value in the river waters can indicate dilution and the intermediate value in the effluents may indicate radon absorption in the coal particles of the reject dumps. The results also indicate that the radon activities in the effluents increase with the sample acidification, possibly due to the higher radium leaching and the subsequent radon transport to the drainage flow. The water samples of Laranjinha River and Ribeirão das Pedras stream, which, respectively, supply Figueira city and receive the mining effluent, exhibited higher pH values upstream the mine, reflecting the acid mine drainage discharge. The radionuclides transport indicates the importance of monitoring their activity concentration in natural waters due to the risks that the radioactivity can represent to human health.

Keywords : radon, radium, acid mine drainage, coal

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