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Recovery of drinking water and valuable minerals from acid mine drainage using an integration of magnesite, lime, soda ash, CO(sub)2 and reverse osmosis treatment processes

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Abstract

In this study, the possibility of recovering valuable minerals and drinking water from acid mine drainage was explored. Neutralisation of Acid Mine Drainage (AMD) and recovery of metals were done at 60 mins of equilibration. DOW water & Process solutions, Reverse Osmosis System Analysis (ROSA), version 9.1 was used to further purify the resultant water to meet the drinking quality standards as required by the South African National Standard (SANS) report (SANS 241). The obtained results revealed that drinking water, metals, gypsum, hydrated lime/limestone were recovered from the treatment process as valuable resources. This was confirmed by X-ray diffraction (XRD) and X-ray Fluorescence (XRF). Morphological properties of initial and recovered minerals were examined using High Resolution Scanning Electron Microscopy (HR-SEM). Carbon Dioxide (CO(sub2)) was bubbled through soda treated water to recover limestone and to stabilise the pH of the product water (pH ˜7.5). Post treatment, the resultant water was further purified by simulated Reverse Osmosis (RO) system to produce water that meet the drinking water quality as stipulated by SANS 241 standards. The pH of recovered drinking water was˜6.5. The metals removal efficiency of the RO system was ˜100%. In general, this study demonstrated that the integration of magnesite, lime, soda ash, CO(sub2) and reverse osmosis treatment processes can convert environmental pollutants and waste resources into commercially valuable products that have industrial applications.