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Feasibility study of a self-remediation system for mine drainage using its thermal energy

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Mine drainage is defined as the water which is discharged to the ground surface through shafts and/or cracks formed by mining activities. Typically, mine drainage features high concentration of acidity and metals since it passes through the underground. Therefore, for the purpose of protecting the surrounding natural environment, mine drainage should be remediated before being discharged to nature. Mine drainage, due to its nature of being retained underground, shows constant temperature which is independent from the temperature of the atmosphere above ground. This condition allows mine drainage to become a promising renewable energy source since energy can be recovered from water with constant temperature. In this research, a self-remediation system is proposed which remediates the mine drainage through electrochemical reactions powered by the thermal energy of mine drainage. High energy efficiency is able to be achieved by shortening the distance between the energy source and consumption, and therefore, this system has a strong advantage to be actualized. A feasibility study for the system was conducted in this research where the thermal energy of mine drainage over time and depth was calculated as energy supply and the required electrical energy for remediating the mine drainage was measured as energy consumption. While the technology of converting thermal energy directly into electrical energy is yet to be developed, energy balance analysis results showed that the proposed self-remediation system is theoretically possible.