MagheClean™

Acid mine drainage treatment

"Cleaning Mines. Saving Water."

Technology

The invention uses maghemite nanoparticles at pH levels below 5 to remove sulphate, manganese, copper, nickel, cobalt, and zinc ions from acid mine drainage (AMD). In traditional AMD treatment methods, these contaminants are usually removed only at higher pH levels, which requires expensive alkaline chemicals. Typically, only iron (III) and aluminium (III) precipitate at low pH. Due to the highly acidic nature of AMD, effective pollutant removal demands precise process optimisation. Compared to conventional methods, adsorption offers a more convenient, cost-effective, and efficient alternative. This invention combines adsorption and precipitation processes to achieve high removal efficiencies across multiple contaminants. The achieved pollutant removal rates were as follows: sulphate (89%), manganese (79%), cobalt and zinc (98%), nickel (96%), and copper (100%). Overall, the method significantly reduces chemical usage while providing a cost-effective solution for AMD remediation, with the added potential for recovering valuable resources from treated effluent.

Market need

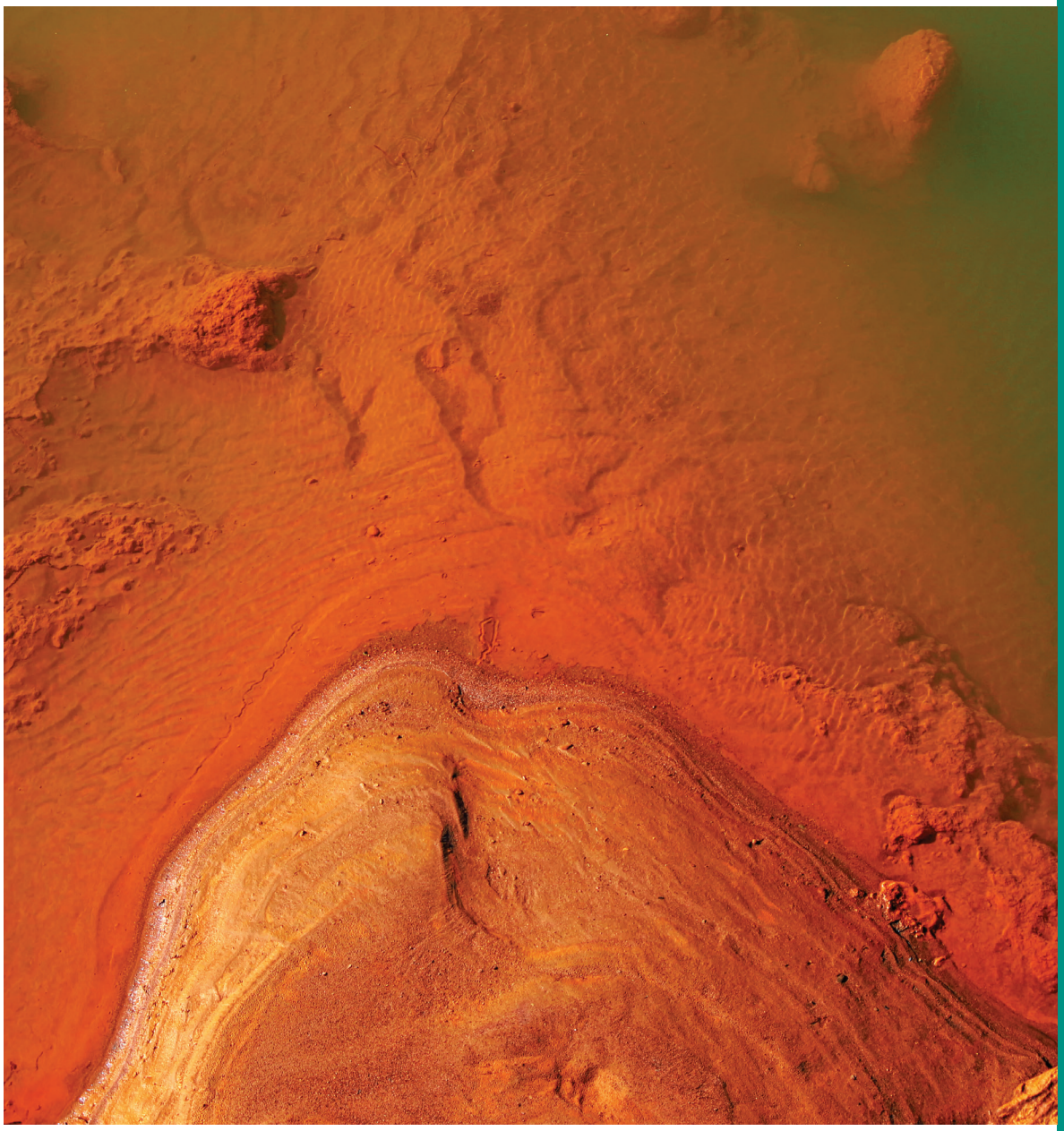
Several technologies exist for AMD treatment, with neutralisation being the most widely used. This method facilitates metal removal through hydroxide precipitation and sulphate removal as gypsum formation. However, since both metals and sulphate co-precipitate, it becomes economically unfeasible to recover either component from the resulting sludge. The sludge, typically disposed of in landfills, contributes to large tailings that pose environmental risks due to the leaching of metals. There is therefore a critical need for cost-effective AMD treatment technologies that enable the recovery and reuse of valuable resources while minimising environmental impact and reducing chemical consumption.

Features

- Employs maghemite nanoparticles for efficient adsorption of metal ions and sulphate.
- Operates efficiently under acidic conditions typical of AMD and produces less sludge.
- Integrates both adsorption and precipitation mechanisms to achieve higher pollutant removal efficiencies.
- Capable of removing multiple contaminants including sulphate, manganese, copper, nickel, cobalt, and zinc simultaneously.

Benefits

- Reduces treatment costs by operating at natural AMD pH and requiring fewer chemicals.
- Provides high removal rates even under harsh acidic conditions.
- Enables the extraction and potential commercial reuse of metals, transforming waste into valuable resources.
- Minimises sludge formation and landfill disposal.
- Helps mining and industrial operators meet environmental discharge standards.



Industry
Water

Potential applications
- Treatment of acid mine drainage and acidic industrial effluents containing heavy metals and sulphates.
- Use in mining, metallurgical, and electroplating industries for wastewater purification.
- Application in environmental remediation and rehabilitation of contaminated water bodies.
- Enables recovery of valuable metals from treated effluent.
- Supports sustainable water management with reduced chemical usage and sludge generation.

Creators
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Stage of development
Laboratory prototype

Intellectual property
Patent Protection

Desired relationship
Co-development, Investor