Escuela Superior Politécnica del Litoral

PARES & NONES Un break científico

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Pilot-scale reverse osmosis treatment of gold cyanidation effluent for the removal of cyanide, heavy metal(loid)s, and ionic species

PROBLEM

Gold mining presents an economic benefit, however, there are significant challenges due to its negative environmental impacts. The use of chemicals such as cyanide for gold extraction releases toxic compounds that cannot be removed by conventional methods, affecting the quality of water resources and the health of population.

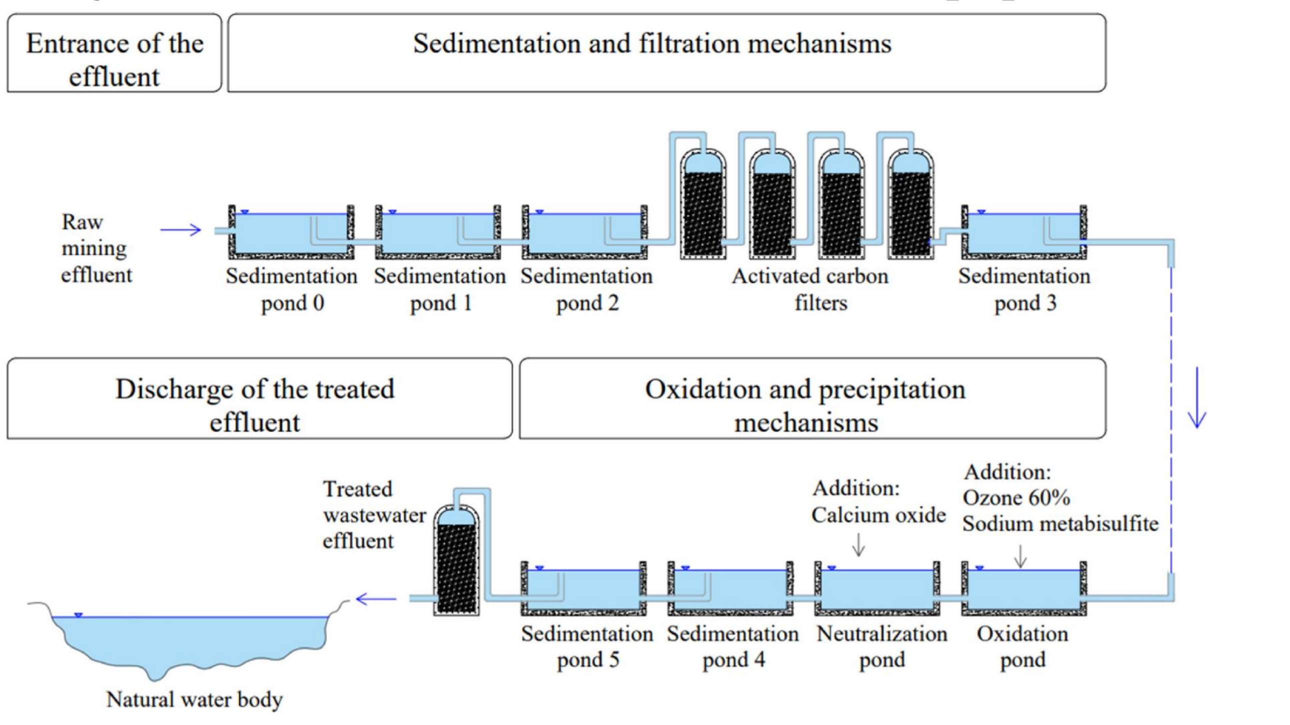


Fig. 1. Conventional treatment process.

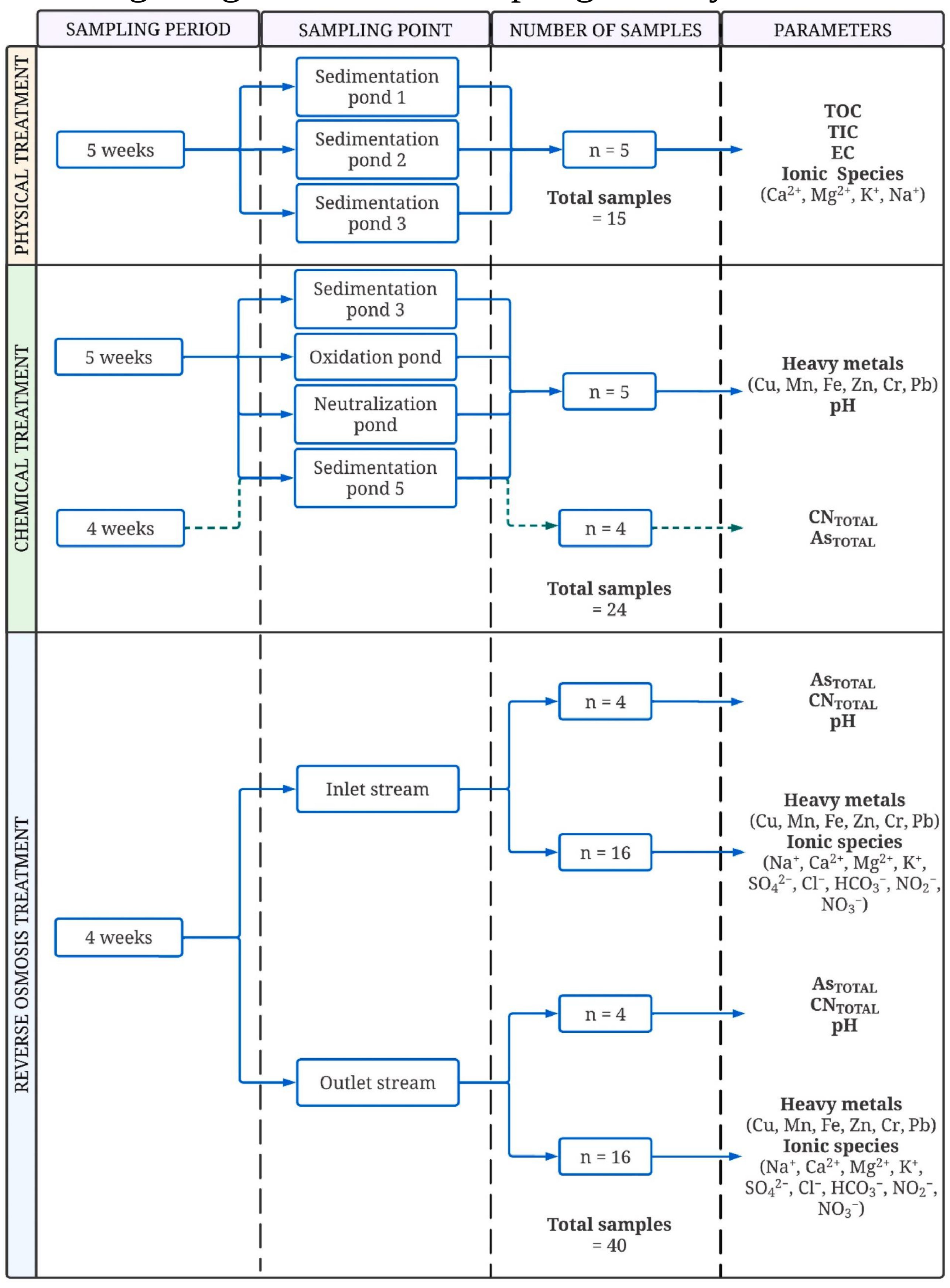
GENERAL OBJECTIVE

Evaluate the conventional treatment and in-situ performance of a pilot-scale reverse osmosis (RO) treatment system deployed within a mining facility to remove CN_{TOTAL}, As_{TOTAL}, heavy metal(loid)s, and ionic species from gold mining effluents.

Fig. 2. Reverse osmosis process.

METHODOLOGY

This research was performed in three stages as: (i) Field work, (ii) Laboratory work, and (iii) Data processing. The following image shows the sampling activity in detail:



RESULTS

- **CONVENTIONAL TREATMENT**

Heavy metals removal, i.e., Cu, Mn, Fe, and Zn, as shown in Fig. 3.

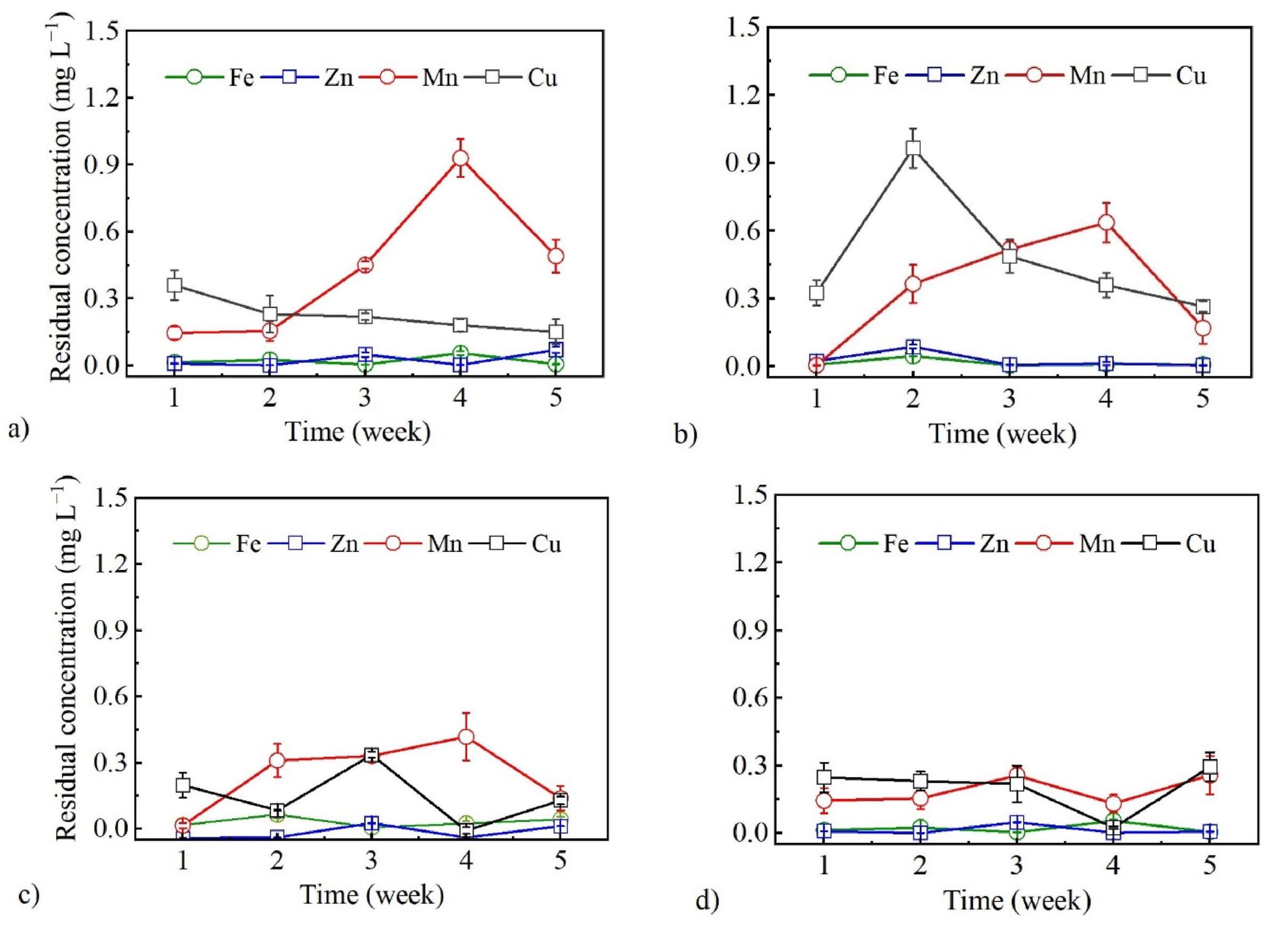


Fig. 3. Residual concentration of heavy metals (Cu, Mn, Fe, and Zn) after the chemical treatment process: (a) Inflow into the conventional chemical treatment process, (b) oxidation and precipitation with metabisulfite, (c) neutralization with lime, and (d) sedimentation of metallic hydroxides.

- **RO TREATMENT**

Fig. 4 presents the reduction in both As_{TOTAL} and CN_{TOTAL} concentrations upon the application of RO technology. Fig. 5 shows the removal efficiencies of these heavy metals during the pilot-scale RO treatment.

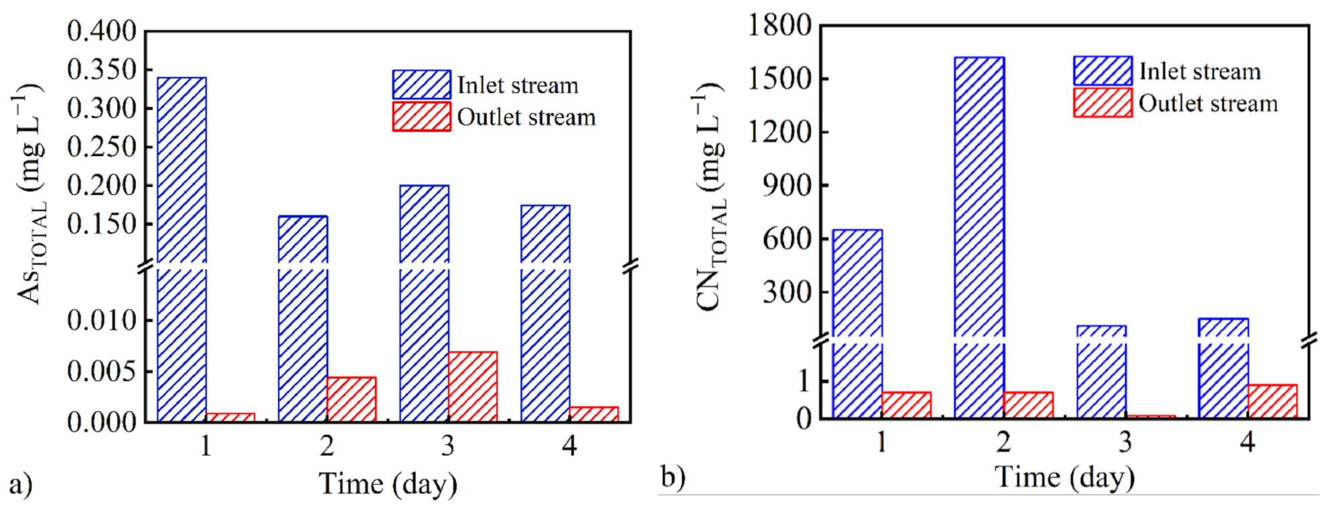


Fig. 4. Residual concentration of: (a) As_{TOTAL} and (b) CN_{TOTAL} in the inlet and outlet stream of the RO treatment.

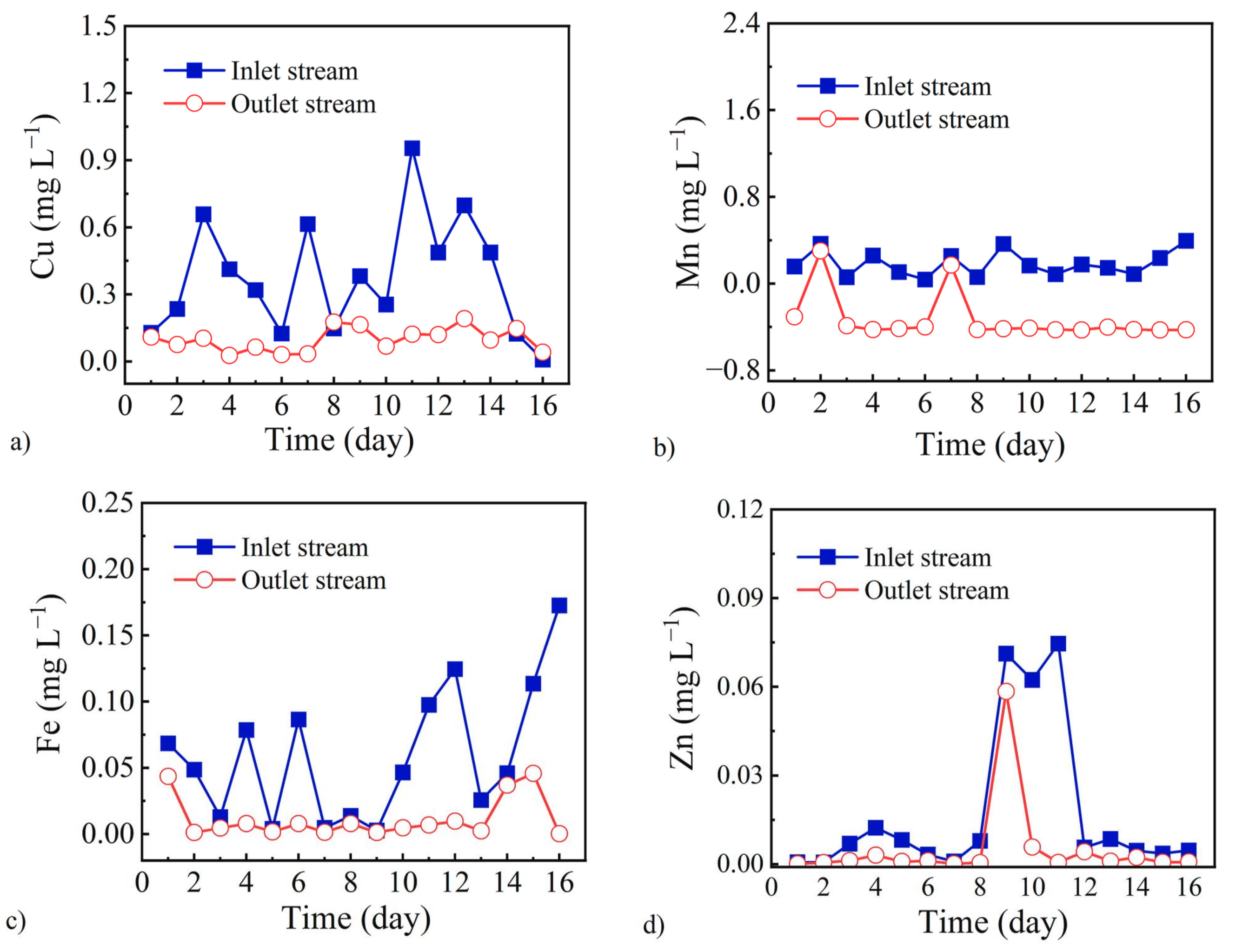


Fig. 5. Concentration of heavy metals: (a) Cu, (b) Mn, (c) Fe, (d) Zn in the inlet and outlet streams of the RO treatment system.

CONCLUSIONS

- The conventional treatment removed heavy metals as . However, it substantially failed to remove CN_{TOTAL} and As_{TOTAL}.
- The RO treatment effectively reduced the concentrations of CN_{TOTAL} by 99.79% and As_{TOTAL} by 98.17%, respectively.

ACKNOWLEDGMENTS

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