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Simulation of cyanide oxidation using calcium and sodium hypochlorite in the Moteh Gold Mine Tailing Dam, Iran

Elham Tavasoli[a], Gholamreza Asadollahfardi[a,*], Ahmad Khodadadi Darban[b], Mohsen Asadi[c]

[a]*Department of Civil Engineering, Faculty of Engineering, Kharazmi University, Tehran, Iran, email: elham.tavasoly@gmail.com (E. Tavasoli), asadollahfardi@yahoo.com (G. Asadollahfardi),*
[b]*Department of Mining Engineering, Tarbiat Modares University, Tehran, Iran, email: akdarban@modares.ac.ir (A. Khodadadi Darban)*
[c]*College of Engineering, University of Saskatchewan, Saskatoon, Canada, email: moa997@mail.usask.ca (M. Asadi)*

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ABSTRACT

Cyanide, as one of the most toxic pollutants existing in the gold mine tailing dams, threatens human health and other species life. The main objective of this study was to simulate the oxidation of cyanide from mineral effluent of the Moteh Tailing Dam (Iran), as a method for removing cyanide. We employed PHREEQC software to model the oxidation of cyanide using calcium hypochlorite ($Ca(OCl)_2$) and sodium hypochlorite (NaOCl). The results indicated that $Ca(OCl)_2$ and NaOCl concentrations, as well as pH, influenced the oxidation of cyanide. The model was run in the constant temperature of 12°C and pH between 12 to 13. By rising $Ca(OCl)_2$ concentration from 0.71 to 1.43 g/l and NaOCl concentration from 1.72 to 5.18 g/l, the removal rates of cyanide increased from 97.01% to 99.20% and 95.46% to 95.90%, respectively. The coefficient of determination (R^2), index of agreement (IA), and Nash- Sutcliffe efficiency (E) were used to assess the predicted removal rate of cyanide in comparison with experimental observations, which demonstrated a suitable agreement: $Ca(OCl)_2$ = 0.71 mg/l, R^2 = 0.97, IA = 0.91 and E = 0.73; $Ca(OCl)_2$ = 0.85 mg/l, R^2 = 0.99, IA = 0.99, E = 0.96; $Ca(OCl)_2$ = 1.43 mg/l, R^2 = 0.97, IA = 0.92, E = 0.79; NaOCl = 1.72 mg/l, R^2 = 0.97, IA = 0.92, E = 0.74; NaOCl = 3.45 mg/l, R^2 = 0.91, IA = 0.91, E = 0.71; NaOCl = 5.18 mg/l, R^2 = 0.96, IA = 0.91, E = 0.77.

Keywords: Cyanide; Oxidation; Calcium hypochlorite; Sodium hypochlorite; PHREEQC

*Corresponding author.