An Assessment of the Environmental Geochemical Processes in the Okiep Copper Tailings: A kinetic geochemical modelling approach

MOTLATJI R. MOLABE[1*], ROBERT N. HANSEN[2]

[1] University of the Free State, Department of Geology, PO Box 339, Bloemfontein 9300, South Africa, (*correspondence: motlatjimolabe@gmail.com)
[2] (hansenr@ufs.ac.za)

Understanding geochemical processes

A study of geochemical processes and environmental impacts of the sulphide-bearing Okiep copper tailings, South Africa is presented. Kinetic geochemical modelling is the main methodology as we aim to expand on the previously limited understanding of the kinetics of major oxidation processes [1, 2] causing environmental impacts in the study area. Our results show a high likelihood of acid mine drainage (AMD) conditions which are typical of environments hosting such sulphide deposits [1].

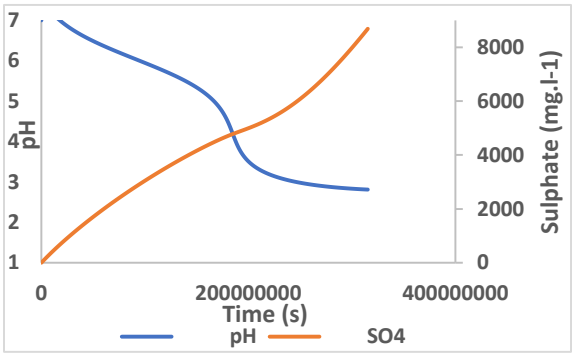

Figure 1: Model results showing the relationship of pH-sulphate-time series

Parameter	*Units*	WHO guideline	Okiep tailings
pH		n.v[1]	2.8
SO_4	*mg.l*$^{-1}$	500	8 688
Cu	*mg.l*$^{-1}$	2	2 013

Table 1: Model results showing parameters of concern in tailings solution
[1]n.v is "no guideline value"

Discussion of Results

The relationship of the parameters plotted in the results is explained by rate laws [3] showing how the system changes over time and elucidating on the controls of AMD formation. The acidic pH has influenced a higher concentration of SO_4 and Cu of which are above the guideline [4], therefore potentially causing negative environmental impacts, detrimental to local communities.

[1] Jambor (1994) *MAC*, **22,** 59-102. [2] Hohne and Hansen (2008) *CGS*, 1-70. [3]. Kimball *et al.* (2010) *Appl. Geochem.* **25,** 972-983. [4] WHO (2017) GDWQ 4th ed., 224-225, 419.