

Relevance of Hydro-Mechanical-Chemical Processes Involved in the Construction and Operation of Copper Heap Leach Pads

M. Tincopa¹, A. Nardi², G. Roman-Ross², J. Molinero²

¹Technic University of Catalonia (UPC), Barcelona, Spain

²Amphos 21 Consulting, Barcelona, Spain

Abstract

Heap leaching in the mining industry had become a fairly sophisticated practice at least 500 years ago. It is defined as a mineral processing technology whereby large piles of crushed Run-of-Mine (ROM) rock are leached with various chemical solutions to extract the valuable minerals.

The main goal of this work is to contribute to the understanding of the behavior of a heap leach pad by using coupled Hydro-Mechanical-Chemical (HMC) simulations and optimize its design by improving the pad stability and the ore recovery efficiency.

The numerical tool COMSOL Multiphysics® used in this work is able to solve simultaneously unsaturated flow, soil mechanics and reactive transport in porous media. The changes in porosity, permeability due to mineral dissolution/precipitation and irrigation time affect significantly the hydromechanical behavior of the heap leach pad. The stability of the pad and the ore recovery efficiency can be predicted with more accuracy because the variable saturation and the mechanical deformation are considered during the construction and operation process.

Figures used in the abstract

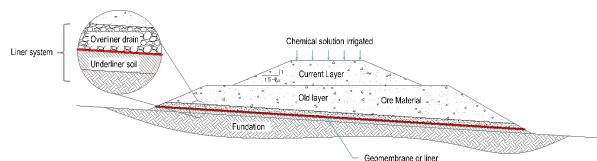


Figure 1: Sketch of a heap leach pad system

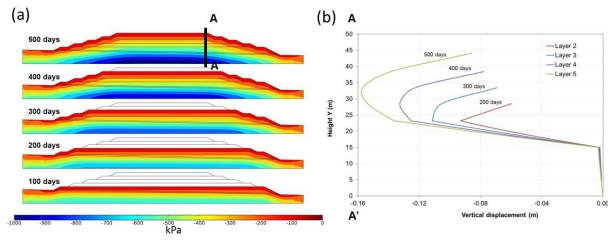


Figure 2: (a) Vertical total-stress distribution, (b) vertical displacement distribution for the cross section A-A' for 200 days, 300 days, 400 days and 500 days due to self-weight.

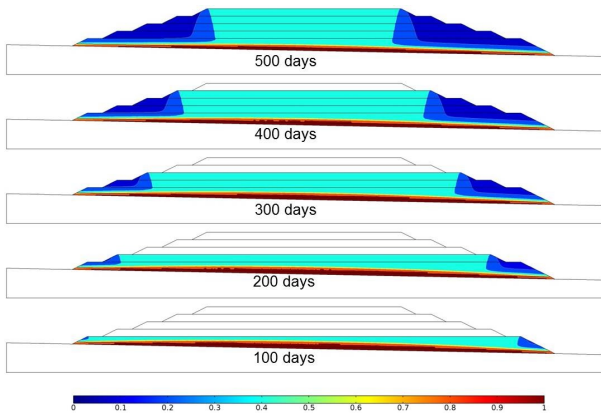


Figure 3: Degree of saturation evolution

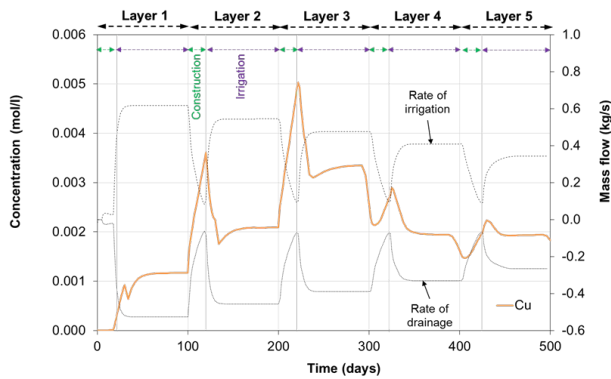


Figure 4: Copper concentration at outflow (left axe) and drainage and irrigation rates (right axe) evolution