We have developed a mathematical model that describes the qualitative behavior of deep well oxidation reactors for operation under subcritical as well as supercritical conditions. The model is used to study the effect of various design and operating parameters on the steady-state behavior of the reactor. The simulations show that for typical operating conditions, the reactor exhibits multiple steady states including an isolated ignited branch and a lower extinguished branch. The results show that an increase in the flow rate, a decrease in the solids concentration or a decrease in the inlet temperature can cause the reactor to extinguish. Further more, the ignited branch is effectively isolated over the range of these operating parameters indicating that the reactor cannot be ignited by varying these parameters. Therefore, start-up can only be achieved by utilizing external heating. In addition, an examination of the design parameter, the oxygen injection depth, showed that for all other parameters fixed, there exists a finite range of injection depths over which an ignited steady state exists. The simulations have also shown that when all other parameters except the Damkohler number, *Da* (dimensionless residence time) remain constant, the bottom temperature reaches an asymptotic value for very large *Da*. In addition, the reaction zone becomes thinner and moves to the bottom of the reactor.

The results of our simulations of the deep well process are useful in understanding the behavior of the process, evaluation of different design alternatives and in developing start-up and control procedures leading to more effective destruction of hazardous wastes.

An operator splitting, domain decomposition numerical model for contaminant transport in aquifer flow

Marcelo Rame and John Killough

Department of Chemical Engineering, University of Houston, 4800 Calhoun Road, Houston, TX 77204-4791 (USA)

Abstract

The objective of this proposed research investigation is to develop an accurate, robust, and cost-effective three-dimensional numerical model for the simulation of groundwater contamination and mitigation techniques. Significant progress has been made in the areas of model development, data acquisition,

and modeling of a contamination site. A two-dimensional test version of the operator splitting formulation has been completed. This prototype model divides the problem into the solution of the pressure field using a finite element based model and a solution for transported species using a finite difference approach. The model has been applied to several sets of data including a real reservoir permeability distribution and two hypothetical cases. Results in all instances were excellent. We are currently modeling a hydrocarbon contaminated aquifer which is undergoing microbial biorestoration at a tractor–trailer operations site. Future work will focus on the development of a three-dimensional modelling capability and application of this model to real field data.

Performance of solidified/stabilized inorganic hazardous waste substances in modified portland cement matrices

Saeed Daniali

Department of Civil Engineering, Lamar University, P.O. Box 10024, Beaumont, TX 77710 (USA)

Abstract

Immobilization of hazardous waste substances in portland cement matrices is considered a major solidification/stabilization method, particularly when the wastes are largely inorganic; however, the compound composition of portland cement is mainly designed and manufactured for construction applications. Therefore, it is necessary to tailor the compound compositions of portland cement according to the nature of the waste substances. The modifications improve both physical and chemical properties of the final products.

The present work reports the performance of several latex-modified portland cement matrices contaminated with Pb(II) nitrates. The TCLP test was used to evaluate the performance of the solidified products. Comparison of these results indicates a significant improvement in the treatment efficiency of the portland cement binder when it is modified with latex.
