

taminants from soil through adsorption and desorption breakthrough curves. The parameters for sorption of toluene, trichloroethane, heptane and carbon tetrachloride from sand and soil with an organic content of 25 have been determined. The adsorption isotherms obtained for these systems are successfully represented by a Langmuir formula. The desorption profiles have also been obtained using moist air. The removal rates of contaminants were found to increase significantly in the presence of water. This was attributed to the effect of water on the thermodynamic equilibrium between the soil and the contaminant. The experimental technique developed is fast, accurate and can be used for quantification of soil contamination from soil gas analysis as well as yielding the necessary equilibrium and mass transport relationships for air stripping as a remediation technique.

Modelling of deep well oxidation of aqueous hazardous wastes under supercritical conditions

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Abstract

Deep well oxidation is a novel process that has been developed recently for oxidizing suspended and dissolved organics from aqueous waste streams. The process employs wet oxidation methods and is carried out in a deep well reactor buried in the ground. The reactor consists of concentric tubes of length 1,500–3,000 meters suspended within a conventionally drilled and cased well. During the oxidation process, the waste stream and oxygen are brought together in a mixture at high pressure and elevated temperature. Oxidation of organics is initiated spontaneously at these conditions. The heat of combustion is used to heat up the incoming feed to the required temperature and the hydrostatic head provides the required pressure. The temperature and pressure within the reactor can be above or below the critical temperature and pressure for water and the process can be accordingly treated as supercritical or subcritical deep well oxidation, respectively.

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

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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,