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MASS TRANSFER MODEL OF SOIL VAPOR EXTRACTION UNDER THERMAL TREATMENT FOR REMOVING A VOLATILE CONTAMINANT

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Abstract

A series of column experiments were conducted to study volatile contaminant (benzene) removal and process principles using soil vapor extraction (SVE) under different thermal conditions. Compared with the normal SVE method, two thermal methods-steam injection and electrical resistance heating effectively increased the benzene vapor diffusion and removal rates. The removal efficiency of benzene with the electrical resistance heating method was 96.5%, which was significantly higher than that with the steam injection method (90.5%, p=0.002) or with the normal SVE method (85.2%, p=0.001). In addition, SVE with electrical resistance heating showed a more stable heating effect than SVE with steam injection in homogeneous sandy soil. Based on existing equilibrium SVE models, we established a one-dimensional non-equilibrium mass transfer model for estimating volatile contaminant removal under thermal enhancement. The improved model can accurately reflect benzene content variations using SVE with electrical resistance heating and provides a theoretical basis for preliminary site remediation assessments using SVE under continuous thermal treatment.

Keywords: mass transfer model, soil vapor extraction, thermal treatment, volatile contaminant

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