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論文名稱: 多孔體二維流散係數及溶質傳輸之研究

英文論文名稱: A Study on the Dispersion Coefficients and Two-Dimensional Solute Transport in Porous Media

【中文摘要】

本研究係針對溶質在多孔體中傳輸的確定性模式進行探討，

共分為三部份。

在第一部份研究中，利用一維對流－流散－線性吸附方程

式之解析解，設定基本參數，求出等時間間距之濃度數列，再

以 Amoozegar-Fard et al. (1983) 之方法推求流散係數及阻滯因子

二參數，以了解純以數學角度分析時，參數誤差之分佈及其特

性。由研究中可知 Pe >= 20、點數 N >= 3、間距 >= 2Δt 時，

可用曲線任意位置之數據求得參數，其誤差是可接受的。

在第二部份研究中，傳統二維無反應多孔體均以二次試驗

，分別求取縱向流散係數 D_L 及橫向流散係數 D_T ；且在濃

度達到穩定狀態之條件下，始可求得橫向流散係數。本研究利

用連續性半平面源之解析解，可在一次試驗中，溶質濃度連續

變化狀態下，同時求得兩種流散係數。

在第三部份研究中，於坡地上設定以連續且濃度固定之溶

質來源，由地表隨水分全面進入均質之土壤時，不考慮吸附，

由二維理論之推導，可得溶質在坡地傳輸的對流－流散方程式

，其型式與一維方程式類似，而流散係數涵蓋坡地角度、橫向

及縱向流散係數可表為 $D_s = n D_L$，其中 n 代表坡地綜合效

應之參數。在決定是否以一維溶質傳輸模式來代替坡地溶質

傳輸時，可用 n 值作為初步判斷之依據。

【英文摘要】

This research is discussing some properties about the deterministic model of solute transport in porous media. It has three parts.
In the first part, we set basic parameters on the analytical solution of one-dimensional convection-dispersion-adsorption equation, to find the concentration data at equal-time intervals, and using Amoozegar-Fard et al. (1983) method to estimate the parameters, which compare with the original ones to find the variation of the relative error.

Under assumed conditions we find that as Pe>= 20、N>= 3 and

time interval 2>=Δt, the errors in dispersion coefficient and retardation factor are acceptable .
Two-dimensional solute dispersion in porous media needs two important parameters, longitudinal and transversal dispersion coefficients, D_L and D_T , which require two independent experiments to estimate, and also must meet the conditions in steady state. In the second part, we investigate these two parameters simultaneously and in the unsteady state
conditions through mathematical treatments.
In the third part, a hillslope convection-dispersion equation was derived for nonreactive solute transport into a homogeneous hillslope and steady flow. The dispersion parameters of this equation includes slope angle, longitudinal dispersion coefficient, and transversal dispersion

coefficient. The relation is $D_s = n D_L$. The n values were defined as the effect of hillslope to solute transport. The value of n could be taken as a critical one to determine the importance of slope effect.