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Effective Vertical Solute Transport in Soils by Artificial Macropore System

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Characteristics of solute transport in soils were important factors which govern the soil environmental processes, such as effective fertilizer application or dispersion areas of remediation chemicals for contaminated soils. However, soils were easy to be clogged by long term infiltration, moreover, infiltration process was disturbed at surface soils by formation of crust or, sometimes, water repellency. Thus it is not easy to maintain fair hydraulic conductivity for long term experiment. In this study, artificial macropores were utilized to achieve long term infiltration process. Macropores are everywhere in soils, and in unsaturated conditions, they enhance air intrusion in soils and avoid clogging of the surface soils. However, their structure was hard to maintain and collapsed by long term infiltration when artificial macropores were made in soils. In this experiment, macropore fillings were introduced into the pores to maintain its structure. They were made of glass fiber or paper towels. Solute transport experiments were conducted for four soils which have: no macropore inside; empty macropores; macropores with paper towel fillings; macropores with glass fiber fillings. Results indicated that macropore fillings successfully conducted solution to the deeper profile, without saturation at the surface, therefore without clogging. When bioremediation experiments were conducted for these four soil columns, soil columns with macropore fillings kept 0.6-0.8 of saturated water content, thus it enhanced biological activity. The resultant residue oil concentration was small for them, because artificial macropores with fabric fillings maintained macropore structure and also stable infiltration for 30 days, kept unsaturated condition by passing the excess water to deeper profile and enhancing biological activity.

Keywords: environmental restoration, macropore, contamination, degradation, solute transport