



Transport of four pharmaceuticals in different horizons of three soil types

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Soil structure, which varies in different soil types and the horizons of these soil types, has a significant impact on water flow and contaminant transport in soils. Transport of many contaminants is in addition strongly influenced by their sorption on soil particles. Transport of four pharmaceuticals (sulfamethoxazole, trimethoprim, atenolol and carbamazepine) was studied in soil columns (a diameter of 10.5 cm and a height of 13 cm) taken from all diagnostic horizons of three different soil types (Haplic Luvisol, Greyic Phaeozem and Haplic Cambisol). The irrigation by water contaminated by a mixture of all four compounds followed by ponding infiltration of distilled water was simulated and water outflow and solute concentrations from the bottom of the soil sample was monitored in time.

The highest infiltration rates were observed for soil samples from the Bt horizons of the Greyic Phaeozem that exhibited prismatic structure, followed by rates observed in the Ap horizons of the Haplic Luvisol, Greyic Phaeozem and Haplic Cambisol (due to their granular soil structure and presence of root channels). The lowest infiltration rate was measured for the Bw horizon of the Haplic Cambisol, which had a poorly developed soil structure and a low fraction of macropores. Compound discharge was however also highly affected by their sorption on solids. The highest mobility was observed for sulfamethoxazole followed by carbamazepine, atenolol and trimethoprim, which corresponds to measured sorption isotherms. Mobility of ionizable compounds in different soil samples was influenced by pH (i.e. degree and form of their ionization) and sites available for absorption. Mobility of sulfamethoxazole decreased with decreasing pH (i.e. the largest sorption measured in horizons of the Haplic Cambisol). While mobility of atenolol and trimethoprim decreased with increasing base cation saturation, and with increasing organic matter content for carbamazepine. As result of both affects (i.e. soil structure and compounds' sorption) the highest discharge of all compounds was observed from the Ap horizon of the Greyic Phaeozem followed by compound discharge from the C horizons of the Greyic Phaeozem and the C and Bt2 horizons of the Haplic Luvisol.

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