Transport characteristics of the pharmaceutical oxaliplatin in natural soil

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Pharmaceuticals have been reported for over forty years to reach natural water and soil resources. The presence of pharmaceuticals in the environment raises concerns regarding their impact on ecosystems and human health, in spite of their minute environmental concentrations. Therefore, better understanding of transport and fate of pharmaceuticals in the subsurface could improve predictions of their environmental impact and facilitate the design of remediation efforts.

Here we discuss the transport of oxaliplatin ($C_8H_{12}N_2O_4Pt$) through packed, saturated soil columns, under controlled and environmentally relevant redox conditions. Oxaliplatin is a commonly used chemotherapeutic agent that has been detected in hospital effluents [1]. Oxaliplatin is prone to hydrolysis and ligand exchange as a function of pH and electrolyte activities, and it is therefore a source of both mobile or sorbed Pt complexes in the subsurface [2,3].

A similar breakthrough pattern of oxaliplatin was found for oxic, nitrate reducing and strong biologically reducing conditions, in columns of loamy, sandy soil. The breakthrough curves exhibit an initial fast sorption phase, reaching a short-term plateau at the outlet concentration of about 10%, and then a slow, continuous increase in recovery, indicating slow desorption. In sand, a significant difference in transport patterns was observed between oxic and chemically reducing conditions. Under both conditions, oxaliplatin elutes from the column together with an inert tracer; under oxic conditions, oxaliplatin recovery is about 90%, whereas under chemically reducing conditions the breakthrough curves exhibit sorption-desoprtion cycles with varying recoveries. Under all redox conditions, oxaliplatin elution was found to be faster as the ionic strength of the oxaliplatin solution decreases. The results indicate that redox conditions in soil are a less significant factor than expected, while chemical composition of oxaliplatin solutions and soil composition are the leading factors affecting oxaliplatin mobility and fate in the subsurface.

[1] Vyas *et al.* (2014) *Sci Total Environ* **493**, 324-329. [2] Turner and Mascorda (2015) *Chemosphere* **119**, 415-422. [3] Lenz *et al.* (2005) *Sci Total Environ* **345**, 141-152.