Surface-induced redox processes: Oxidative transformation of oxytetracycline by Fe- and Mn-containing minerals

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Pharmaceuticle degradation by Fe and Mn minerals

Transformation of pharmaceuticals by mineral surfaces significantly affects their environmental behaviour [1]. Manganese oxides and iron-enriched minerals are common redox-reactive species, participating in a variety of redox reactions resulting in the transformation of organic and inorganic pollutants in the environment [2].

In this work, we compared reaction kinetics and mechanisms of adsorption and oxidation of oxytetracycline (OTC), an antibacterial agent and an environmental pollutant [3], by Fe(III)-enriched montmorillonite and birnessite (δ-MnO_2).

This is the first work which investigated the oxidative transformation of OTC by Fe(III)-enriched mineral surface.

Results and discussion

OTC sorption (including inter-layer adsorption in case of Fe(III)-montmorillonite) and oxidation by both minerals were accompanied by their reductive dissolution. Participation of various radicals in OTC oxidative transformation, forming multiple detected transformation products, was suggested for both OTC-mineral systems. However, OTC transformation kinetics, its oxidation intensity and pathways, and transformation products, were distinct for Fe- and Mn-containing minerals due to different reduction potential and structure of the mineral surface.

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