

## **How does the presence of metal influence the retention and transfer of pharmaceuticals in soils?**

S. SAYEN\*, E. GUILLON

ICMR, UMR CNRS 7312, Université de Reims  
Champagne-Ardenne, BP 1039, 51687 Reims  
cedex 2, France (\*correspondence:  
stephanie.sayen@univ-reims.fr)

Pharmaceuticals used for decades for both personal health and veterinary purposes became recognized as emerging environmental contaminants at the end of 1990s. After their use, they are not fully metabolized in the body and are either excreted unchanged or as metabolites via urine and faeces. As a consequence, they are omnipresent in wastewater worldwide and are continuously emitted in the environment. They are designed to have pharmacological effects at low concentrations, which have led to concerns regarding their distribution in the environment and potential non-wanted biological effects in different organisms.

Once they reach a wastewater treatment plant (WWTP) via the sewage system, they are not completely eliminated, some pharmaceuticals being relatively resistant to elimination, resulting in only partial removal from the water phase, and often partition into sewage sludges (biosolids). As a result, considerable amounts of these contaminants remain in WWTPs effluents and treated sewage sludges.

Pharmaceuticals then enter soils via effluent reuse through irrigation or groundwater recharge, and land application of biosolids as soil amendment. Once they have been introduced into soils, sorption processes at the solid-liquid interfaces play a major role in the environmental fate of these organic pollutants, governing their mobility, transfer from soil to groundwater and surface water, and their availability for soil organisms and plants.

In environmental compartments, notably in biosolids, only mixtures of pollutants are present and not isolated substances. For example, pharmaceuticals can interact with metals present in water and solid matrixes due to the presence of functional groups able to form stable complexes with metal ions. These interactions can modify their reactivity and thus their fate in the environment.

We will present several results obtained from adsorption experiments of pharmaceuticals in soils in presence of metals. Investigations at molecular scale are conducted to bring insight into the co-sorption processes. In some cases, metals greatly affect the sorption behaviour of pharmaceuticals, but in other cases the influence is negligible. Thus, it is important to consider the presence of metals when assessing the risk related to the presence of pharmaceuticals in soils.