Minghua Li
ISEQ Profile from September 2005

Pharmaceutical and personal care products (PPCPs) are a group of chemical compounds that are used in large quantities on a daily basis for various purposes by man and animals. It has been reported that PPCPs are potential endocrine disruptors (Daughton, 1999). Each year, large quantities of pharmaceuticals are sold and consumed in the United States and worldwide for the diagnosis, treatment, alteration, or prevention of human diseases. In addition to pharmaceutical compounds, large quantities of personal care products, such as food supplements, fragrances, skin care and hair care products, insect repellants, cleaning products, and flame retardants are produced and sold in large quantities worldwide each year.

Large quantities of a wide spectrum of PPCPs (and their metabolites) can enter the environment following use by multitudes of individuals or domestic animals and subsequent discharge to (and incomplete removal by) sewage treatment systems or by other pathways such as direct land application of waste water treatment plant (WWTP) biosolids and poultry and/or livestock manure. How do PPCPs move around in the soil-water system? What are the major factors controlling the fate, transformation and transport of PPCPs in soils? These are some of the relevant questions that need answers as to establish PPCPs standards for land application of WWTP effluents and biosolids.

The proposed research is to investigate the fate, transformation and transport of selected PPCPs in soils. Many mechanisms can be visualized in the fate, transformation and transport of PPCPs in soil-water system. Hydration, redox reaction, biodegradation, and sorption can all affect the total transport of PPCPs in soil-water environment. Depending on the physicochemical properties of the selected PPCPs and the soil environment, chemical transformation and surface catalytic redox reactions can take place. Hydration reactions will render the PPCPs hydrophilic thereby increasing the K_{ow} values which in turn will modify the sorption characteristics of PPCPs by soils. Biological activities brought by microbes such as fungal species can convert PPCPs to various intermediates and byproducts. The presence of organic maters in soil can contribute to sorption of PPCPs and increase their stay in the soil environment.

Specifically, the objectives of the research are to study: 1) the adsorption and desorption of selected PPCPs by soils and related minerals; 2) PPCPs molecular level adsorption mechanisms in the soil environment, 3) the transformation of selected PPCPs in the soil environment, 4) the potential remediation methods of PPCPs in soil, and 5) the overall transport dynamics of selected PPCPs in soils.