Special issue on thermodynamics and kinetics of emerging contaminants in the environment

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Editorial

Special issue on thermodynamics and kinetics of emerging contaminants in the environment

The prevalence of environmental issues worldwide has generated increasing public concerns since the middle of the 20th century. Because of the magnitude and complexity of environmental problems, environmental scientists and engineers have to understand the chemistry of contaminants in the environment, particularly from the fundamental aspects of the thermodynamics and kinetics underlying many important contaminant transformation or transport processes. Improved understanding of the environmental chemistry of common inorganic and organic contaminants can contribute to more reliable prediction of their fate, transport, and advancing the design of more effective treatment methods.

Recently, chemicals of emerging concerns, including halogenated flame retardants, surfactants, pharmaceuticals and personal care products, and materials carrying features at the nanometer scale, have been widely detected in the environment. Although majority of these contaminants are not subject to regulatory control at the present, their extensive use in industrial processes and consumer products have led to increasing concerns over their potential accumulation in the natural environment. Most of these emerging contaminants are of a synthetic origin and possess unique properties by design; as a result, their properties and ecological impacts may differ from those of the conventional contaminants. Assessing the environmental implications of these newly documented contaminants requires a sound understanding of the behavior of these emerging contaminants in different environmental media.

This special issue is a collection of 24 research articles and 2 reviews that deal with these timely issues. For the fate of emerging pollutants in the environment, some studies in this issue address the transformation of pharmaceuticals on mineral surface (Chen et al., in press) and in wastewater effluents (Söderström et al., in press). For perfluoroalkyl chemicals, their fate and transport behaviors were evaluated in the field (Anderson et al., in press) and their sorption in sediment was also reported (Pan et al., in press). Some hazardous chemicals could even be formed from emerging contaminants during water treatment processes (Huang et al., in press).

For nanoparticles (NPs), the effects of water chemistry on NP aggregation (Lee et al., in press), sedimentation (including floatation of NP aggregates) (Hsiung et al., in press), and transport in unsaturated soils (Kobayashi et al.) were investigated. Another two studies focused on the photodegradation of byproducts from brominated flame retardants (Altarawneh et al., in press) and the release kinetics of inorganic pollutants in soils (Rinklebe et al., in press). Finally, two reviews cover the occurrence and fate of perchlorate in the soil, water, and food (Vithanage et al., in press) and the occurrence and mitigation of antibiotic resistant genes and bacteria (Sharma et al., in press).

To further elucidate the impact of the emerging contaminants on the environment, their environmental bioavailability and toxicity have to be assessed. Several papers address the toxicological effects of silver NPs (Aspray et al. and He et al. in press), TiO_2 NPs (Huang et al., in press), and carbon nanotubes (Cañas-Carrell et al., in press) on microbial, algal, fish and plant species. Another study focuses on the effect of pharmaceutical mixture on an amphibian receptor (Melvin et al., in press).

Effective treatment technologies to remove emerging contaminants have been proposed, many drawing on insights into the environmental chemistry of these contaminants. In this special issue, several papers address the adsorption of emerging pollutants such as pharmaceuticals by graphene oxide (Gao et al., in press), clay mineral (Sturini et al., in press), and biochars (Gao et al., in press). The sequestration of NPs by metal organic frameworks (Pen-Menez et al., in press), inorganic emerging pollutants by nanocrystalline mineral (Lee et al., in press), and arsenite by a modified coagulation process (Li et al., in press) are also included in this special issue. Furthermore, the kinetics and pathways of chemical reduction of pharmaceuticals and other micropollutants by iron (Sinha et al., in press) and their oxidation by ozone/UV processes (Fang et al., in press) were investigated. The biodegradation of micropollutants in membrane processes was studied (Chiemchaisri et al., in press). Finally, the guest editors of this special issue wish to express their appreciation for the contributions by the authors, reviewers and editorial staff of Chemosphere.

Table of content (the order of papers)

Fate of emerging contaminants in the environment

1. Roxarsone desorption from the surface of goethite by competitive anions, phosphate and hydroxide ions: significance of the presence of metal ions
2. Fate of three anti-influenza drugs during ozonation of wastewater effluents - degradation and formation of transformation products
3. Occurrence of select perfluoroalkyl substances at U.S. Air Force aqueous film-forming foam release sites other than fire-training areas: field-validation of critical fate and transport properties
4. Influence of oxic/anoxic condition on sorption behavior of PFOS in sediment

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5. Effects of combined UV and chlorine treatment on chloroform formation from triclosan
6. The influence of ionic strength and organic compounds on nanoparticle TiO_2 (n-TiO_2) aggregation
7. Effects of water chemistry on the destabilization and sedimentation of commercial TiO_2 nanoparticles: Role of double-layer compression and charge neutralization
8. Transport of colloidal silica in unsaturated sand: Effect of charging properties of interfaces
9. Photodecomposition of bromophenols
10. Redox effects on release kinetics of arsenic, cadmium, cobalt, and vanadium in Wax Lake Deltaic freshwater marsh soils
11. Perchlorate as an emerging contaminant in soil, water and food

Environmental toxicology of emerging contaminants

12. Pseudomonas putida biofilm dynamics following a single pulse of silver nanoparticles
13. Uptake and effect of highly fluorescent silver nanoclusters on *Scenedesmus obliquus*
14. Adsorption characteristics of nano-TO_2 onto zebrafish embryos and its impacts on egg hatching
15. Determination of uptake, accumulation, and stress effects in corn (*Zea mays* L.) grown in single-wall carbon nanotube contaminated soil
16. Oxidative stress, energy storage, and swimming performance of *Limnodynastes peronii* tadpoles exposed to a sub-lethal pharmaceutical mixture throughout development

Treatments of emerging contaminants

17. Adsorption of silver nanoparticles from aqueous solution on copper-based metal organic frameworks (HKUST-1)
18. Removal of fluoroquinolone contaminants from environmental waters on sepiolite and its photo-induced regeneration
19. Removal of levofloxacin from aqueous solution using rice-husk and wood-chip biochars
20. Graphene oxide as filter media to remove levofloxacin and lead from aqueous solution
21. Equilibrium, kinetic and thermodynamic study of cesium adsorption onto nanocrystalline mordenite from high-salt solution
22. Enhanced arsenite removal through surface-catalyzed oxidative coagulation treatment
23. Reductive dehalogenation of endosulfan by cast iron: Kinetics, pathways and modeling
24. Oxidative degradation of *N*-nitrosopyrrolidine by the ozone/UV process: Kinetics and pathways
25. Kinetics of phenolic and phthalic acid esters biodegradation in membrane bioreactor (MBR) treating municipal landfill leachate
26. A review of the influence of treatment strategies on antibiotic resistant bacteria and antibiotic resistance genes

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