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Estrogenic steroids and their microbial and photochemical degradation in wastewater and coastal seawater

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Estrogenic steroids excreted by humans and animals enter the environment through the discharge of domestic sewage effluents and disposal of animal wastes. These compounds could affect wildlife and human health by disrupting their normal endocrine systems. Increasing research results have demonstrated the existence of hormone steroids in wastewater effluents and surface water at various levels. This research focused on how to establish GC-MS and HPLC analytical methods that can be used to detect and quantify natural hormone steroids – estrone (E1), estradiol (E2) and estriol (E3), and synthesized estrogens – ethinylestradiol (EE2) and mestranol (MeEE2) in waste and natural water and their microbial and photochemical degradation. The developed methods were applied to the water samples periodically collected from wastewater treatment plants and Acushnet River. The interested compounds were detected in several of water samples in nano- to micro-gram per liter concentration range, in which can certainly cause fish feminization and may also contribute to the observed declines in lobster population in Buzzards Bay. Microbial and photochemical degradation of E1, E2, E3, EE2 and mestradiol (MeEE2) have been also investigated in seawater as well as in waste and river waters as a comparison. The microbial degradation of synthetic steroid estrogens is extremely slow with a half-life of longer than 70 days in seawater. However, the photodegradation of these compounds are much faster with a half-life of 17 hours for EE2 and 19 hours for MeEE2. Humic and other dissolved organic substances significantly accelerate the sunlight-induced photodegradation of estrogenic steroids. Transition metal Fe(III) can further catalyze the photochemical decomposition of these steroids.

Biography

Yuegang Zuo is currently a Full Professor in Analytical and Environmental Chemistry and Director of Graduate Programs at Department of Chemistry and Biochemistry, University of Massachusetts Dartmouth. He is also a Full Professor in Marine Chemistry at the School of Marine Science and Technology, University of Massachusetts. He received his BS degree in Chemistry from Wuhan University in 1982, his MS degree in Environmental Chemistry from the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, in 1984, and his PhD in Environmental Science from Swiss Federal Institute of Technology Zurich in 1992. Most of his recent research has focused on endocrine disrupting pollutants, especially estrogenic steroids, in the environment and examined their occurrence, sources, distribution, transportation and fate in the biosphere. He has published over 70 peer-reviewed papers in prestigious international scientific journals such as Science, and Environmental Science and Technology.

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