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Enantiomer-Specific Measurements of Current-Use Pesticides in Aquatic Systems

Elin M. Ulrich[1,*], Patti L. TenBrook[2], Larry M. McMillan[3], Qianheng Wang[4] and Wenjian Lao[5]

[1]*National Exposure Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC*

[2]*Region 9, U.S. Environmental Protection Agency, San Francisco, CA*

[3]*National Caucus and Center on Black Aging, Durham, NC*

[4]*Student Contractor, US Environmental Protection Agency, Research Triangle Park, NC*

[5]*Southern California Coastal Water Research Project, Costa Mesa, CA*

**Corresponding author Elin M. Ulrich, email:* ulrich.elin@epa.gov

ABSTRACT

Some current-use pesticides are chiral and have nonsuperimposable mirror images called enantiomers that exhibit identical physical–chemical properties but can behave differently when in contact with other chiral molecules (e.g., regarding degradation and uptake). These differences can result in variations in enantiomer presence in the environment and potentially change the toxicity of pesticide residues. Several current-use chiral pesticides are applied in urban and agricultural areas, with increased potential to enter watersheds and adversely affect aquatic organisms. The present study describes a stereoselective analytical method for the current-use pesticides fipronil, *cis*-bifenthrin, *cis*-permethrin, cypermethrin, and cyfluthrin. We show use of the method by characterizing enantiomer fractions in environmental sample extracts (sediment and water), and laboratory-dosed fish and concrete extracts previously collected by California organizations. Enantiomer fractions for most environmental samples are the same as racemic standards (equal amounts of enantiomers, enantiomer fraction = 0.5) and therefore are not expected to differ in toxicity from racemic mixtures typically tested. In laboratory-derived samples, enantiomer fractions are more frequently nonracemic and favor the less toxic enantiomer; permethrin enantiomer fractions range from 0.094 to 0.391 in one type of concrete runoff and enantiomer fractions of bifenthrin in dosed fish range from0.378 to 0.499.We use enantiomer fractions as ascreening tool to understand environmental exposure and explore ways this uncommon measurement could be used to better understand toxicity and risk. *Environ Toxicol Chem 2018;37:99–106*. Published 2017 Wiley Periodicals Inc. on behalf of SETAC. This article is a US government work and, as such, is in the public domain in the United States of America.

Full Text

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