

Time-Dependent Toxicity of Fluoranthene to Freshwater Invertebrates and the Role of Biotransformation on Lethal Body Residues

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The time-dependent toxicity of fluoranthene was examined for *Hyaella azteca*, *Chironomus tentans*, and *Diporeia* spp. *C. tentans* appeared to be the most sensitive species, and *Diporeia* was the least sensitive. Incipient LC₅₀ values, the concentration at which the LC₅₀ reaches an asymptote and does not change with increasing duration of exposure, for *H. azteca* and *C. tentans* were approximately 60 and 40 $\mu\text{g}, \text{L}^{-1}$, respectively. Incipient levels were not reached for *Diporeia*; however, the 28-d LC₅₀ concentration was 95.5 $\mu\text{g}, \text{L}^{-1}$. There was a temporal relationship with respect to lethal body residues for each of the test species. For *H. azteca*, the LR₅₀, the median lethal residue at an identified exposure time required to cause 50% mortality, based on total fluoranthene equivalents (parent + metabolite compounds) decreased from 3.19 $\mu\text{mol}, \text{g}^{-1}$ at 5 d to 0.80 $\mu\text{mol}, \text{g}^{-1}$ at 28 d. For *C. tentans*, the LR₅₀ decreased from 0.43 to 0.17 $\mu\text{mol}, \text{g}^{-1}$ from 2 to 10 d. The 10-d LR₅₀ for *Diporeia*

was 9.97 $\mu\text{mol}, \text{g}^{-1}$, and the 28-d value was 3.67 $\mu\text{mol}, \text{g}^{-1}$. The toxicokinetics are not sufficient to address the temporal changes in LR₅₀ values. Thus, the data were fit to a Damage Assessment Model that also accounts for toxicodynamic processes. This analysis provides estimates of the incipient lethal residues for *H. azteca*, *C. tentans*, and *Diporeia*: 0.84, 0.21, and 3.00 $\mu\text{mol}, \text{g}^{-1}$, respectively. When comparing the relative sensitivity among species using lethal body residues, special attention should be given to ensure that comparisons are made at a common point in relation to exposure duration (i.e., time to steady state, T_{ss}). When the LR_{50(lipid)} values among the three species were compared at steady state, *C. tentans* is more sensitive than *H. azteca* and *Diporeia* spp.; however, there are no significant differences between the amphipod species. The greater sensitivity of *C. tentans* to fluoranthene as compared to the amphipods may be due, in part, to a potential toxic metabolite.

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