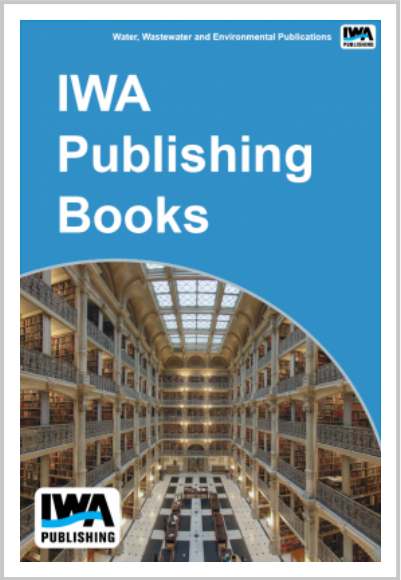
Navigating the TMDL Process: Sediment Toxicity



A key step in the development of Total Maximum Daily Load (TMDL) allocations for water bodies impaired due to sediment toxicity is the identification of chemicals responsible for toxicity. Sediment toxicity identification evaluation procedures (TIEs) are one of the primary tools used in this process.

This project evaluated standardized and recently developed sediment TIE methods to determine their utility for identifying chemicals responsible for toxicity. In this study, formulated sediments were spiked with five chemicals: copper, fluoranthene, tetrachlorobenzene, nonylphenol and ammonia. Experiments were conducted using sediments spiked with single chemicals and chemical mixtures. Toxicity tests used the estuarine amphipod Eohaustorius estuarius and the freshwater amphipod Hyalella azteca. TIEs were conducted using solid-phase (whole sediment) and sediment interstitial waters.

The results indicate that the TIE methods are sufficient to characterize and identify toxicity due to single and multiple chemicals using spiked sediments. One key finding from the spiked sediment experiments is that methods to elute chemicals from extraction media used in solid-phase and interstitial water TIEs require further refinement to ensure complete and consistent elution of sorbed chemicals. An additional finding is that both solid-phase and interstitial water TIE procedures provide useful lines of evidence and that both approaches should be used in a weight-of-evidence approach in the sediment TIE process. In the final phase, TIE procedures were evaluated using ambient samples collected from three marine sites and three freshwater sites.

Multiple solid-phase and interstitial water TIEs were conducted on each sediment and results of these were combined with chemical analyses and other lines-of-evidence to evaluate the methods. The results indicate that sediment TIE methods are sufficiently developed to characterize toxicity due to general classes of chemicals such as cationic metals, organic chemicals, and ammonia.

Methods to improve extraction and elution of metal and organic chemicals in highly toxic sediments require further refinement in order to allow identification of specific chemicals responsible for toxicity as part of the Phase II TIE process. Recommendations and refinements are suggested following the findings presented.

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