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Using High-Resolution Mass Spectrometry to Identify Organic Contaminants Linked to Urban Stormwater Mortality Syndrome in Coho Salmon

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ABSTRACT

Urban stormwater is a major threat to ecological health, causing a range of adverse, mostly sublethal effects. In western North America, urban runoff is acutely lethal to adult coho salmon (*Oncorhynchus kisutch*) that spawn each fall in freshwater creeks. Although the mortality syndrome is correlated to urbanization and attributed to road runoff contaminant(s), the causal agent(s) remain unknown. We applied high-resolution mass spectrometry to isolate a coho mortality chemical signature: a list of nontarget and identified features that co-occurred in waters lethal to coho spawners (road runoff from controlled exposures and urban receiving waters from two field observations of symptomatic coho). Hierarchical cluster analysis indicated that tire wear particle (TWP) leachates were most chemically similar to the waters with observed toxicity, relative to other vehicle-derived sources. Prominent road runoff contaminants in the signature included two groups of nitrogen-containing compounds derived from TWP, polyethylene glycols, octylphenol ethoxylates, and polypropylene glycols. A (methoxymethyl) melamine compound family, previously unreported in North America, was detected in road runoff and urban creeks at concentrations up to ~9 and ~0.3 µg/L, respectively. The results indicate TWPs are an under-appreciated contaminant source in urban watersheds and should be prioritized for fate and toxicity assessment.

Full Text:

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