

Identifying Bioaccumulative Halogenated Organic Compounds Using a Nontargeted Analytical Approach: Seabirds as Sentinels

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ABSTRACT

Persistent organic pollutants (POPs) are typically monitored via targeted mass spectrometry, which potentially identifies only a fraction of the contaminants actually present in environmental samples. With new anthropogenic compounds continuously introduced to the environment, novel and proactive approaches that provide a comprehensive alternative to targeted methods are needed in order to more completely characterize the diversity of known and unknown compounds likely to cause adverse effects. Nontargeted mass spectrometry attempts to extensively screen for compounds, providing a feasible approach for identifying contaminants that warrant future monitoring. We employed a nontargeted analytical method using comprehensive two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GC×GC/TOF-MS) to characterize halogenated organic compounds (HOCs) in California Black skimmer (*Rynchops niger*) eggs. Our study identified 111 HOCs; 84 of these compounds were regularly detected via targeted approaches, while 27 were classified as typically unmonitored or unknown. Typically unmonitored compounds of note in bird eggs included tris(4-chlorophenyl)methane (TCPM), tris(4-chlorophenyl) methanol (TCPMOH), triclosan, permethrin, heptachloro-1'-methyl-1,2'-bipyrrole (MBP), as well as four halogenated unknown compounds that could not be identified through database searching or the literature. The presence of these compounds in Black skimmer eggs suggests they are persistent, bioaccumulative, potentially biomagnifying, and maternally transferring. Our results highlight the utility and importance of employing nontargeted analytical tools to assess true contaminant burdens in organisms, as well as to demonstrate the value in using environmental sentinels to proactively identify novel contaminants.

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