

ANTHROPOGENIC AND NATURALLY OCCURRING BROMINATED COMPOUNDS



DR. JOHN. P. GIESY
DEPT. BIOMEDICAL VETERINARY SCIENCES &
TOXICOLOGY CENTRE,
UNIVERSITY OF SASKATCHEWAN, SASKATOON,
SASKATCHEWAN S7N 5B3, CANADA

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ABSTRACT: There are nearly 3200 known naturally occurring organo-halogen compounds, and more than 1600 of these contain bromine. Little is known about the sources, transformations and biological activities of many of these compounds. Anthropogenic brominated compounds, especially brominated flame retardants (BFRs), have attracted recent interest due to their large production volumes and ubiquitous occurrence in the environment. Among the brominated compounds, polybrominated diphenyl ethers (PBDEs) and polybrominated biphenyls (PBBs) are of major concern. Several recent studies have described the presence of naturally occurring organo-bromine compounds, such as methoxy-PBDEs (MeO-PBDEs), hydroxy-PBDEs (OH-PBDEs) bromo-phenols (BRPs), polybrominated dibenzo-p-dioxins (PBDDs) in the marine environment. These classes of naturally occurring compounds have in some cases been measured at concentrations greater than that of the anthropogenic brominated contaminants. Some OH-PBDEs and BRPs have been reported to be degradation products of anthropogenic organo-bromines. OH-PBDE's are of particular concern due to their greater toxicities relative to synthetic PBDEs. To clarify the relationships between anthropogenic and naturally occurring brominated compounds, environmental investigations and in vitro metabolism studies of these compounds have been conducted. The results demonstrated the metabolic production of OH-PBDEs from naturally occurring MeO-PBDEs as a previously unidentified mechanism that could be an important contributor for the occurrence of OH-PBDEs found in marine wildlife. To further assess the contribution of anthropogenic organo-brominated compounds to total bromine in samples, a mass balance of total bromine was conducted. Total bromine in samples and organic sample extracts was determined by neutron activation spectroscopy. Combined concentrations of PBDEs, MeO-PBDEs, OH-PBDEs, BRPs and PBBs accounted for 0.01-0.04% of total bromine present in the livers of tuna, albatross, and polar bears collected from marine environments worldwide. Furthermore, extractable organic bromine accounted for only 7.03-16.81% of total bromines in the samples. Ongoing studies are exploring the nature origins and toxicities of the predominant brominated compounds in these samples. These studies highlight the need to consider potential natural sources of organo-halogen compounds when assessing environmental and human health risk assessments of the marine environment.