臺灣西北部沿海底泥中溴系阻燃劑(PBDEs)及磷系阻燃劑(OPEs)之分佈研究

Occurrence of Polybrominated Diphenyl Ethers (PBDEs) and Organophosphate Esters (OPEs) in Surface Estuarine and Marine Sediments

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ABSTRACT

Marine pollution poses significant threats to coastal ecosystems, with pollutants accumulating in sediments over time. In this study, we investigated the levels of polybrominated diphenyl ethers (PBDEs) and organophosphate esters (OPEs) in surface estuarine and marine sediments from industrial areas within Taoyuan, Taiwan. These compounds are commonly used as flame retardants and additives in various industrial processes, raising concerns about their environmental fate and potential impacts. A microwave-assisted extraction method was employed to extract PBDEs and OPEs from sediment samples collected at five estuaries and different depths (5m, 15m, and 30m) from the coastal shores. The extracted samples underwent multistage adsorbent and silica solid-phase extraction for PBDEs and OPEs, respectively. Compound analysis was conducted using high-resolution gas chromatography-mass spectrometry (HRGC-HRMS) and GC with tandem MS (GC-MS/MS), respectively. Our results revealed significant contamination of marine sediments with PBDEs and OPEs. PBDE concentrations ranged from 1731 to 26902 pg/g, with BDE-209 being the predominant congener, accounting for 58.7-93.9% of the total concentrations. Meanwhile, OPE concentrations ranged from 10.45 to 46.82 ng/g, with TCPP, TEHP, and TPHP identified as the predominant compounds. The high levels of PBDEs and OPEs in sediment samples indicate widespread contamination in the study area. Furthermore, the predominance of BDE-209 suggests its extensive use in industrial processes, highlighting the need for stricter regulations and monitoring efforts. Higher concentrations of PBDEs and OPEs were observed in estuarine than in marine sediments. This discrepancy can be attributed to the concentrated discharge of pollutants from upstream sources, emphasizing the importance of source identification and pollution control measures. The findings underscore the urgent need for comprehensive monitoring and management strategies to mitigate the impact of PBDEs and OPEs on coastal ecosystems. Further research is warranted to better understand the long-term effects of these contaminants and to develop effective remediation strategies.

關鍵字：溴系阻燃劑、磷系阻燃劑、海洋污染、持久性有機污染物

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