Determination and Risk Assessment of PAHs and PCBs in Seawater and Blue Mussels from Vila-do-Conde, Portugal

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Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs) are persistent organic pollutants that significantly threaten aquatic life. PAHs are formed through incomplete combustion and are found in sources such as oil spills, vehicle emissions, and industrial discharges. PCBs are synthetic chemicals used in electrical equipment and industrial applications before being banned due to their harmful effects. Both groups exhibit hydrophobic properties, leading to their accumulation in sediments and fatty tissues of aquatic organisms. The toxicity of these compounds varies depending on their chemical structure and concentration, with some being carcinogenic, mutagenic, and endocrine-disruptors. This study evaluated fluctuation patterns of 16 priority PAHs and 7 indicator PCBs in seawater and wild mussel samples collected from four sampling sites along the Atlantic Iberian Northwest Coastline (Vila-do-Conde, Portugal). Extraction methods included solid-phase extraction (SPE) for water samples and the QuEChERS method for mussel samples, followed by gas chromatography-mass spectrometry (GC-MS) analysis. Toxicity equivalents (TEQs) and risk quotient (RQ) were calculated to measure environmental risks. Exposure daily intake (EDI), target hazard quotient (THQ) and carcinogenic risk (CR) were calculated to measure potential human health risks. Seawater samples revealed the presence of PAHs and PCBs, indicating moderate contamination in the region. The results suggest that (i) PAHs have petrogenic and pyrogenic origins and pose a low ecological risk with potential carcinogenicity and that (ii) PCBs have minimal toxic potential and sources remain uncertain. Wild mussels showed widespread contamination due to low metabolizing and high accumulation capacities. From our analysis, PAHs posed a moderate environmental risk, exceeding legal levels, but revealed considerable potential carcinogenicity, mainly due to high ingestion rates. The study calls for further monitoring and controlling POPs to protect local communities and ecosystems, as these contaminants are often found in complex mixtures, posing greater risks than the current study's findings.

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