Mutagenic Hazards of Polycyclic Aromatic Compounds in Aquatic Sediments

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Sediments are the sink for particle-sorbed contaminants in aquatic systems and can serve as a reservoir of toxic contaminants that continually threaten the health and viability of aquatic biota. This work is a comprehensive review of published studies that investigated the genotoxicity of sediments in rivers, lakes and marine habitats. The sources of mutagens in sediment are primarily anthropogenic; including inputs from chemical and allied production, pulp and paper manufacturing, defence and munitions activities, and petroleum refining. A number of bioassays have been employed for assessment of sediment genotoxicity. The Salmonella mutagenicity test is the most frequently used assay and accounts for 41.1% of the available data. The Salmonella data revealed mutagenic potency values for sediment extracts (in revertants per g dry wt) that spans over 7 orders of magnitude from undetectable to highly potent (10^5 revertants per g). Analyses of the Salmonella data (n = 510) showed significant differences between rural, urban/industrial, and heavily contaminated (e.g., dump) sites assessed using TA98 and TA100 with S9 activation. Moreover, analyses showed a significant positive correlation between Salmonella mutagenic potency (TA98 and TA100 with S9) and PAH contamination (r^2 = 0.19 to 0.68). The second and third most commonly used assays for the analysis of sediments and sediment extracts are the SOS Chromotest (9.2%) and the Mutatox® assays (7.8%), respectively. These assays are frequently used for rapid initial screening of collected samples. A variety of other in vitro endpoints employing cultured fish and mammalian cells have also been used to investigate sediment genotoxic activity. Endpoints investigated include sister chromatid exchange frequency, micronucleus frequency, chromosome aberration frequency, gene mutation at *tk* and *hprt* loci, unscheduled DNA synthesis, DNA adduct frequency, and DNA strand break frequency. More complex in vivo assays have documented a wide range of effects including neoplasms and preneoplastic lesions in fish and invertebrate exposed *ex situ*. Although costly and time consuming, these assays have provided definitive evidence linking sediment contamination and a variety of genotoxic and carcinogenic effects observed *in situ*.