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(P41) Drinking water contaminants: toxicity of halogenated polycyclic aromatic hydrocarbons

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Food may be contaminated with polycyclic aromatic hydrocarbons (PAHs) in the process of smoking or heating. These contaminants or their derivatives can also be present in drinking water when raw water contacts with discharges of untreated industrial/waste water effluents, forest fires or by solubilisation of organic material from contaminated soils. A few studies have shown that water disinfection can lead to halogenated derivatives of PAHs (HPAHs) as chlorinated and brominated derivatives, and there are evidences that these compounds may have greater mutagenicity than the parent PAHs.

In this study the cytotoxic and genotoxic effects of chlorinated/brominated derivatives of pyrene (Pyr) and benzo[a]anthracene (BaA), 1-ClPyr, 1-BrPyr and 7-ClBaA, which can be formed as water disinfection by-products, were studied in HepG2 cells to assess their potential hazard to human health.

The formation of 1-ClPyr, 1-BrPyr and 7-ClBaA under aqueous disinfection conditions in waters contaminated with Pyr and BaA, was confirmed with an optimized gas chromatography method. Cells exposed (24h) to several concentrations of BaA and 7-ClBaA (1 to 200 μ M) displayed a dose-related and significant increase of cytotoxicity (neutral red assay) with IC50 values of 3.37 and 12.63 μ M respectively. For Pyr, 1-ClPyr and 1-BrPyr (10 to 200 μ M), a lower but significant dose-related cytotoxicity was observed. At non-cytotoxic concentrations (10 and 15 μ M), 7-ClBaA was able to induce a

significantly higher level of oxidative DNA damage in HepG2 cells than its parent compound, as assessed by the FPG-modified comet assay. Under these conditions neither Pyr nor its derivatives were genotoxic.

In conclusion, the disinfection process may give rise to genotoxic HPAHs with potential impact on human health and it should be performed in raw waters with minimal content of total organic carbon. In real conditions, humans may be exposed to a mixture of these organic compounds and thus their combined toxic effects should be further evaluated.