Endocrine Disruptors in Surface and Ground Water: The Case of the APEOS and PAHS

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The occurrence and persistence of anthropogenic pollutants in the environment showing estrogenic-endocrine modulating effects in aquatic organisms is a “hot” issue of major health- and environment-related concern worldwide [1,2]. The population growth and the increasing scarcity of water in many regions of the world have led to a comprehensive reuse of treated wastewater that ultimately may cause a long-term concentration buildup of many toxic chemicals in the closed cycle of water supply and wastewater treatment and reuse [3]. Endocrine disrupting chemicals (EDCs) refer to chemicals affecting the endocrine system. The endocrinic/mutagenic potencies of the EDCs-branched chain alkylphenol ethoxylates (APEOs), polycyclic aromatic hydrocarbons (PAHs) and their metabolites are well-documented. Less so is the endocrinic ecoctoxicological/health risk potential of these persistent organic pollutants (POPs) in groundwater, rivers and their sediments and sea water. From ~5×10⁸ m³/y of sewage produced in Israel (to serve here as a case study), ~70% are reused, mainly in agriculture, following a conventional activated sludge treatment (AST). A major related question is: Does this practice conform to sustainability? We have found the APEOs concentration profiles of Israel's rivers/streams, groundwater, and Mediterranean Sea coastal water to be 12.5-74.6, 4.5-25.0 and trace-20.2 µg/L, respectively [4,5]. Of particular significance, in this context is the homologic distribution of the APEOs in the aquatic environment found in this study [Fig. 1]

![Fig. 1. The homologic distribution of APEOs in Israel surface- and groundwater](image)

In two "representative" rivers, in the central coastal region of the country, the total concentrations of the PAHs and APEOs were found to be (in the upper layers of their sediments) 1.02-1.59, 1.78-2.30, 1.48-3.12 ng and 31.27-376.23, 2.40-91.70, 62.99-63.63 µg/g, respectively [6]. The distribution of the PAHs in the co-presence of APEOs in rivers and their sediments, can be rationalized in terms of the hydrophobicity/nobinbiodegradability of the former and the hydrophilicity-CMC/nobinbiodegradability of the latter. Based on (a) the zebrafish egg production test (ZFEPT) [4] – a long-term exposure of zebrafish to actually found environmental concentrations of APEOs; and (b) the low effectiveness of POPs removal in AST, our preliminary conclusions are that (1) there is a potential ecotoxicological/health risk problem; and (2) the practice of conventional wastewater treatment plants (WWTPs)-treated water reuse is incompatible with sustainability.

References