The case of the nonionic alkylphenol ethoxylates in the Mediterranean region: Is there a problem?

U. Zoller, I. Plaut, M. Hushan

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Given the environmental imperatives, the potential ecotoxicological risk of anthropogenic chemicals and the limited economic feasibility of advanced large-scale treatment and remediation technologies, the currently emerging corrective-to-preventive paradigm shift in production, development, consumption and disposal are unavoidable. Surfactants, the dominant components in detergent formulations, constitute a particular issue of concern since they enter the aqueous and terrestrial compartments of the environment as such or as (bio-)degradation products.

In Israel about $5 \times 10^8$ m$^3$ of the annually produced sewage – containing ca 9-12 mg/l of anionic (mainly LABS) and 1-3 mg/l of nonionic (mainly APEOs) surfactants (approx. 85:15 ratio), about 27% and 45% of the total quantity is used following secondary treatment, or directly for aquifer recharge and agricultural irrigation, respectively. About 15% of the total amount is disposed into the Mediterranean Sea. Since (1) only secondary treatment is available for sewage effluents in the country; (2) APEOs are quite biodegradation-resistant due to their branched-carbon alkyl chain; and (3) about 2/3 of the nonionic surfactants used in Israel are of the “hard” APEO type, these nonionic surfactants and/or their metabolites reach surface and groundwater. The nonionic (alkylphenol ethoxylate, APEO) surfactants concentration profiles of Israel’s rivers, groundwater and coastal water of the eastern Mediterranean Sea were found to be within the range of 12.5-74.6, trace – 20.2 and 4.2-25.0 µg/L, respectively.

A preliminary determination of APEOs’ homologic distribution revealed “skewing” towards the more toxic shorter-chain ethoxylates, compared with that in commonly-used commercial products.

Consequently, (1) a total ban on the use of hard APEOs in detergent formulations should be considered; (2) appropriate sewage-treatment facilities should be constructed to effectively remove surfactants, the “hard” nonionics in particular, from domestic and industrial wastewaters; and (3) a switch to a research-based management of water resources, groundwater in particular, should be implemented.