

Between concentration and effect, exposure is the key

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Analytical chemistry is central to the study of chemical pollutants, yet the interpretation of analytical data often remains disconnected from real exposure and effect. The detection of contaminants at ultra-trace levels has reached an unprecedented degree of sensitivity, particularly through advanced mass spectrometry and non-targeted screening approaches. However, analytical performance alone does not define relevance. Concentration values are bounded by instrumental limits, target selection, and matrix effects, and they provide only a partial view of chemical risk. What ultimately determines toxicological and environmental significance is exposure: its duration, frequency, routes, and bioaccessible fraction [1,2]. Emerging pollutants such as bisphenols, PFAS, and rubber-related additives illustrate this gap between analytical detection and meaningful interpretation [1,3,4]. Transformation products, mixture effects, and cumulative low-dose exposure challenge traditional concentration-centric paradigms [1,3-5]. By integrating analytical chemistry with exposure-oriented tools - such as migration studies, passive and continuous sampling, and human biomonitoring - chemical data acquire contextual depth [1,6,7]. The exposome concept offers a unifying analytical framework to connect chemical fingerprints with realistic exposure scenarios and downstream effects. Reframing analytical results through the lens of exposure allows analytical chemistry to move from compound detection toward actionable knowledge, supporting more robust risk assessment and evidence-based environmental and regulatory decisions.

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