

Sarah Stevens (ZELLTOX): Endocrine and metabolism disrupting chemicals in plastic food packaging: Addressing the unknowns

Wednesday 7 May 2025 09:15 (15 minutes)

Authors: Sarah Stevens, Molly McPartland, Zdenka Bartosova, Johannes Völker, Martin Wagner

Abstract:

Plastics are chemically highly complex materials with more than 16 000 chemicals likely used or present in plastics. Of these, more than one quarter is known to be hazardous, while more than 10 000 lack basic data on identity, functionality, and toxicity. In addition, plastics contain impurities, reaction byproducts, or degradation products in even greater numbers, further contributing to the knowledge gap regarding the composition of finished plastic articles. Therefore, this study aimed to characterize the endocrine and metabolic disrupting activity of the chemical mixtures leaching from plastic food contact articles (FCAs) and to identify drivers of toxicity. FCAs made of seven commodity polymers were purchased from five high plastic-waste countries. Chemicals were extracted with methanol and migrated into food simulants according to EU regulation. Reporter gene assays for four nuclear receptors relevant to human health were used for screening the leachates. Liquid chromatography high-resolution mass spectrometry was used in the nontarget analysis. Effect-directed analysis (EDA) was conducted to identify toxicity-driving chemicals. Most FCAs leached chemicals that activate receptors of the metabolic and endocrine system with the pregnane x receptor as the predominant target of leaching chemicals. While chemicals leaching from FCAs made of all polymers interfered with at least one receptor, PPAR γ and estrogenic activity were associated with specific polymers. The chemical fingerprints of the FCAs were diverse, with 8 to 10 631 chemical features detected in a single product. Twenty-four percent of the extractable chemicals features also leached into both food simulants, making human exposure to these more likely. Using EDA, we confirmed 2-ethylhexyl paraben as responsible for the estrogenic activity in a PVC migrate. The migration of endocrine and metabolic disrupting chemicals into food simulants indicates potential for human exposure and challenges the safety of current FCAs.

Session Classification: Session I: Environmental Chemistry, Chair: tbd