Safety issues for recycled PET and beyond:

Abstract

The rapid adoption of recycled materials-from plastics to cellulosic substances-has outpaced policymakers' and industry leaders' consideration of potential consequences. This presentation tackles the critical issue of quantifying and managing the inherent risks of unknown chemicals in recycled materials. We examine the challenges of ensuring the safety of recycled materials, such as recycled polyethylene terephthalate (rPET), in applications demanding the same level of safety as virgin materials, including food-contact packaging without functional barriers and hot-fill processes.

Addressing the unknown necessitates innovative methodologies; we employ information theory as a transformative lens. This approach extends thermodynamics principles, allowing us to harness analytical chemistry and spectroscopic data into a 'chemical genetic code.' This encodes the observable chemical information-regardless of its immediate interpretability-and enables the quantification of information entropy, an extensive property adhering to algebraic operations. This facilitates the isolation, tracking, and comparison of unique contamination fingerprints.

We will showcase several examples where over 150 streams from four continents have been encoded and evaluated against virgin polymers, using Euclidean distance as a measure of purity. This novel metric translates into a quantifiable number of chemicals, offering insights into the mutual contamination across materials, packaging components, and the food supply chain and the efficacy of contamination removal during recycling. These findings lay the groundwork for a collaborative research project to fortify the recycling loop and safeguard the journey from waste to future packaging.

Keywords: food packaging, recycling, risk assessment, fingerprint, information theory, decision theory, analytical chemistry, spectroscopy