



Risk Assessment of Food Additives and Packaging



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Introduction^{1,2,3,4}

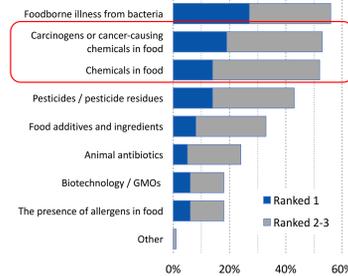
- Consumers are more concerned about chemicals in food than how a food is packaged
- Migration of chemicals from packaging can influence the chemical constituents of a food
- The public amplifies the risks associated with unfamiliar or synthetic substances and technologies
- Effective communication is a key component of helping the public understand risk

Consumer Perceptions^{1,5}

- 'Natural' ingredients are preferred over 'synthetic'
- Healthy foods have fewer ingredients
- Ingredients should be recognizable and familiar



Most Important Food Safety Issues Today



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Communicating Hazards and Risks⁷

Hazard-based Approaches to Food Safety

Advantages

- Management of highly toxic substances
- Easier to regulate and explain

Disadvantages

- Overuse of precautionary statements
- Regrettable substitutions
- Little regard for practicality

Risk-based Approaches to Food Safety

Advantages

- Risk-benefit assessment considered
- Allows for quantification and prioritization of risk
- Potential for reduction of food waste

Disadvantages

- Takes more time and data
- Inherent uncertainties in the risk assessment process



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Path Forward⁴

Use principles of good food safety risk communication

- Openness
- Transparency
- Timeliness
- Responsiveness

Hazard X Exposure = Risk

Foods are chemicals

Detection of the presence of a chemical does not equate to risk

Your resources for ingredient and packaging safety:

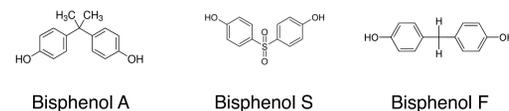
Center for Research on Ingredient Safety

- Established in 2014 to serve as a reliable and unbiased source for information on the safe use of chemical ingredients in food and consumer products

MSU School of Packaging

- 60 years of teaching, research, and outreach focused on packaging containers, materials, their functionality and improvement

Case Study: BPA^{8,9,10,11}



- Used in the production of polycarbonate plastics and epoxy resins
- Approved for use as a food contact substance
- Public concern: endocrine disruption properties
- Banned from plastic baby bottles, sippy cups, and infant formula packaging by the FDA
 - Due to market abandonment, not safety
- Metabolism and environmental fate of BPA substitutes not as well studied
 - PubMed search: >10,000 studies for BPA vs. <150 for BPS

Safe exposure level:

NOAEL (No Observed Adverse Effect Level) = 5000 ug/kg/d
NOAEL for average 70 kg adult = 350,000 ug/d

Typical exposure level:

Estimated Daily Intake (EDI) = 0.5 ug/kg/d
EDI for average 70 kg adult = 35 ug/d

Exposure level for risk of toxicity:

Level BPA found in canned green beans = 18 ppb or 18 ug/L
64 cans daily for average 70 kg adult to be vulnerable to toxicity

Lost safety messages:

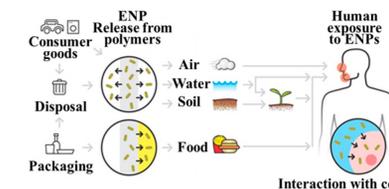
- Increased can integrity / decreased foodborne illness risk
- Prevents migration of can metal into the food
- Not unsafe when used as intended

Case Study: Nanoparticles^{12,13}

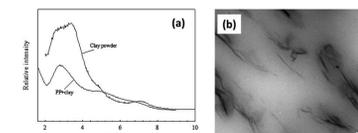
- Engineered particles with at least one dimension in 1-100 nm range
- Nanoclays are used to enhance barrier properties of plastic packaging
 - Clay is GRAS (Generally Recognized As Safe)
 - Nanoparticles have different behavior than larger particles, so may pose different hazards
 - Assumed to not migrate from packaging materials to food
 - Evidence for limited transfer from near-surface area to contacting phase
 - Surfactants used to modify clay to improve performance, migrate significantly more than clay itself
- Nanosilver is used as antimicrobial agent
 - Enhances food safety by preventing growth of toxic organisms
 - Questions about amount released to environment, potential contribution to antibiotic resistance, etc.



Image credit: NEIHS^d

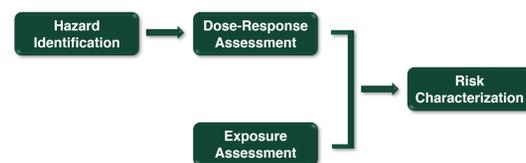


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PP-clay nanocomposite characterization. (a) X-ray diffraction patterns for nanoclay and nanocomposite. (b) Transmission electron micrograph of nanocomposite showing intercalated and exfoliated structures.

The 4 Step Risk Assessment Process⁶



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