Chemical risk assessment of food contact materials in Europe

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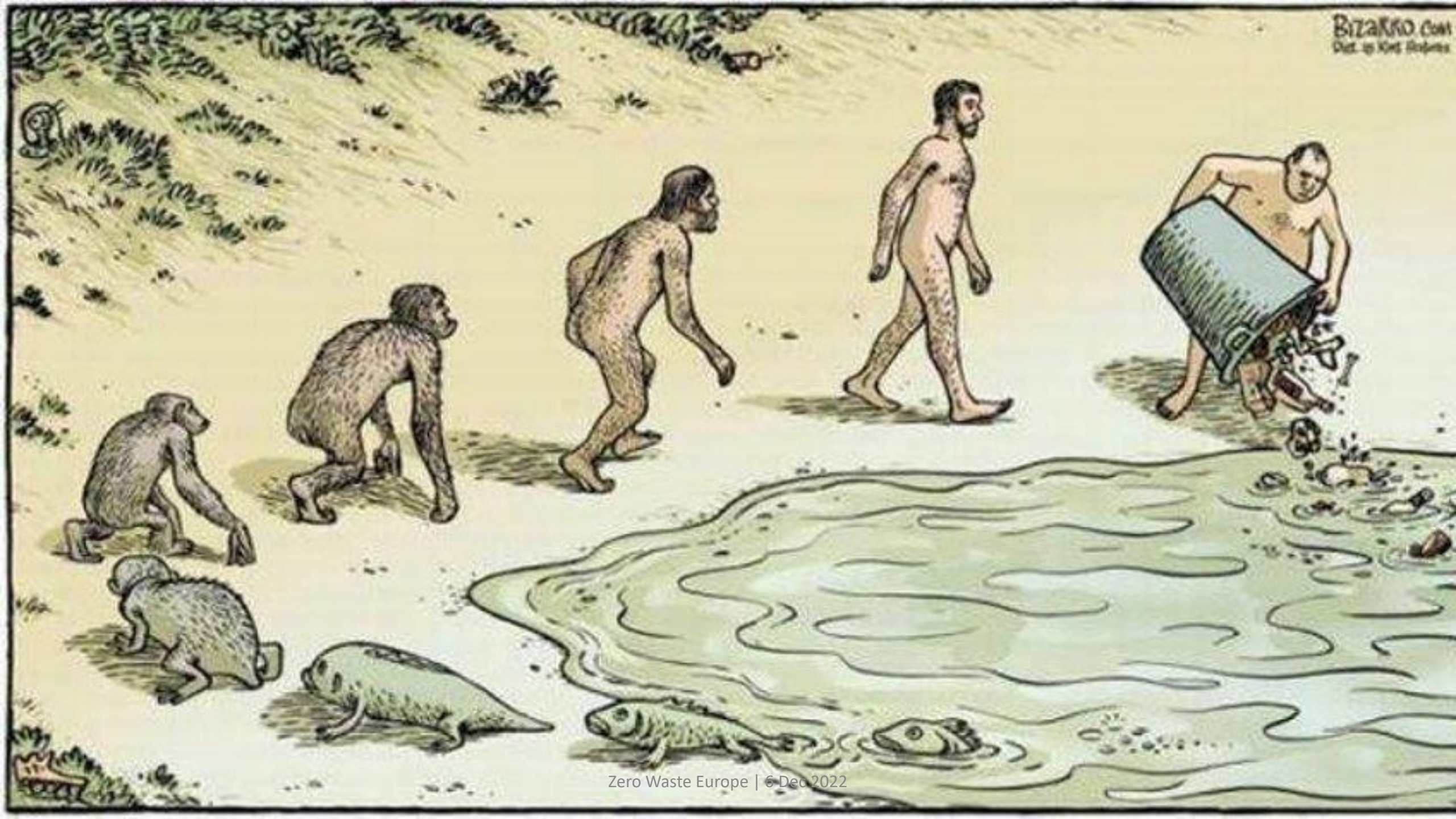
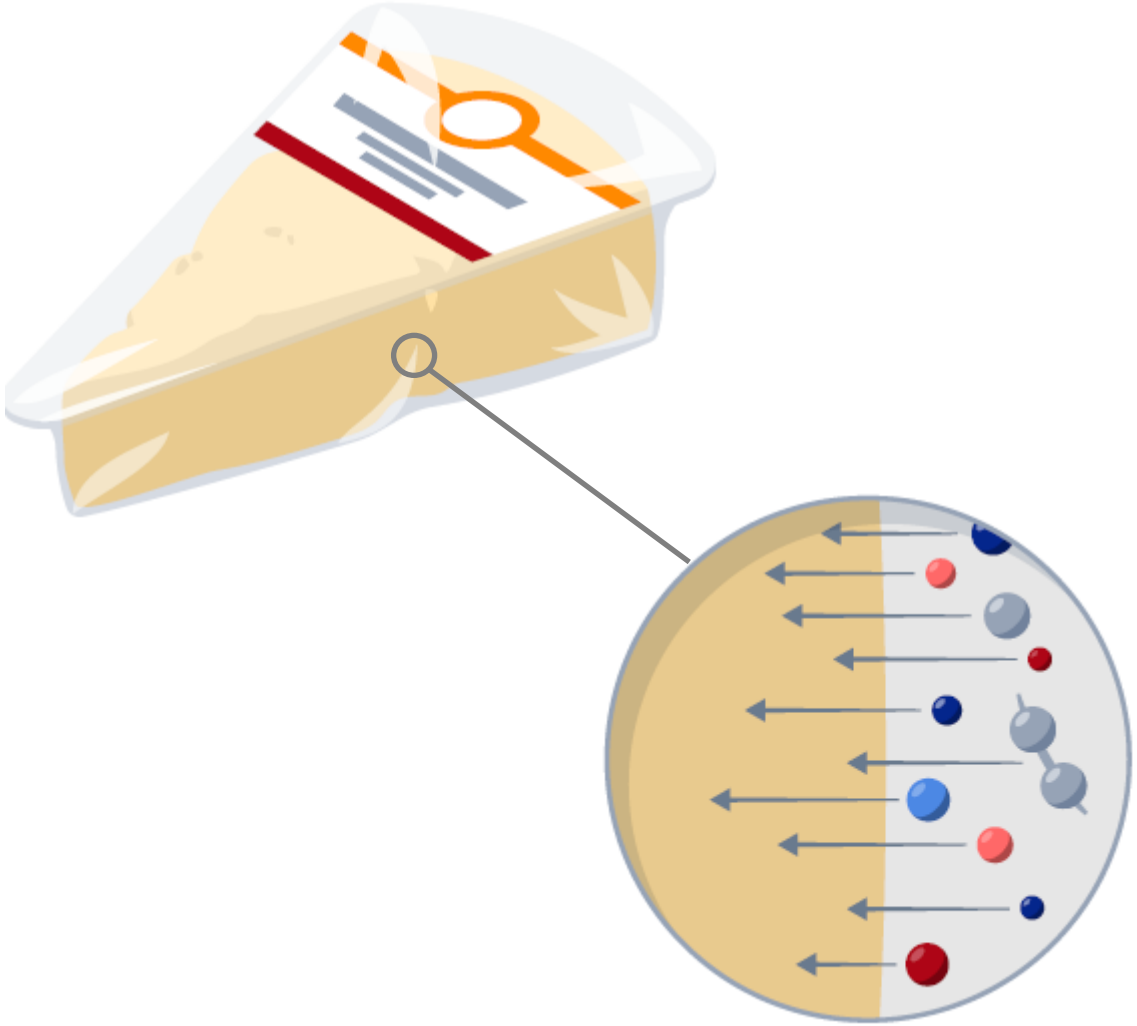

BIZARRO

Circular Economy

Waste hierarchy

https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en

chemical migration



WHAT INFLUENCES MIGRATION OF CHEMICALS INTO FOOD?

...at high temperature

higher migration

...after long contact times

...when using small portion sizes

...of fat-soluble chemicals into fatty foods

Find out more: bit.ly/fpf-factsheet

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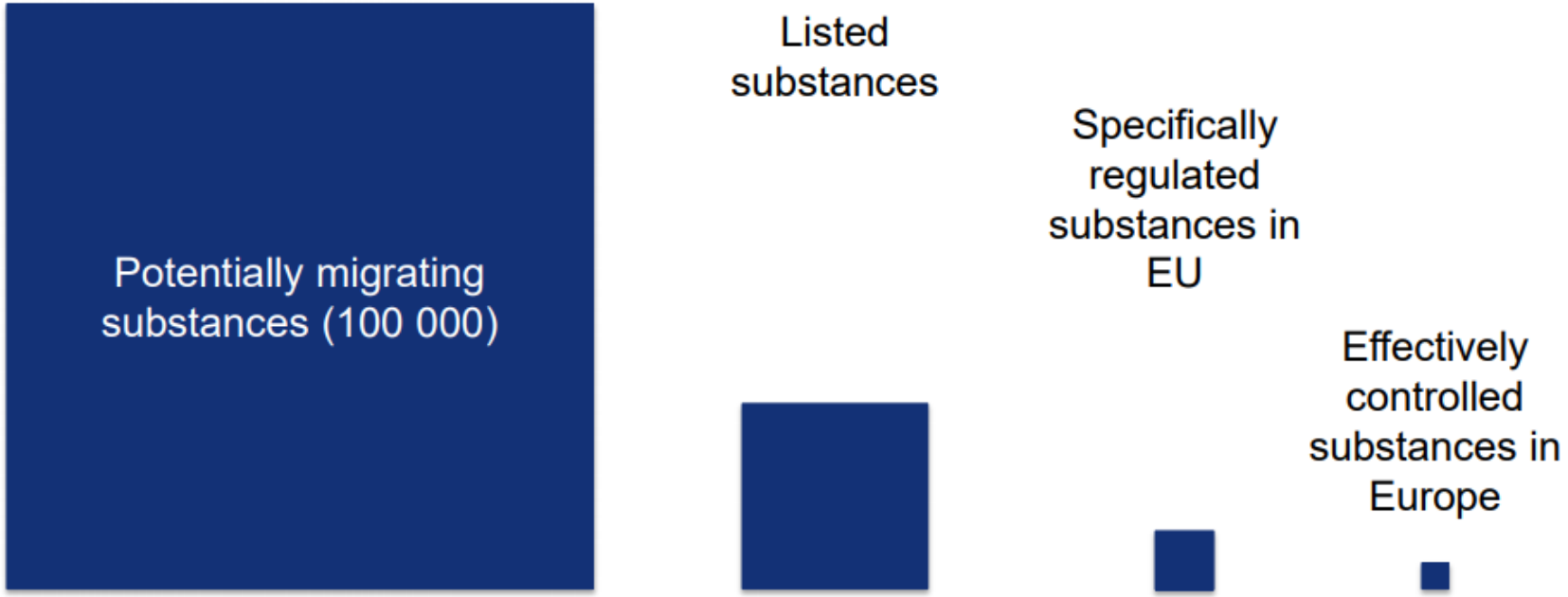
What *chemicals* are in food contact materials?

What *chemicals migrate*?

Migration of Food Contact Chemicals: *potential vs known*

(slide modified, original by Dr. Gregor McCombie)

Non-intentionally added substances (NIAS)



Source & more: https://food.ec.europa.eu/system/files/2018-09/cs_fcm_eval-workshop_20180924_pres07.pdf
Grob et al. 2006 https://www.ncbi.nlm.nih.gov/pubmed/16954061

What are *the types* of chemicals in food contact materials?

INTENTIONALLY ADDED SUBSTANCES:

- Monomers
- Catalysts and production aids
- Additives
- Pigments

NON-INTENTIONALLY ADDED SUBSTANCES (NIAS):

- Reaction by-products
- Impurities
- Degradation products
- Oligomers
- Contaminants

→ food contact chemicals (FCCs)

What *chemicals migrate*?

Journal of Hazardous Materials 430 (2022) 128410

Contents lists available at ScienceDirect

Journal of Hazardous Materials

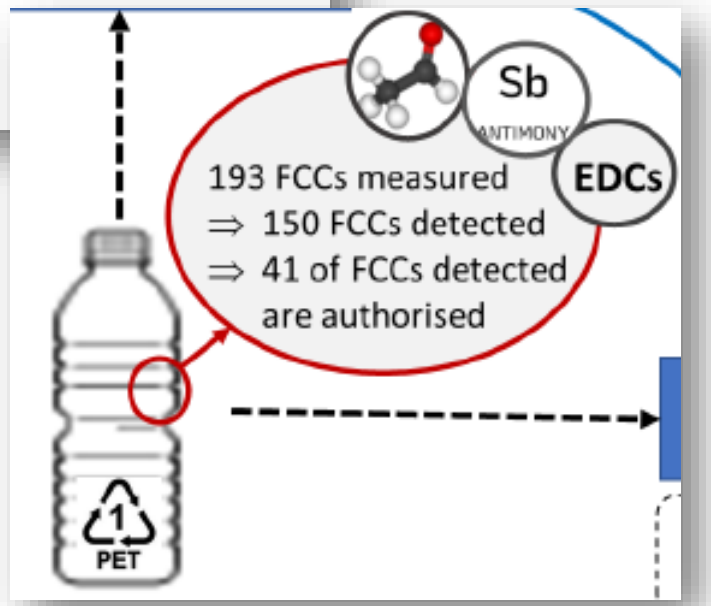
journal homepage: www.elsevier.com/locate/jhazmat

Review

Unpacking the complexity of the PET drink bottles value chain: A chemicals perspective

Spyridoula Gerassimidou [a], Paulina Lanska [a], John N. Hahladakis [b], Elena Lovat [c], Silvia Vanzetto [d], Birgit Geueke [e], Ksenia J. Groh [f], Jane Muncke [e], Maricel Maffini [g], Olwenn V. Martin [a,h,*], Eleni Iacovidou [a,i,*]

FCC: food contact chemical



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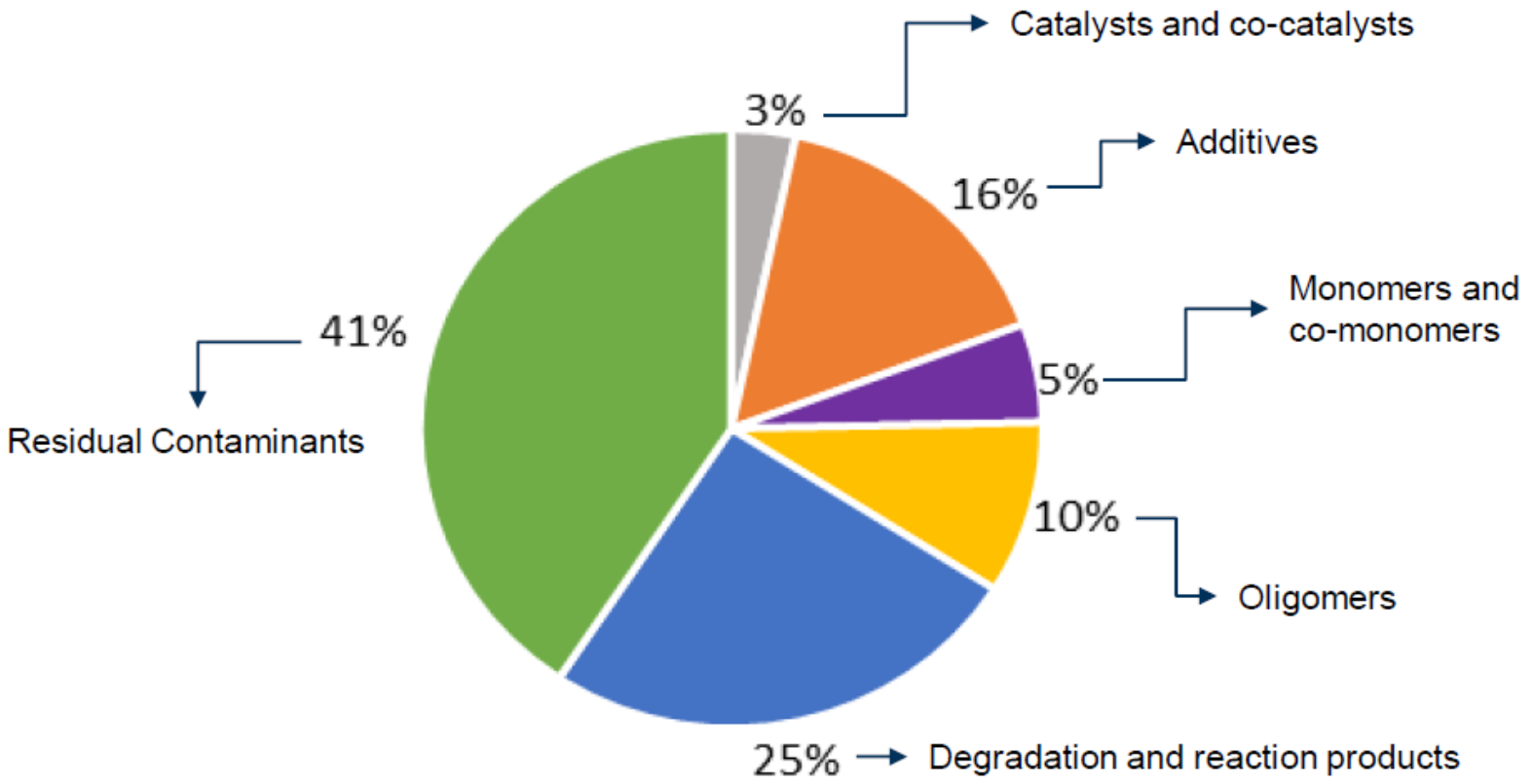
Proportional distribution of specific types of FCCs to the total number of FCCs that have been detected to migrate from PET drink bottles into food simulant/food samples.



Brunel University London

Gerassimidou S. et al. 2022 J Haz Mat.

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Environment International 167 (2022) 107387

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Full length article

Evaluating the food safety and risk assessment evidence-base of polyethylene terephthalate oligomers: Protocol for a systematic evidence map

Verena N. Schreier [a,b,*], Christian Appenzeller-Herzog [c], Beat J. Brüschweiler [d], Birgit Geueke [e], Martin F. Wilks [a,b], Thomas J. Simat [f], Benoit Schilter [g], Martin Smieško [a,b], Jane Muncke [e], Alex Odermatt [a,b], Nicolas Roth [a,b]

[a] Department of Pharmaceutical Sciences, University of Basel, Basel, Switzerland
[b] Swiss Centre for Applied Human Toxicology (SCAHT), University of Basel, Basel, Switzerland
[c] University Medical Library, University of Basel, Basel, Switzerland
[d] Federal Food Safety and Veterinary Office (FSVO), Risk Assessment Division, Bern, Switzerland
[e] Food Packaging Forum Foundation, Zurich, Switzerland
[f] Chair of Food Contact Materials, Dresden University of Technology, Dresden, Germany
[g] Nestlé Institute of Food Safety and Analytical Sciences, Lausanne, Switzerland

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How is *safety* defined for food packaging?

Legal definition of *Food Contact Material* **safety** in the European Union

Regulation (EC) No 1935/2004, Art. 3.1.(a)

”Materials and articles, […], shall be manufactured […] so that, under normal or foreseeable conditions of use, they **do not transfer their constituents** to food in **quantities** which could endanger human health”

low levels = safe levels

How is the ***risk*** of a chemical to “endanger human health” assessed?

Risk = hazard · exposure

[CANCER RESEARCH 36, 2973-2979, September 1976]

Fundamental Carcinogenic Processes and Their Implications for Low Dose Risk Assessment

K. S. Crump,[1] D. G. Hoel,[2] C. H. Langley, and R. Peto

National Institute of Environmental Health Sciences, National Institutes of Health, Research Triangle Park, North Carolina 27709 [K. S. C., D. G. H., C. H. L.], and University of Oxford, Oxford, England [R. P.]

Summary

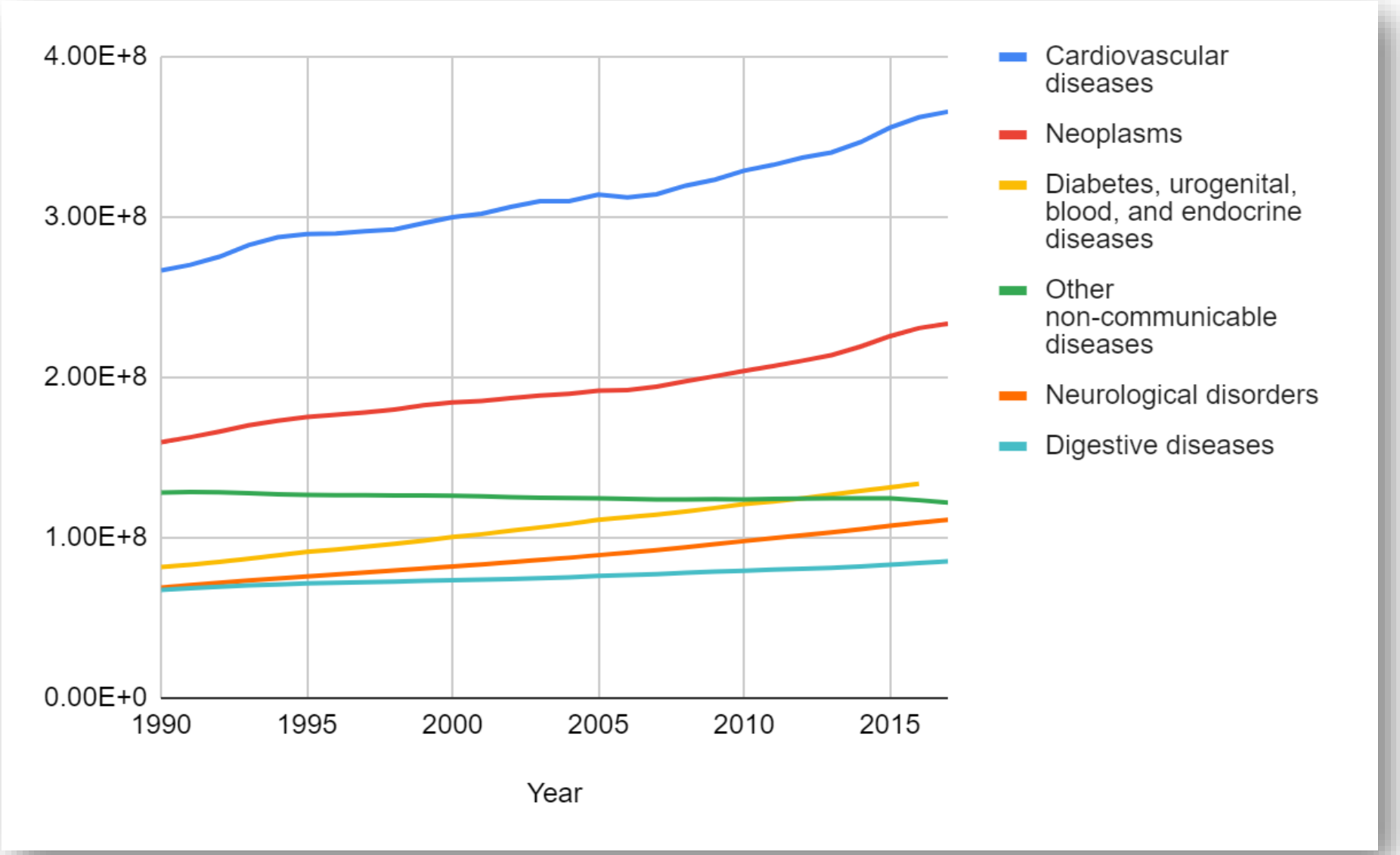
Various possible models of carcinogenesis are analyzed with respect to low dose kinetics. The importance of background carcinogenesis upon the shape of the dose-response curve at low dose is emphasized. It is shown that, if carcinogenesis by an external agent acts additively with any already ongoing process, then under almost any model the response will be linear at low dose. Measures of the degree of linearity are obtained for multistage models of carcinogenesis, where it is shown that throughout the dose range where the extra risk is less than the spontaneous risk linear extrapolation must be quite accurate.

1. Cancers are believed to be single cell in origin (6, 7). Of a large number of cells at risk in the individual organism, 1 undergoes certain changes that allow it to divide and grow into a tumor. Thus we can view the carcinogenic process as mechanistically single cell in origin even though, by the time a cancer is pathologically recognizable, very extensive changes may have developed.

2. It will be shown that it is important to know whether the causal processes associated with the particular carcinogen of interest are common to those involved in carcinogenesis due to other causes, either "spontaneous" or from other carcinogens. In other words, we need to know whether or not carcinogenesis due to a particular carcinogen is inde-

Chronic Diseases are increasing globally

Some diseases are associated with chemical exposures



Disability-Adjusted Life Years (DALYs) of worldwide selected non-communicable diseases in both sexes and all age groups, 1990 - 2017 (Diabetes, urogenital, blood, and endocrine diseases: data 1990-2016). Data: Global Burden of Disease 2021.

The Commission will:

- extend the generic approach to risk management to ensure that consumer products – including, among other things, food contact materials, toys, childcare articles, cosmetics, detergents, furniture and textiles - do not contain chemicals that cause cancers, gene mutations, affect the reproductive or the endocrine system, or are persistent and bioaccumulative. In

Food packaging plays a key role in the sustainability of food systems. The Commission will revise the food contact materials legislation to improve food safety and public health (in particular in reducing the use of hazardous chemicals), support the use

low levels ≠ safe levels

Contents lists available at ScienceDirect

Journal of Hazardous Materials

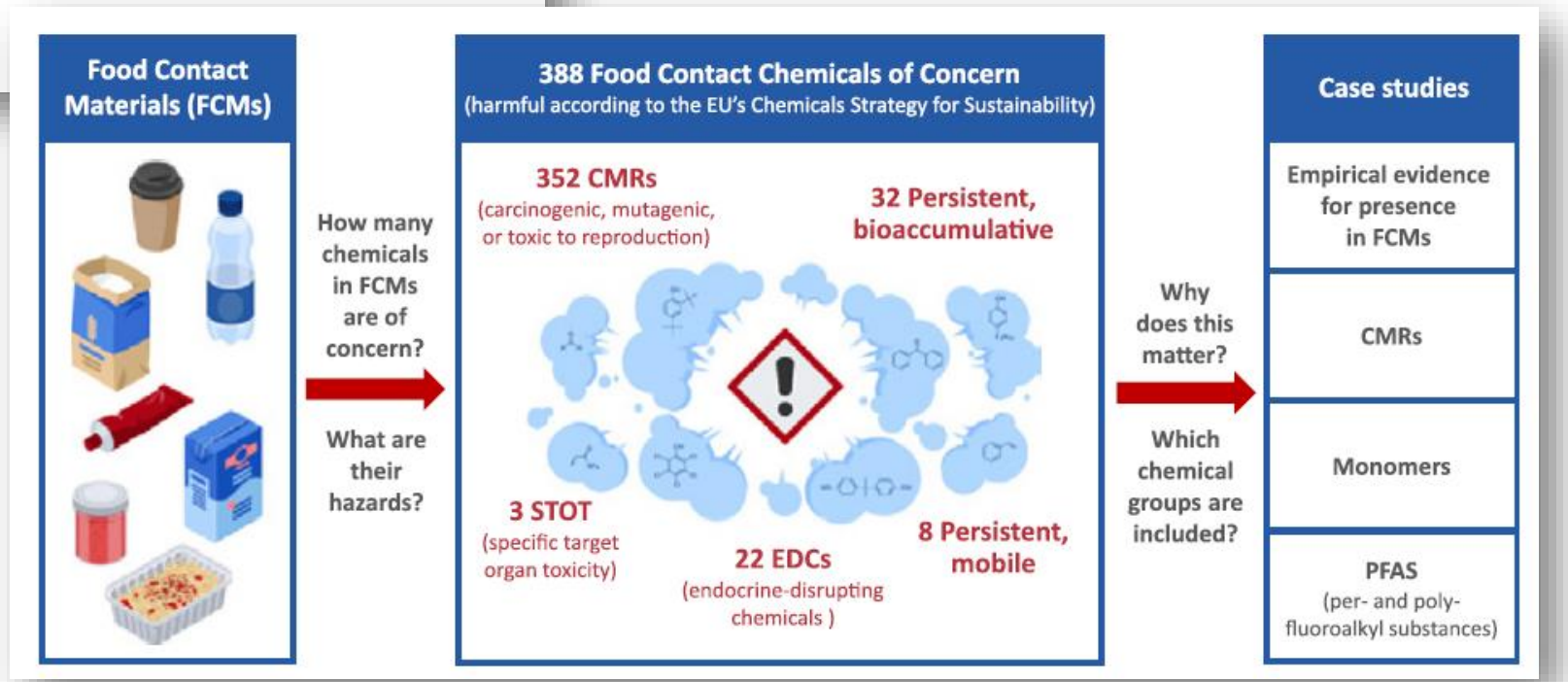
journal homepage: www.elsevier.com/locate/jhazmat

Research Paper

Implementing the EU Chemicals Strategy for Sustainability: The case of food contact chemicals of concern

Lisa Zimmermann [a,*], Martin Scheringer [b], Birgit Geueke [a], Justin M. Boucher [a], Lindsey V. Parkinson [a], Ksenia J. Groh [c], Jane Muncke [a]

[a] Food Packaging Forum Foundation, 8045 Zürich, Switzerland
[b] Department of Environmental Systems Science, ETH Zürich, 8092 Zürich, Switzerland
[c] Eawag, Swiss Federal Institute of Aquatic Science and Technology, 8600 Dübendorf, Switzerland



Food contact materials (FCMs)

How many chemicals in FCMs are of concern?

What are their hazards?

388 Food Contact Chemicals of Concern

(harmful according to the Chemicals Strategy for Sustainability)

352 CMRs

32 Persistent, bioaccumulative

3 STOT

22 EDCs

8 Persistent, mobile

Why does this matter?

Which chemical groups are included?

Case Studies

- Empirical evidence for presence in FCMs
- CMRs
- Monomers
- PFAS

Zimmermann et al. 2022

Environmental Science & Technology

pubs.acs.org/est

Article

Plastic Products Leach Chemicals That Induce *In Vitro* Toxicity under Realistic Use Conditions

Lisa Zimmermann, Zdenka Bartosova, Katharina Braun, Jörg Oehlmann, Carolin Völker,[‖] and Martin Wagner*[,‖]

Cite This: https://doi.org/10.1021/acs.est.1c01103

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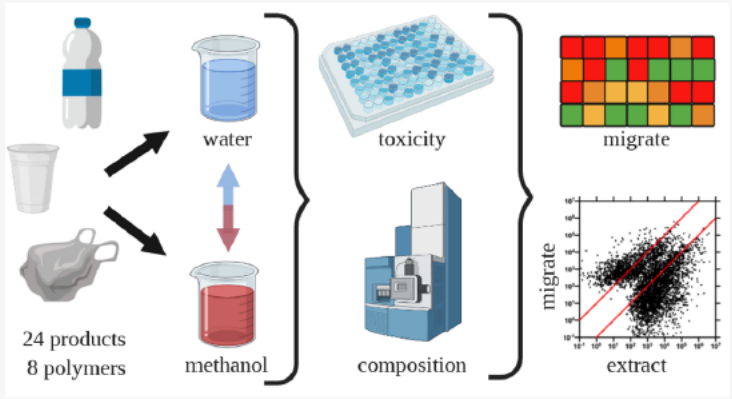
ABSTRACT: Plastic products contain complex mixtures of extractable chemicals that can be toxic. However, humans and wildlife will only be exposed to plastic chemicals that are released under realistic conditions. Thus, we investigated the toxicological and chemical profiles leaching into water from 24 everyday plastic products covering eight polymer types. We performed migration experiments over 10 days at 40 °C and analyzed the migrates using four *in vitro* bioassays and nontarget high-resolution mass spectrometry (UPLC-QTOF-MS^{E}). All migrates induced baseline toxicity, 22 an oxidative stress response, 13 antiandrogenicity, and one estrogenicity. Overall, between 17 and 8681 relevant chemical features were present in the migrates. In other words, between 1 and 88% of the plastic chemicals associated with one product were migrating. Further, we tentatively identified ~8% of all detected features implying that most plastic chemicals remain unknown.



- Food contact materials contain MANY different chemicals: some are intentionally used, others are non-intentionally added substances, or NIAS.
- Most NIAS are unknown – and for unknown chemicals, their risk cannot be assessed.
- Chemicals migrate from food contact articles as complex mixtures, but their health risk is currently assessed on a substance-by-substance basis.

low levels ≠ safe levels

Muncke et al. Environmental Health (2020) 19:25
https://doi.org/10.1186/s12940-020-0572-5

Environmental Health

COMMENTARY Open Access

Impacts of food contact chemicals on human health: a consensus statement

Jane Muncke[1*], Anna-Maria Andersson[2], Thomas Backhaus[3], Justin M. Boucher[4], Bethanie Carney Almroth[3], Arturo Castillo Castillo[5], Jonathan Chevrier[6], Barbara A. Demeneix[7], Jorge A. Emmanuel[8], Jean-Baptiste Fini[7], David Gee[9], Birgit Geueke[1], Ksenia Groh[1], Jerrold J. Heindel[10], Jane Houlihan[11], Christopher D. Kassotis[12], Carol F. Kwiatkowski[13], Lisa Y. Lefferts[14], Maricel V. Maffini[15], Olwenn V. Martin[16], John Peterson Myers[17,18], Angel Nadal[19], Cristina Nerin[20], Katherine E. Pelch[13], Seth Rojello Fernández[21], Robert M. Sargis[22], Ana M. Soto[23], Leonardo Trasande[24], Laura N. Vandenberg[25], Martin Wagner[26], Changqing Wu[27], R. Thomas Zoeller[28] and Martin Scheringer[4,29]

https://ehjournal.biomedcentral.com/articles/10.1186/s12940-020-0572-5

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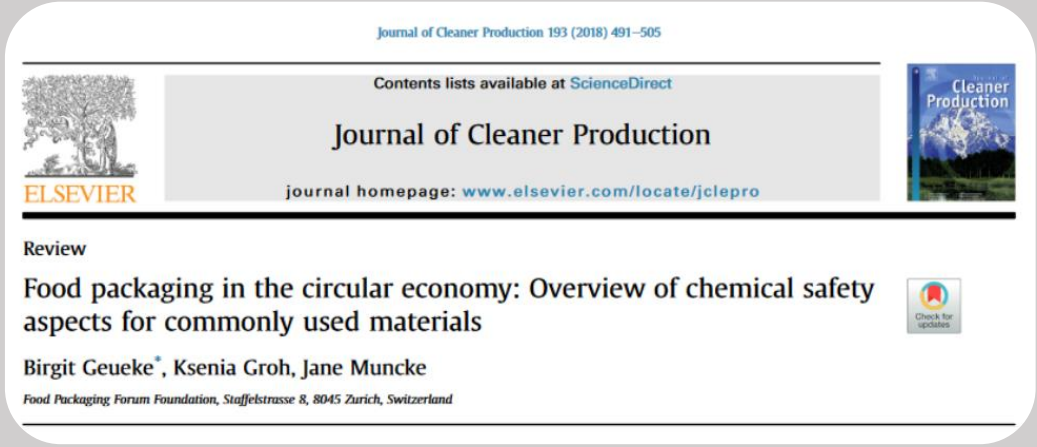
Find out more!
Properties of *food packaging materials*

Fact sheets on 5 food packaging materials



Peer-reviewed article on food packaging in the circular economy

https://www.foodpackagingforum.org/resources/publications/peer-reviewed-papers
https://www.foodpackagingforum.org/packaging-fact-sheets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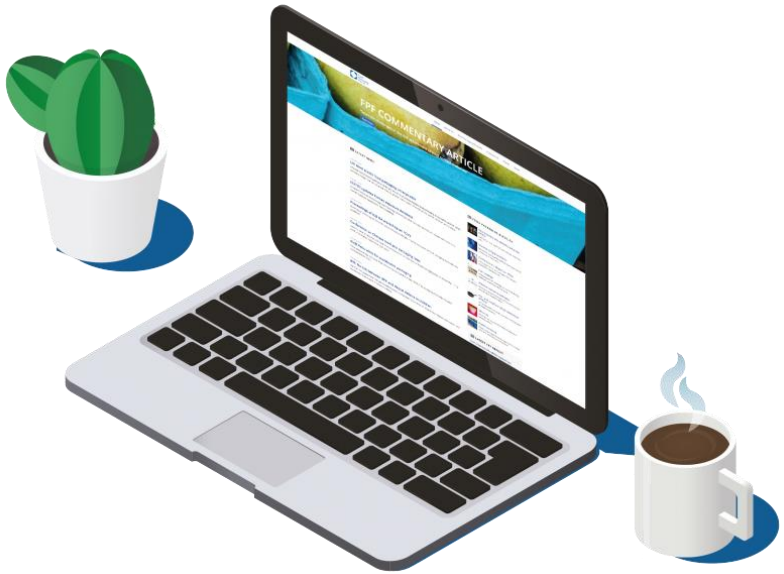

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www.foodpackagingforum.org

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