Recent analysis on the toxicities of bioplastics and plant-based materials

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Bioplastics

Previous publication on conventional plastics

- Everyday plastics contain toxic chemical mixtures

ENVIRONMENTAL Science & Technology

Article

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Benchmarking the in Vitro Toxicity and Chemical Composition of Plastic Consumer Products

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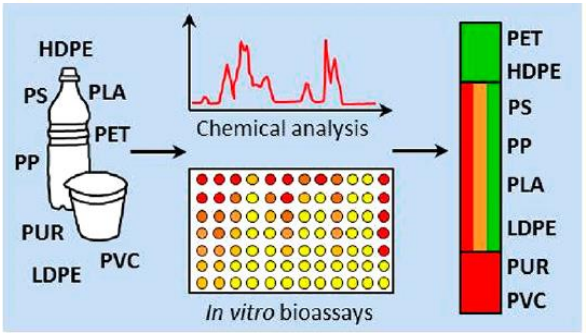

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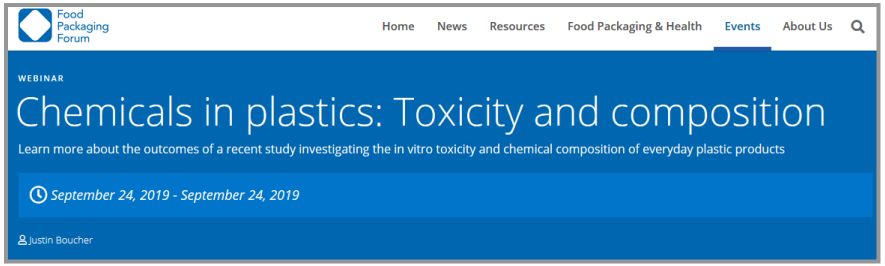

Research question

- What is the chemical composition and toxicity of bioplastics and plant-based materials?

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Are bioplastics and plant-based materials safer than conventional plastics? *In vitro* toxicity and chemical composition

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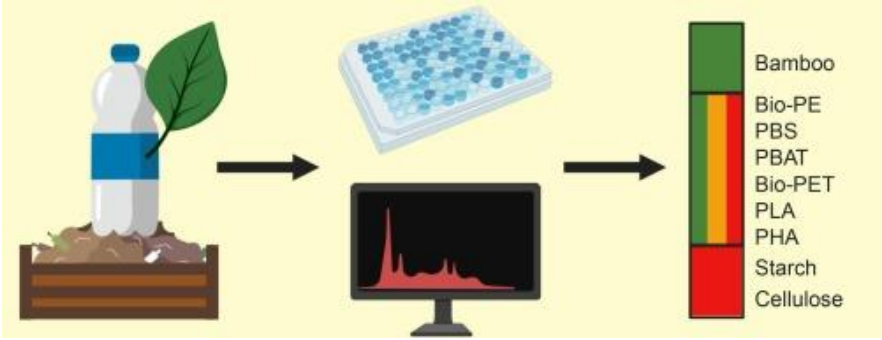


DOI: 10.1016/j.envint.2020.106066

Defining „bioplastics“

Bio-based

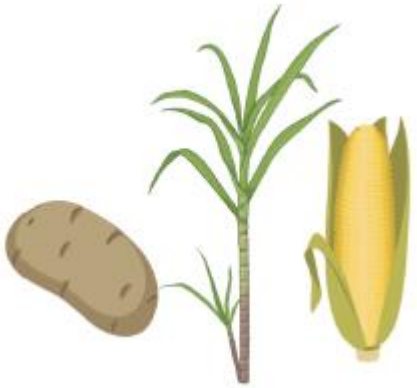
Bio-PE
Bio-PET

Biodegradable

PBS
PBAT

Bio-based & biodegradable

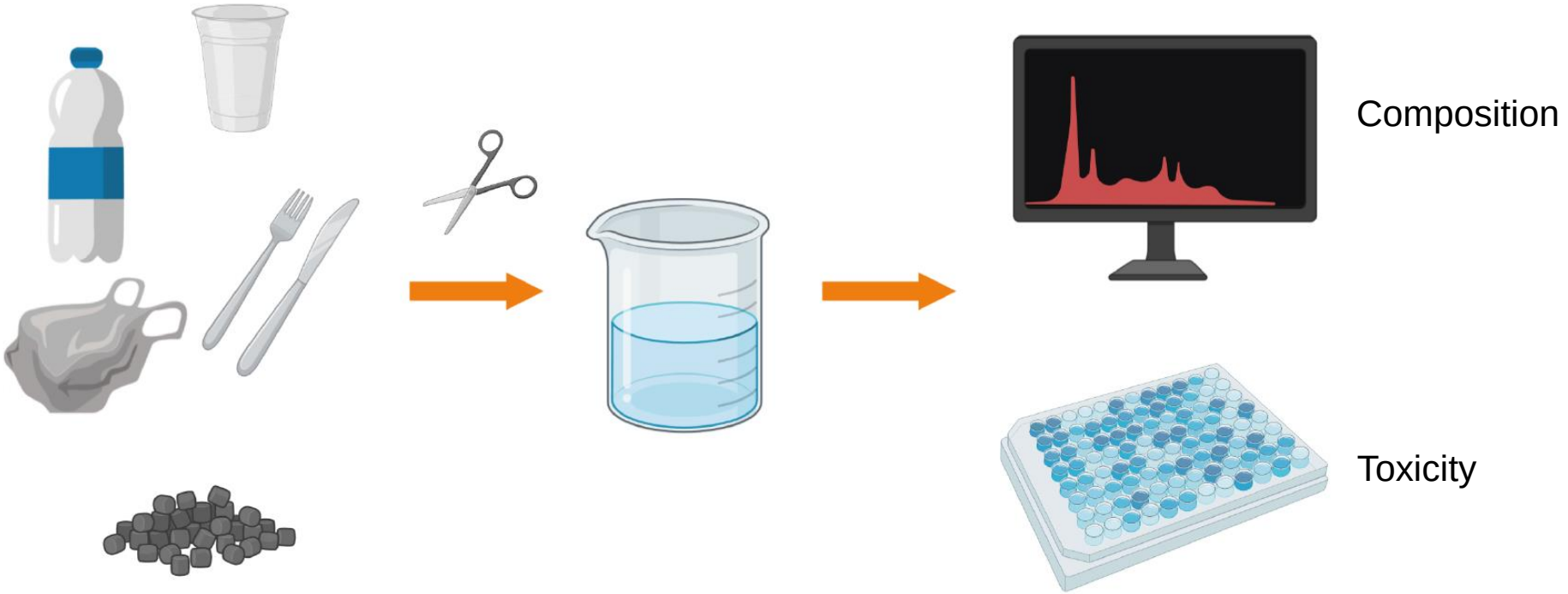
PLA
PHA



Plant-based blends

Cellulose
Starch
Bamboo

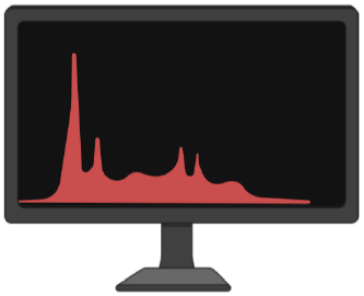
Study design

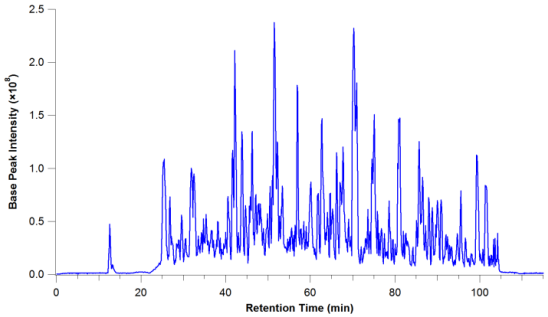


43 products

Chemical composition

- Bioplastics and plant-based materials contain a large number and variety of chemicals





80% > 1,000 chemicals

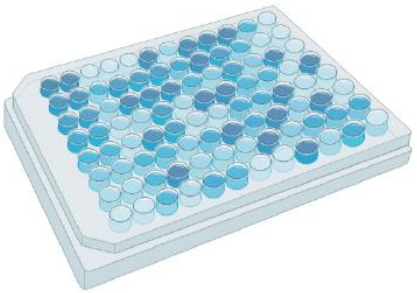
Challenge for risk assessment

Monomers Oligomers	Additives
Lubricants	NIAS

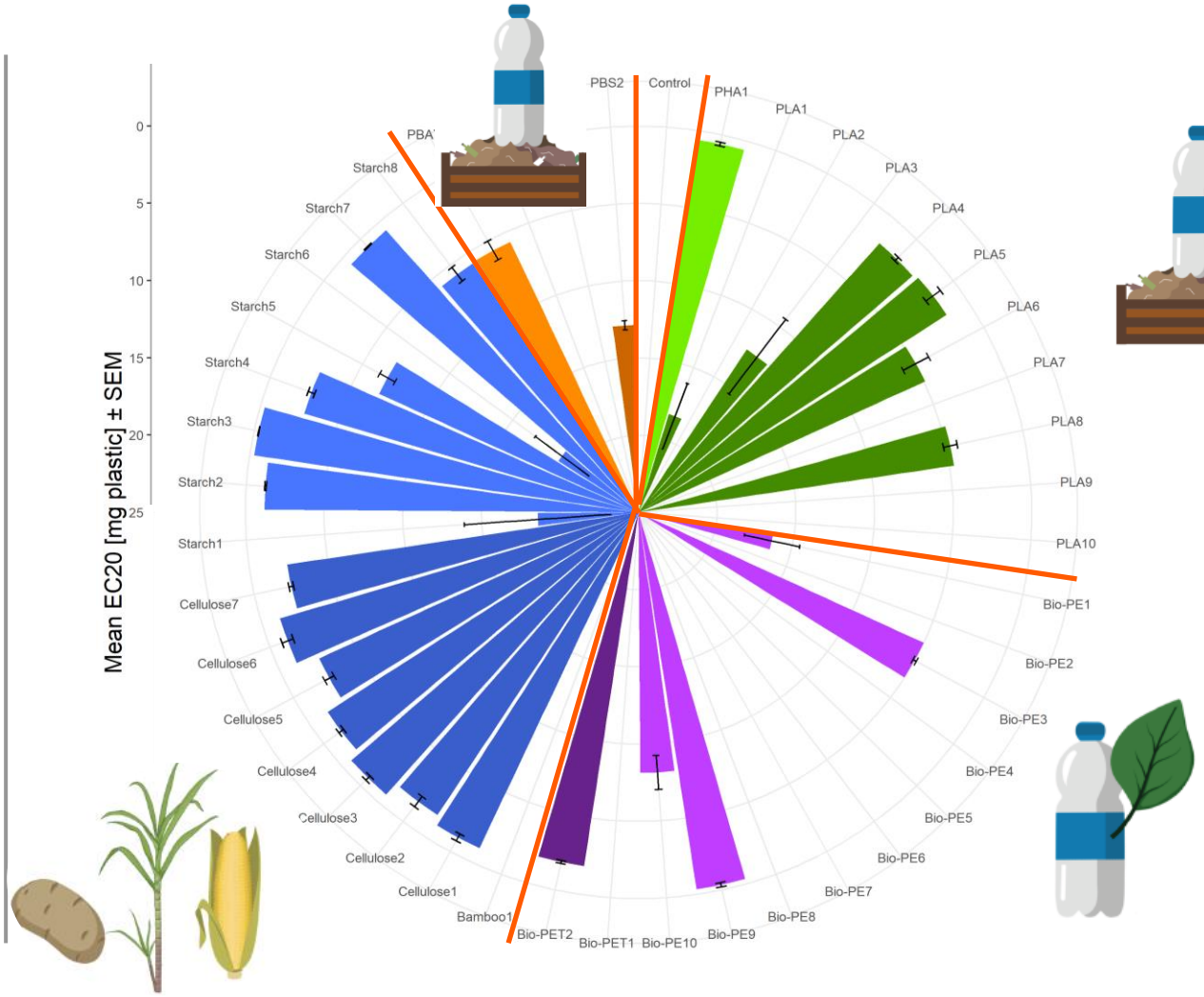
Identified compounds

Toxicity

- With 67% of the samples, the majority contained chemicals toxic *in vitro*

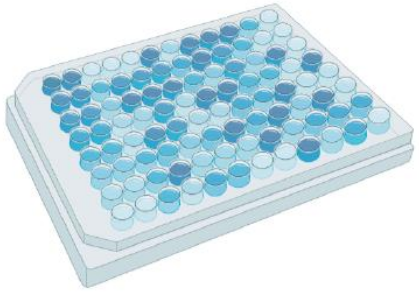


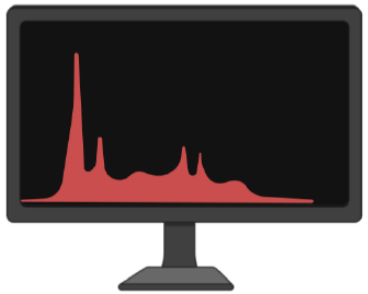
Baseline toxicity

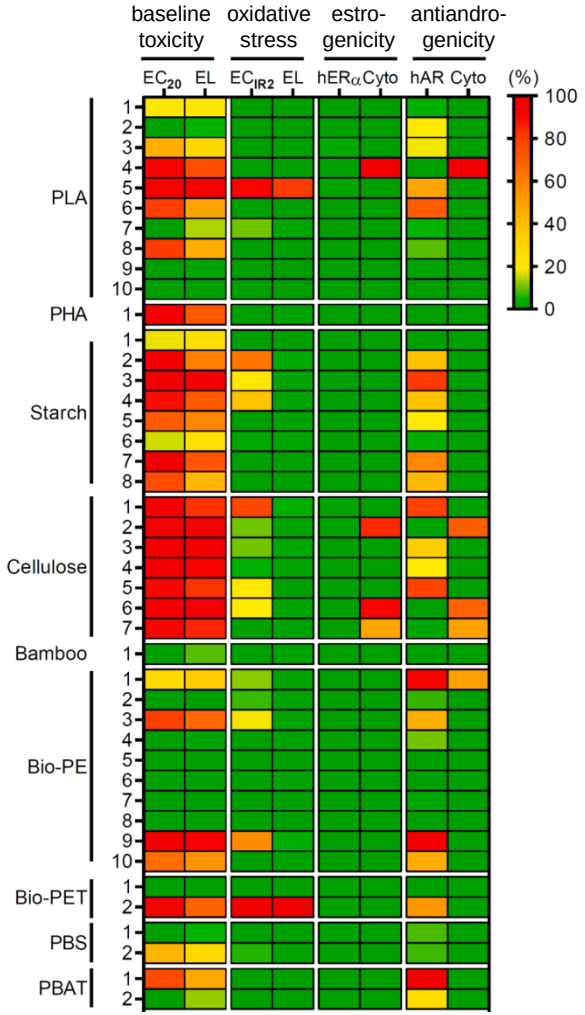


Chemical composition & toxicity

- Every product has an individual chemical composition and toxicity





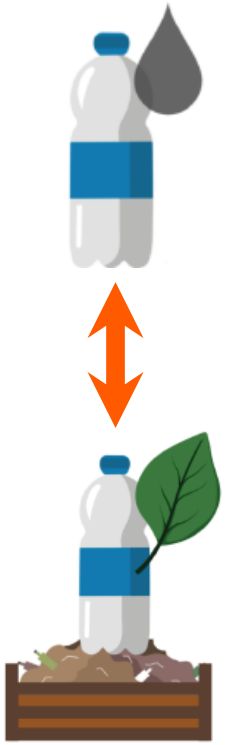


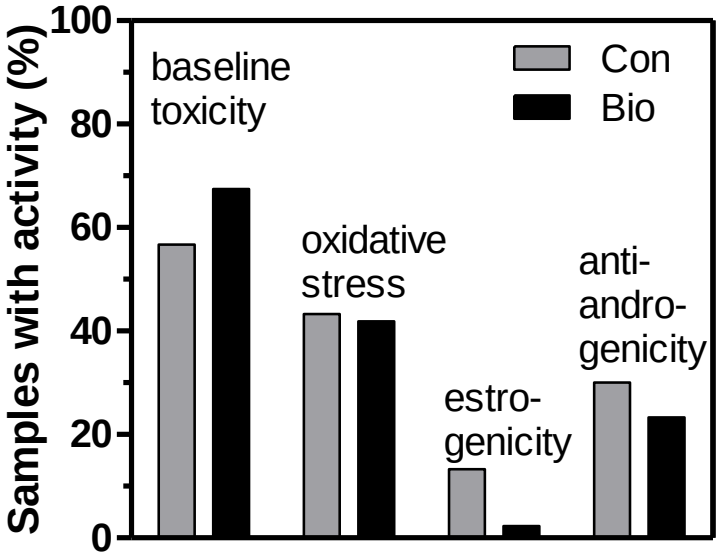
&

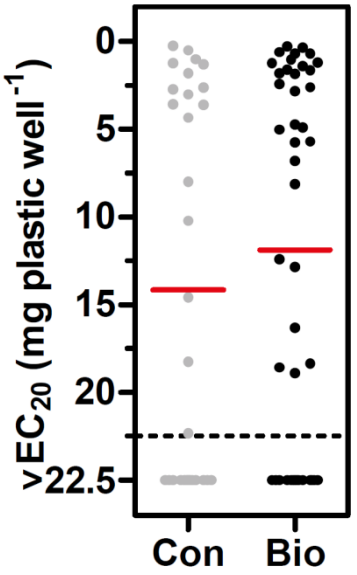
30% of the features
in max. 3 samples

Conventional vs. bioplastics

- Toxicologically, bio-based/biodegradable materials are not better than conventional plastics

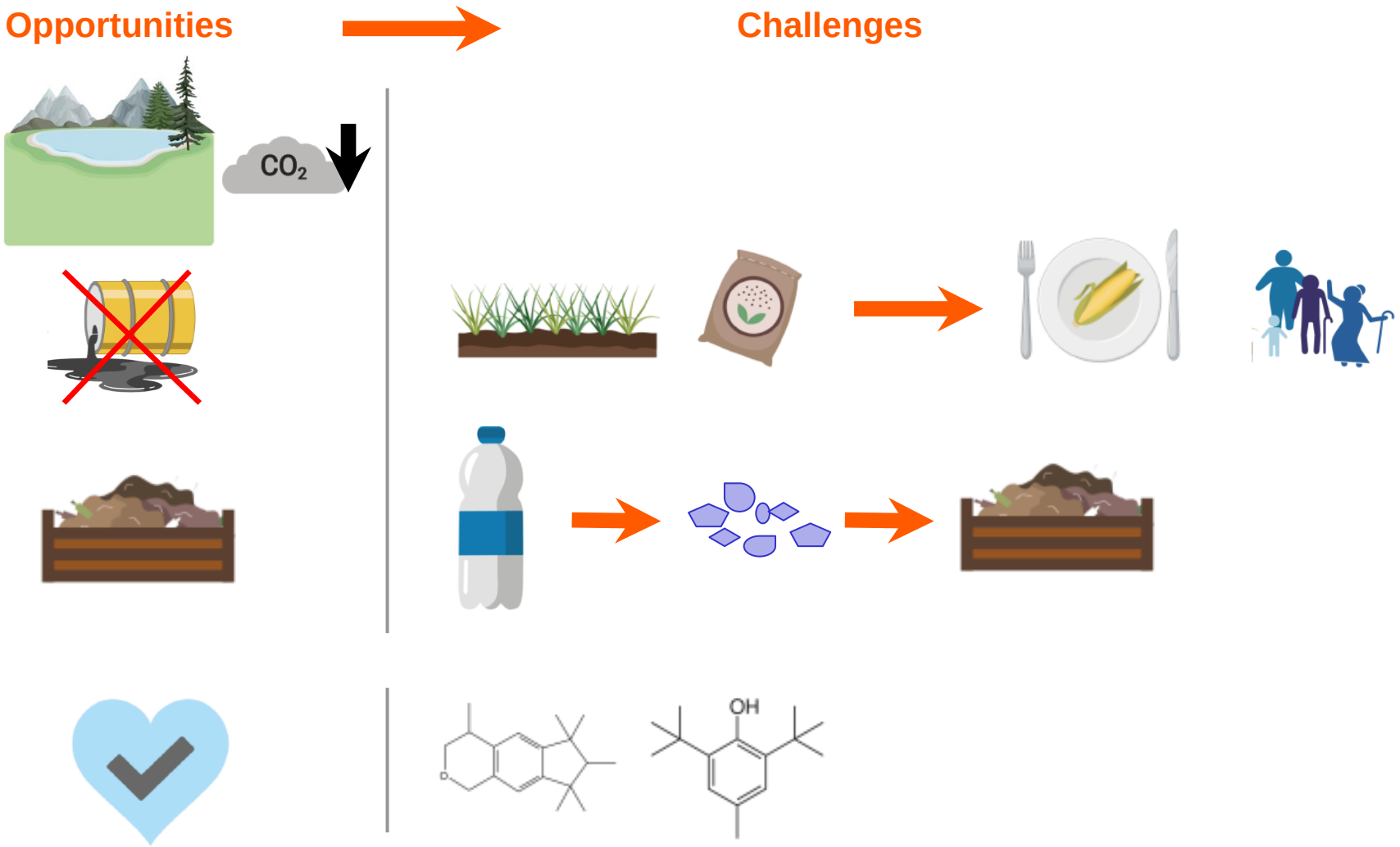






→ Chemical safety needs to be considered more in the design of materials

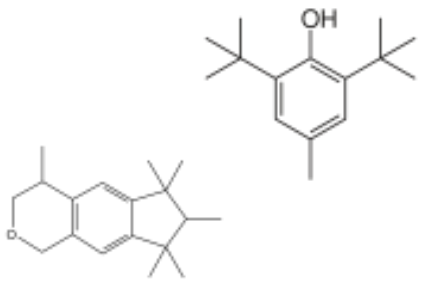
Opportunities and challenges



Solution options

Challenges → **Way forward**

Chemical safety



- Consider in frameworks (e.g. LCA) & regulations
- Reduce complexity (number of chemicals & polymers)
- Make chemical composition transparent
- Test the whole migrate of the end product

Solution options

Challenges → **Way forward**

Bio-based:
origin of resource

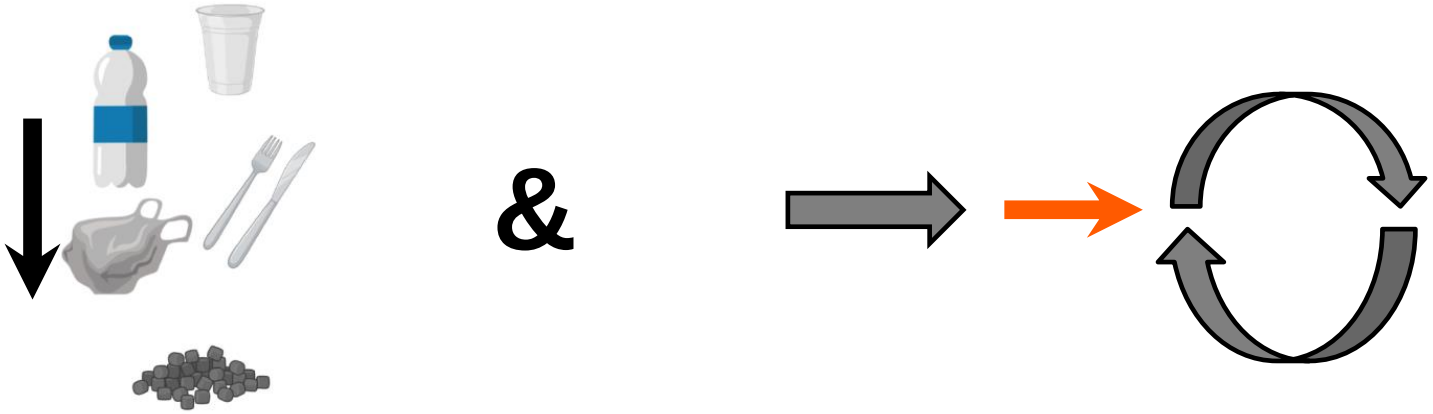
Biodegradable:
degradation

- Use residues of food production
- Advantage: Recycling with petroleum-based polymers

- Niche application
  - Biodegradability part of the function
  - Environmental entry not avoidable
- Improve certification

Conclusions

Complex requirements → Complex challenges → One-size-fits-all solution unlikely



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