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Alternative materials to SUPs and prioritisation of potentially migrating chemicals

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EDQM-AESAN symposium, 19th September 2024

EU's Directive on single-use plastics

- Single-use plastic (SUP) products are used once, or for a short period of time, before being thrown away.
- EU rules on SUPs aim to prevent and reduce the impact of certain plastic products on the environment and on human health.
- Aim to promote the transition to a circular economy with innovative and sustainable business models, products and materials.

Single-use plastics - European Commission (europa.eu)

EU's Directive on single-use plastics

30 November 2023 — Commission adopts Implementing Decision 2023/2683

Commission Implementing Decision 2023/2683 laying down rules for calculation, verification and reporting of data on recycled plastic content in single-use plastic beverage bottles

30 May 2023 — Commission adopts Implementing Decision 2023/1060

Commission Implementing Decision 2023/1060 on a harmonised standard for test methods and requirements to demonstrate that plastic caps and lids remain attached to beverage containers

4 February 2022 — Commission adopts Implementing Decision 2022/162

Implementing Decision 2022/162 lays down rules for the calculation, verification and reporting on the reduction in the consumption of single-use plastic food containers and beverage cups

17 December 2021 — Commission Implementing Decision (EU) 2021/2267 laying down the format for reporting data and information on the collected post-consumption waste of tobacco products with filters and of filters marketed for use in combination with tobacco products

1 October 2021 — Commission adopts Implementing Decision 2021/1752

Implementing Decision 2021/1752 lays down rules for the calculation, verification and reporting of data on the separate collection of waste single-use plastic beverage bottles

3 July 2021 — The EU no longer allows certain single-use plastic items to be placed on the Member States market; and marking requirements enter into force

Find out more about the marking specifications and download the pictograms

31 May 2021 — Commission adopts guidelines on single-use plastics products, and implementing decision on reporting on fishing gear

View the guidelines in all EU languages

View the implementing decision on reporting on fishing gear

2 July 2019 — Directive on single-use plastics enters into force

16 January 2018 — Publication of the EU plastics strategy - outlining the need for a legislative proposal on single-use plastics

Single-use plastics - European Commission (europa.eu)

Published work on the topic

Zwartsen *et al.* 2023 - Alternative food contact materials ….. | RIVM

McKeon *et al.* 2024 - Inventory of reusable food contact materials …| RIVM

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Alternative single-use products

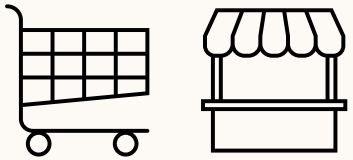
Research questions:

1. Which alternative materials to SUP FCMs are available on the Dutch market?
2. Which chemicals may be present in these materials, and can they pose a toxicological concern?
3. Which alternative materials should be prioritised for follow-up research?

Product focus:

Cutlery, plates and bowls, straws, stirrers, food containers, cups

Product data



Chemical migration data

FCCmigex
Migrating and Extractable Food Contact Chemicals

Hazard data

ECHA
EUROPEAN CHEMICALS AGENCY

Classification
Labelling
Packaging

Prioritisation

Alternative single-use products

Identified bio-based materials:

Paper > Cardboard > Wood > Cardboard > Bamboo > Bioplastic > Cane > Palm leaf > Wheat straw

Migrating chemicals with highest priority:

Chemical	Material
Formaldehyde	Paper & cardboard, wood, bamboo, sugarcane
Bisphenol A	Paper & cardboard, wood
Di-isobutyl phthalate	Paper & cardboard
Dibutyl phthalate	Paper & cardboard
Di-ethylhexyl phthalate	Paper & cardboard
Lead	Paper & cardboard

Criteria for high-priority chemicals:

- Substance found to migrate from single use in ≥ 75% of the experiments, confirmed in ≥ 4 experiments,
  and
- Hazard classification CMR cat.1A or 1B

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Alternative single-use products

Criteria chemicals with medium priority:

- Hazard classification CMR cat.1A or 1B, found to migrate from single use in < 75% of the experiments
  or
- Substance CMR cat 2 or STOT-RE cat 1, and found to migrate from single use FCM in ≥ 50% of experiments

Material	# chemicals	examples
Paper & cardboard	27	3-MCPD, monomers, borates, PFAS, amines, amides, cyanides, ethers, cadmium
Wood	19	Pesticides, chlorophenols, plant metabolites, solvents
Bamboo	2	DDT; PFOA
Sugarcane	1	caffeic acid
Palm leaves	1	DDT

Conclusions

- Paper (including coated paper) was the most common material used in single-use products
- Paper and cardboard had the highest frequency of hazardous migrating chemicals (i.e. BpA, formaldehyde, DiBP, DBP, DEHP, Pb)
- Recommended screening of prioritised migrating chemicals in respective materials

Alternative reusable products

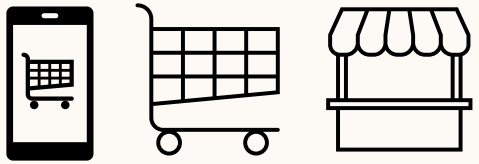
? **Research questions:**

1. What reusable materials are available on the Dutch market as alternatives to SUP?
2. What potential toxicological safety issues could be associated with their use?
3. Which reusable materials would be relevant candidates for further investigation?

Product focus:

Straws, tea/ coffee cups, drinking bottles, party/ festival cups

Product data



Chemical migration data

Hazard data

Prioritisation

Alternative reusable products

Identified materials:

Plastic (unspecified > polypropylene > Tritan > PET > melamine > polycarbonate > recycled plastic > bioplastic > polystyrene) > Stainless steel > Silicone > Glass > Bamboo > Ceramic > Unknown > Cardboard > Wood

Prioritisation criteria chemicals:

- > 2 database entries (FCCmigex) for reuseable FCM
- Migration concentrations above SML
- (self-)classified as CMR 1 or 2, STOT-RE 1 or 2 and / or ED

Material	Chemical
Plastic (PP, PE)	Silver Dibutyl phthalate
Plastic (melamine)	Melamine Formaldehyde
Plastic (polycarbonate)	Dibutyl phthalate Bisphenol A
Plastic (polyamide)	4,4'-methylenedianiline 2,4-toluenediamine 2,6-toluenediamine 3,3'-dimethylbenzidine aniline O-anisidine O-toluidine M-phenylenediamine PA 66 & PA 6
Stainless steel	Nickel Cadmium Lead Cobalt
Silicone	Aniline Cyclic siloxanes

Conclusions

- Material of reusable products were often ‘unknown’ or ‘unspecified’
- Plastics (various polymers) were the most common material used in reusable products
- Novel materials (e.g., Tritan) had limited migration data
- Several chemicals were without migration limits (e.g., SMLs)
- Polyamide reusable products had the highest migration of hazardous chemicals, especially NIASs
- Imported stainless steel products had high migration of heavy metals
- Recommended screening of prioritised migrating chemicals in respective materials

Bisphenol A alternatives

CRITICAL REVIEWS IN TOXICOLOGY
2024, VOL. 54, NO. 5, 291–314
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REVIEW ARTICLE

OPEN ACCESS Check for updates

A prioritization strategy for functional alternatives to bisphenol A in food contact materials

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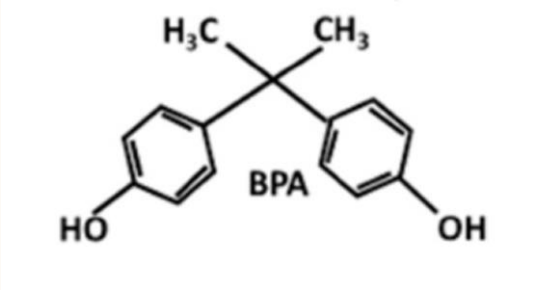


Van den Brand et al. 2024 - A prioritization strategy for functional alternatives to bisphenol A …. (tandfonline.com)

Bisphenol A alternatives

Compilation of inventory

Official bodies and governmental agencies

- **ECHA 2021** 148 substances
- **ECCC and HC 2018** 34 substances
- **ECCC and HC 2020** 204 substances
- **Government of Canada, 2021** 188 substances
- **UBA, 2019** 93 substances
- **INERIS, 2022** 3 additional substances

Scientific literature

- **Literature search in EMBASE** 95 substances

Den Braver et al. 2020: BPS, BPAF, BPF, BPE, BPM, BPZ, BHPF, TBBPA

Removal of:
- Duplicates
- Substances without proper name
- No functional alternatives

376 substances

Prioritization*

Table 1. Overview of the selected potential BPA alternatives in the current study and their CAS numbers.

Substance	CAS
Bisphenol TMC	129188-99-4
4,4′-Dihydroxydiphenyl ether	1965-09-9
2,2′-Bisphenol F	2467-02-9
2,4′-Bisphenol F	2467-03-0
4,4-Dihydroxybenzophenone	611-99-4
2,2′-Bisphenol A	7559-72-0
Tetrachlorobisphenol A	79-95-8
3,3′-Dichlorobisphenol A	79-98-1
BPA 2EO	901-44-0
Benzophenone-6	131-54-4

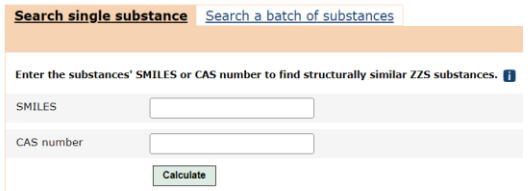
* Structural Similarities And Hazard Data

ECHA EUROPEAN CHEMICALS AGENCY

Derek Nexus

Classification
Labelling
Packaging

RIVM (SVHC-) ZZS-similarity tool):



Selected: substances ≥ 50% similarity

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THANK YOU

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