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toute une vie en bonne santé

Risks of new trends concerning materials and objects in contact with food

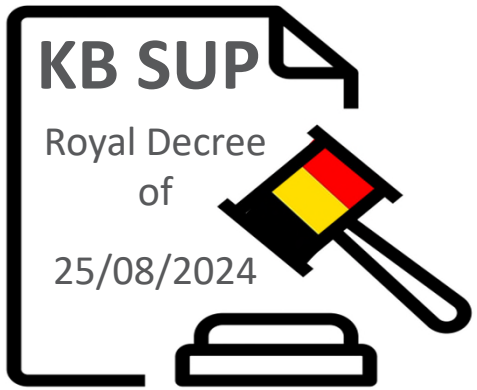
Results of the TREFCOM project (RT 21/4)

Els Van Hoeck

.be

Introduction

New materials and/or applications are appearing on the market



Fevia

Federation of Belgian Food Industry

Food sold in bulk

Introduction

What are the **potential risks** related to these new trends?

New materials and/or applications are appearing on the market




Food sold in bulk

Methodology

Market study

Selection of the samples

Identification of (potential) migrants

Risk assessment of migrants

Allergenicity

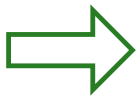
Market study

Ciano et al., 2023 (DOI: 10.3390/foods12142737)

Market study

Web scraping

59 Websites



Data cleaning and harmonization

Key-words

Natural

Zero-waste

Recycled

Environmentally friendly

Compostable

Eco-friendly

Bio-degradable

Anti-microbial

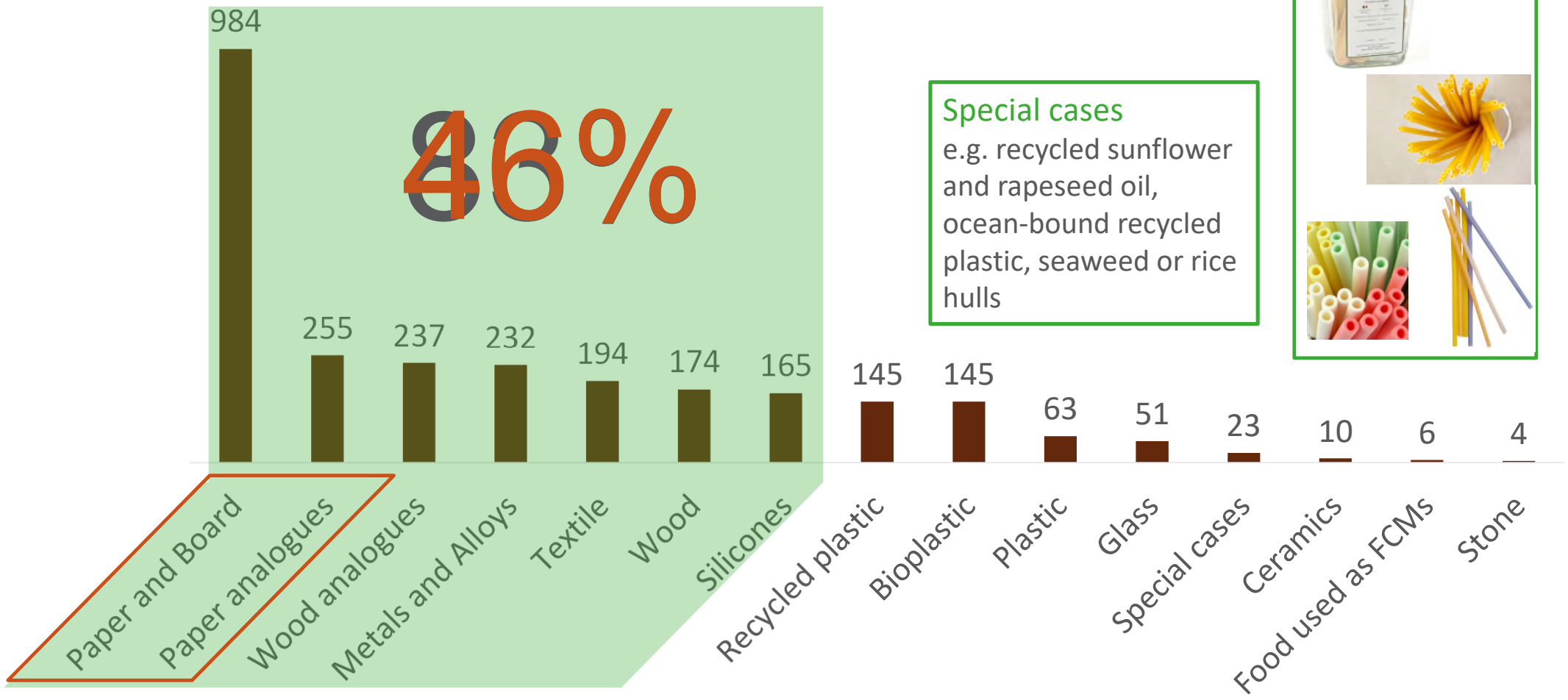
Green

Re-usable

Sustainable

Market study

Items per material category

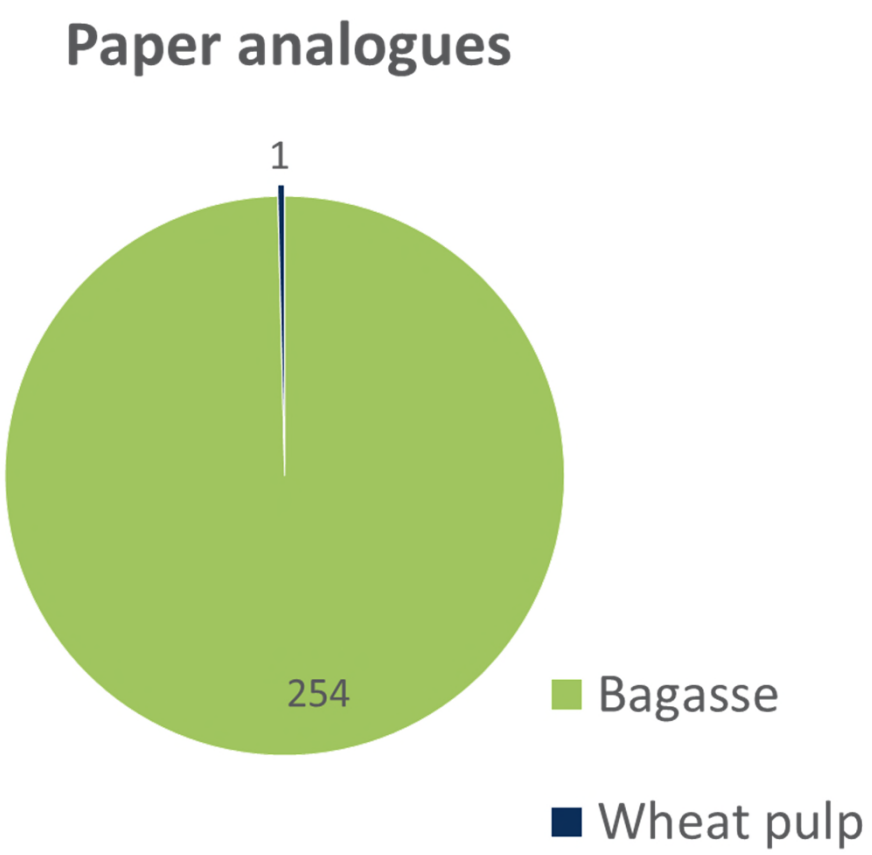


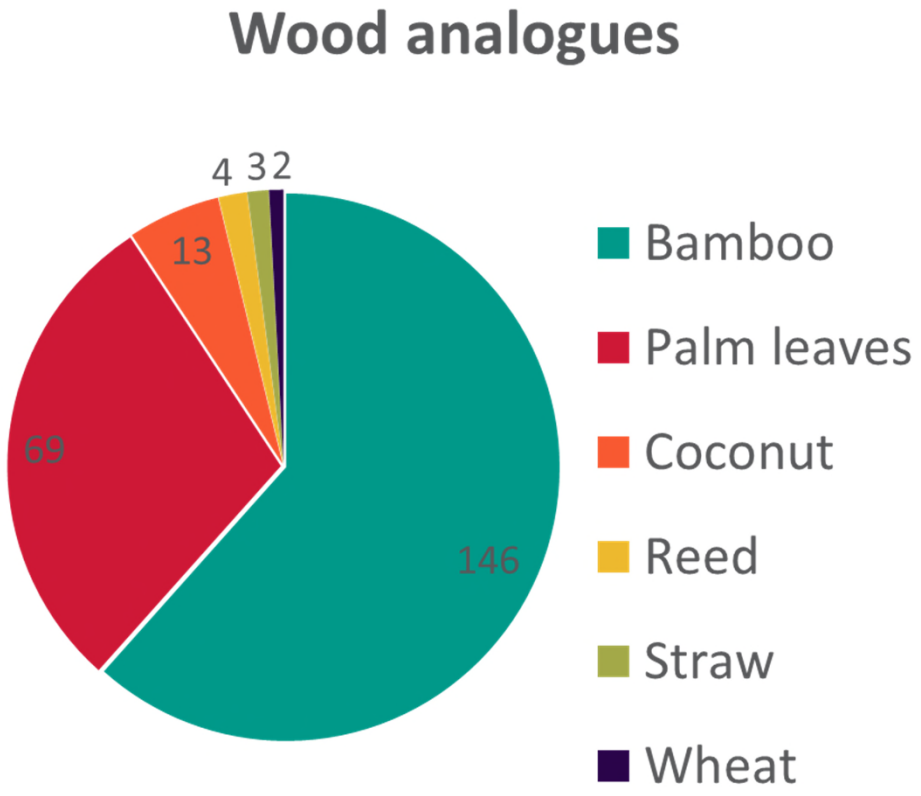
Special cases
e.g. recycled sunflower and rapeseed oil, ocean-bound recycled plastic, seaweed or rice hulls

Food used as FCM

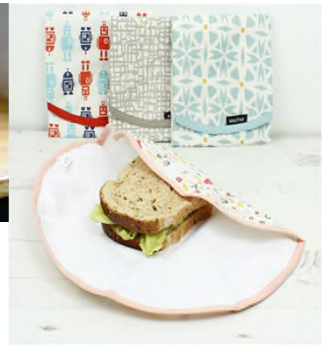
4 entries

Paper and Wood analogues





Selection of the samples



Textiles

Wood analogues

Bioplastic

Recycled Plastic

Silicones

Paper analogues

99

representative samples were selected

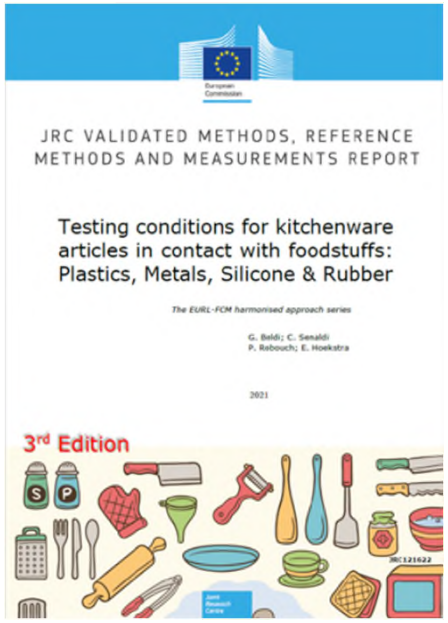
(only high priority materials were considered)

Identification of potential migrants

Analytical strategy

Analysis of nanoparticles
using GC-MS/MS and LC-HRMS

Migration experiments
According to the EURL kitchenware guidelines

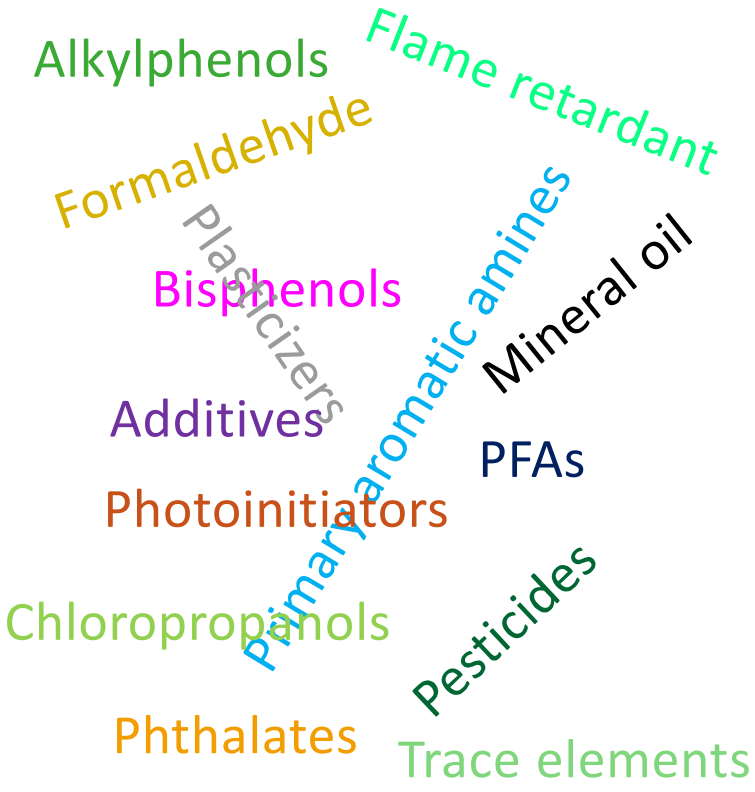


Quantitative analysis of (in)organic substances
using GC-MS/MS, LC-GC-FID, LC-MS/MS and ICP-MS

Target screening of substances included in Annex I of Regulation (EU) No. 10/2011

Untarget screening
using GC-MS/MS and LC-HRMS and ICP-MS

Targeted analyses - prioritization



513

substances

Targeted analyses - Results

Detected substances

Plasticisers
DiNCH
BBP
DMP
DiBP
DiPrP
DEHP
DBP
DEP
in 40/99 samples

Mineral oil
MOSH
MOAH
in 30/38 samples

Formaldehyde
in 3/54 samples

Pesticides
Fipronil
in 1/61 samples

Metals
Zn
As
Pb
Ti
Cd
Cu
Ag
in 40/99 samples

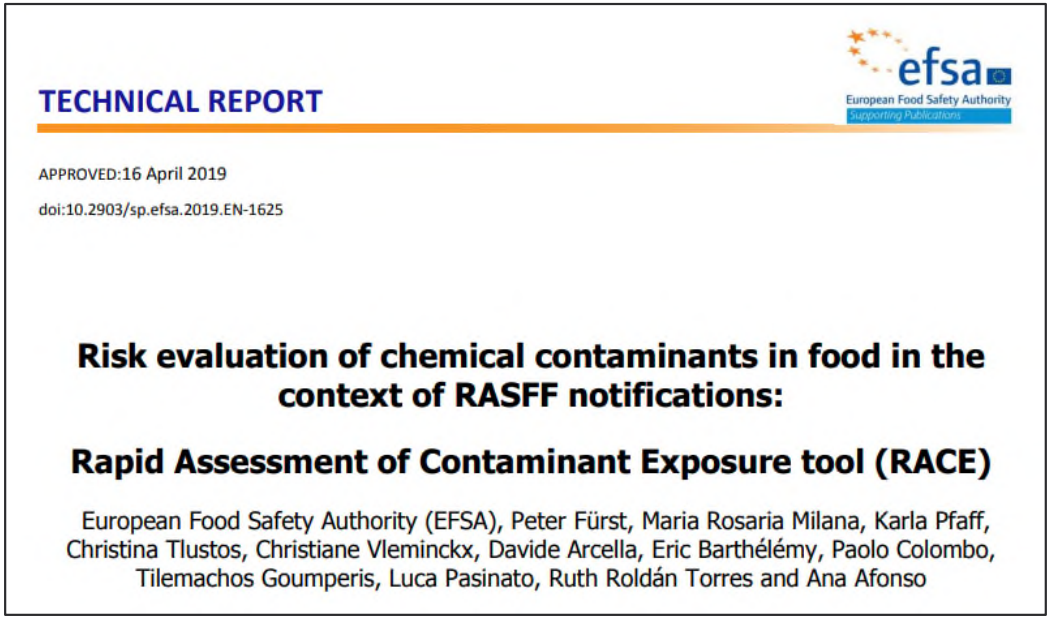
PAAs
4,4'-MDA
in 1/66 samples

PFAS
PFNA
PFDA
PFDoDA
PFOA
PFHpA
PFHxA
PFBA
PFTrDA
PFPeA
PFUnDA
in 15/16 samples

Risk assessment of the quantified migrants

RACE tool

Rapid Assessment of Contaminant Exposure tool
developed by EFSA for FAST risk evaluation of food contaminants, including FCM substances



TECHNICAL REPORT

efsa European Food Safety Authority Supporting Publications

APPROVED:16 April 2019

doi:10.2903/sp.efsa.2019.EN-1625

Risk evaluation of chemical contaminants in food in the context of RASFF notifications:

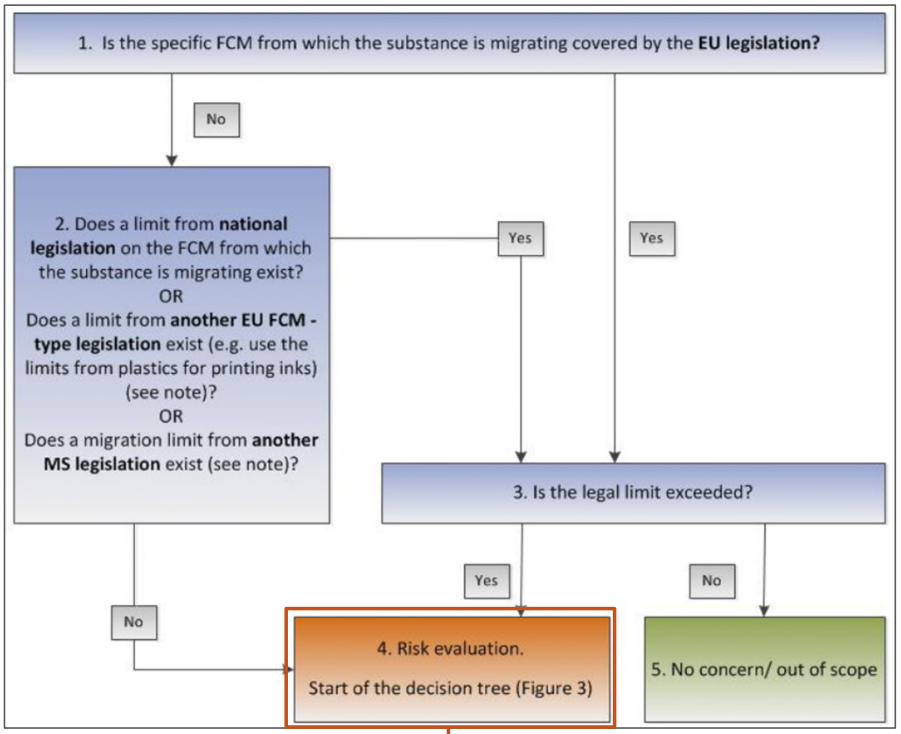
Rapid Assessment of Contaminant Exposure tool (RACE)

European Food Safety Authority (EFSA), Peter Fürst, Maria Rosaria Milana, Karla Pfaff, Christina Tlustos, Christiane Vleminckx, Davide Arcella, Eric Barthélémy, Paolo Colombo, Tilemachos Goumperis, Luca Pasinato, Ruth Roldán Torres and Ana Afonso

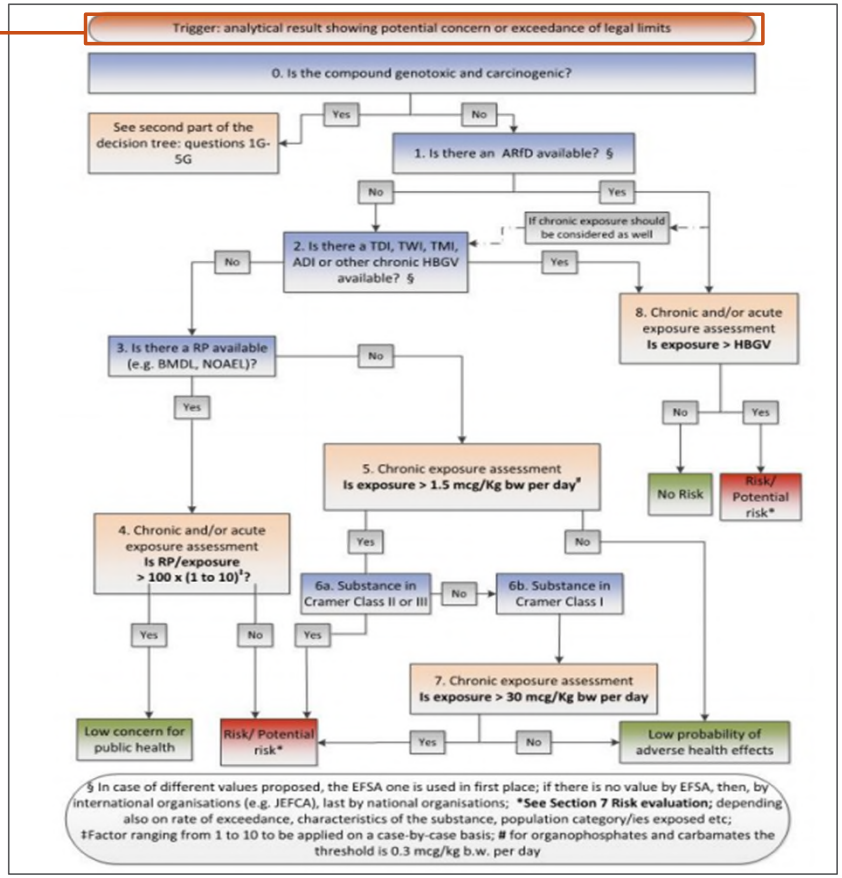
EFSA suporting publication (10.2903/sp.efsa.2019.EN-1625)

EFSA RACE tool

Pre-decision tree for food contact materials



Decision tree for food contact materials



Substances covered by EU legislation

COMMISSION REGULATION (EU) No 10/2011
of 14 January 2011
on plastic materials and articles intended to come into contact with food

100%

of the samples are compliant

Category	Substance	SML
PAAs	4,4'-MDA	0.002 mg/kg
Plasticisers	DBP	0.12 mg/kg
	DEHP	6 mg/kg
	DBP*5 + DiBP*4 + BBP*0.1+ DEHP*1	6 mg/kg
	DiNCH *(as part of a sum)*	60 mg/kg
Other	Formaldehyde	15 mg/kg

Substances covered by other FCM legislations

Category	Substance	LOWEST SML
Plasticisers	DMP	0.05 mg/kg
	DBP	0.12 mg/kg
	BBP	0.6 mg/kg
	DEHP	6 mg/kg
Metals	Ag	0.08 mg/kg
	As	0.002 mg/kg
	Cd	0.002 mg/kg
	Pb	0.01 mg/kg
Other	Formaldehyde	15 mg/kg
Mineral oil	MOSH	5 mg/kg
	MOAH	0.5 mg/kg

COMMISSION REGULATION (EU) No 10/2011
of 14 January 2011
on plastic materials and articles intended to come into contact with food

FEDERALE OVERHEIDSDIENST VOLKSGEZONDHEID,
VEILIGHEID VAN DE VOEDSELKETEN
EN LEEFMILIEU

[C − 2021/40623]

17 FEBRUARI 2021. — Koninklijk besluit betreffende materialen en voorwerpen van metaal en legering die bestemd zijn om in aanraking te worden gebracht met voedingsmiddelen

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Annex 10 of the Ordinance of the FDHA on materials and articles intended to come into contact with foodstuffs

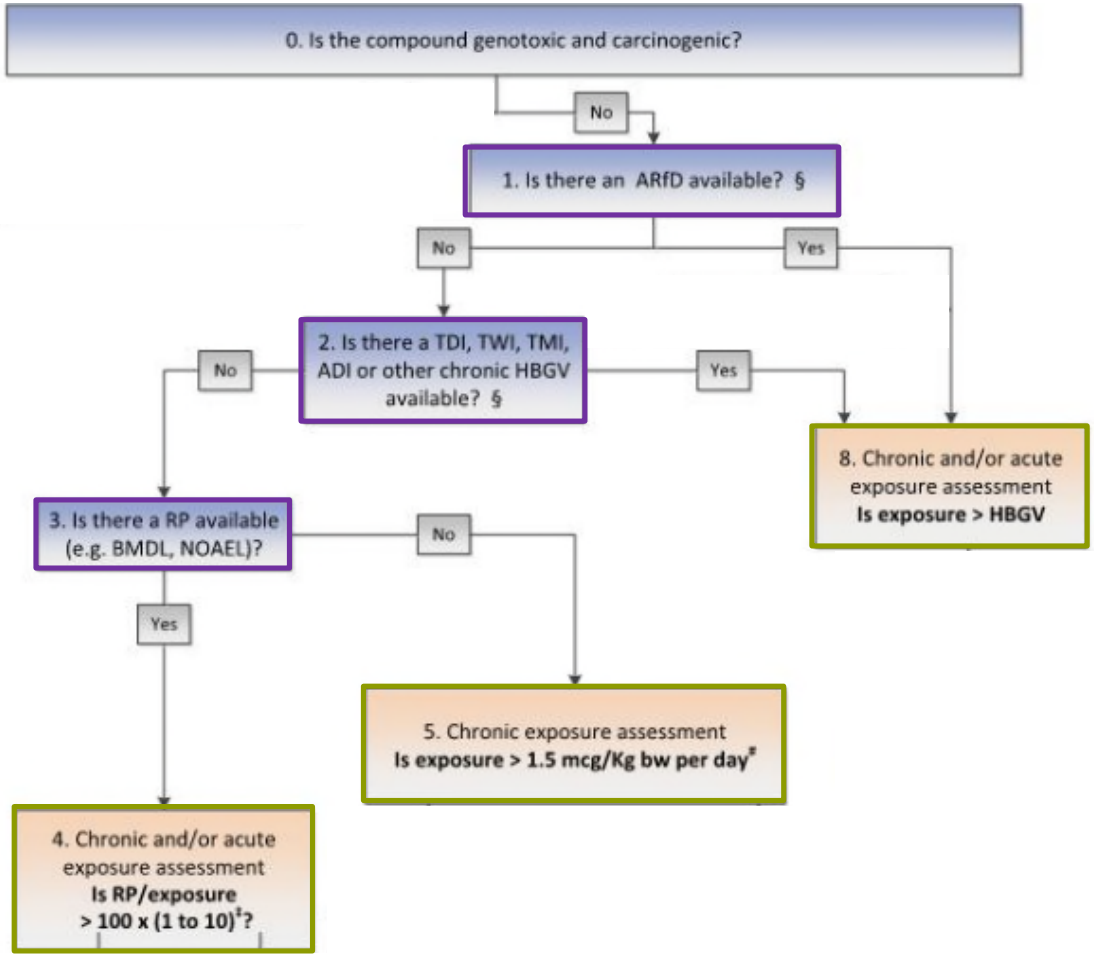
Exceedances for mineral oil, DBP, Pb and Cd

➡ ***Further risk assessment is needed***

SciCom
Scientific Committee of the Federal Agency for the Safety of the Food Chain

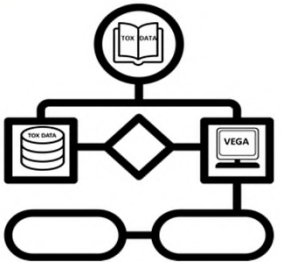
Advice 19-2017 of the Scientific Committee of the FASFC on action thresholds for mineral oil hydrocarbons in food

Application of the EFSA RACE tool



Next steps:

Collection of/Search for a reference value using the SILIFOOD tool



https://www.vegahub.eu/portfolio-item/silifood/

Comparison with the exposure

Exposure estimation from the use of the FCMs

Amount of substance that could potentially migrate

Hypotheses of consumption per population category

e.g. a child uses 5 straws/week

Estimated daily intake

Children
(3-10 years old, 23 kg)

Teenagers
(14-18 years old, 61 kg)

Adults
(18-64 years old, 70 kg)

Body weights obtained from EFSA Journal 2012;10(3):2579

Risk assessment: PFAS

PFAS

1 sample
is a potential risk for the consumer

Mineral oil

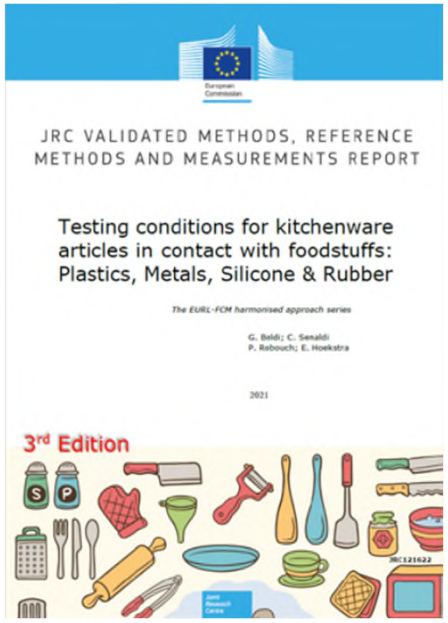
8 samples
are a potential risk for the consumer

Remark: Risk assessment is based on worst case assumptions, a more refined risk assessment is needed

Identification of potential migrants

Analytical strategy

Migration experiments
According to the EURL kitchenware guidelines



Quantitative analysis of (in)organic substances
using GC-MS/MS, LC-GC-FID, LC-MS/MS and ICP-MS

Target screening of substances included in Annex I of Regulation (EU) No. 10/2011

Analysis of nanoparticles
using GC-MS/MS and LC-HRMS

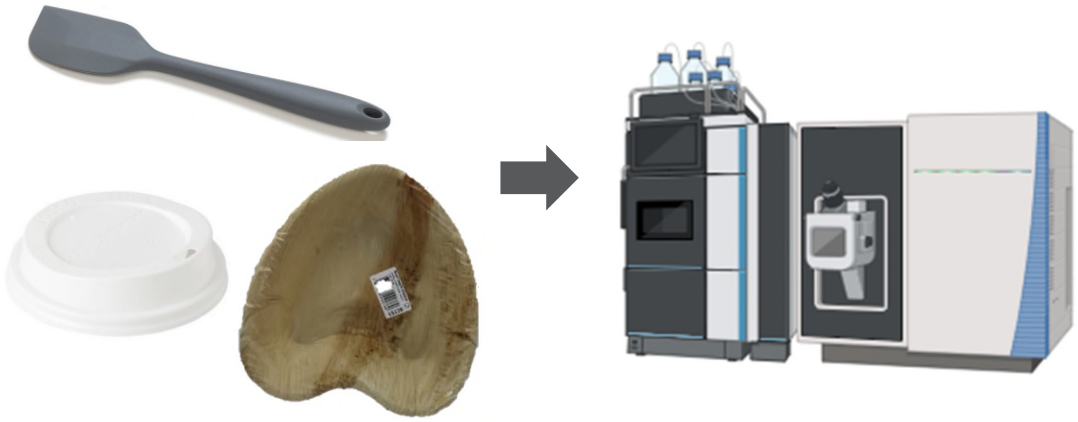
Untarget screening
using GC-MS/MS and LC-HRMS and ICP-MS

Untarget screening

Target screening method by LC-HRMS of

~ 100 substances

included in Annex I of Regulation (EU) No. 10/2011



52 samples

At least 1 substance was detected in 50% of the samples

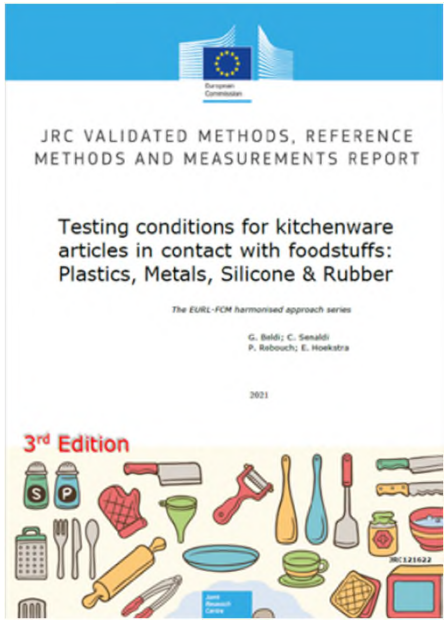
Substances most often detected

- Bis(4-ethylbenzylidene)sorbitol (7 samples)
- 2,4-Dihydroxybenzophenone (7 samples)
- Sorbitan monostearate (5 samples)

Identification of potential migrants

Analytical strategy

Migration experiments
According to the EURL kitchenware guidelines



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Untarget screening
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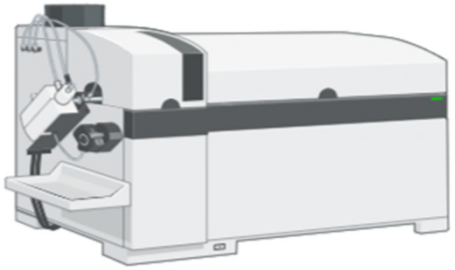
Analysis of nanoparticles
using GC-MS/MS and LC-HRMS

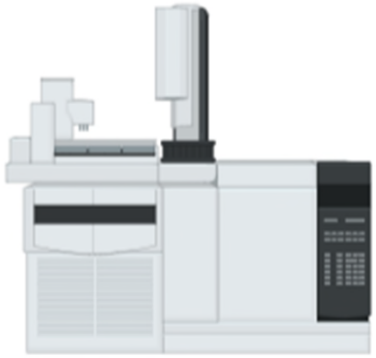
Untarget screening

Sub-set of samples

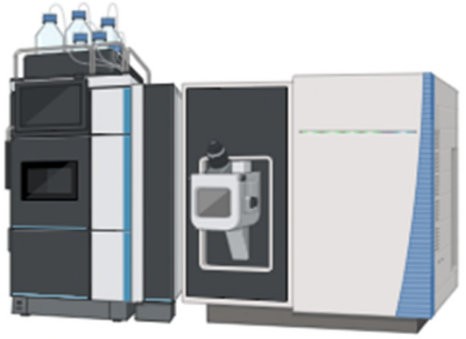
ICP-MS



GC-MS/MS



LC-HRMS



Other elements were detected

Al Br Ba Fe Rb Mn Sr

A methodology for data-interpretation was developed and applied

Untarget screening by GC-MS/MS and LC-HRMS

Migration experiments

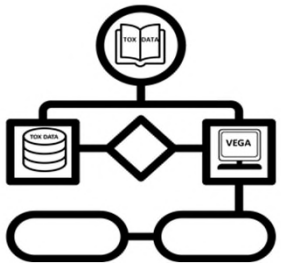
Analysis by GC-MS/MS & LC-HRMS

Search in spectral databases

mzCLOUD™ NIST

564
substances identified

Fast risk assessment
SILIFOOD



91
priority substances

Confirmation by
reference standard*

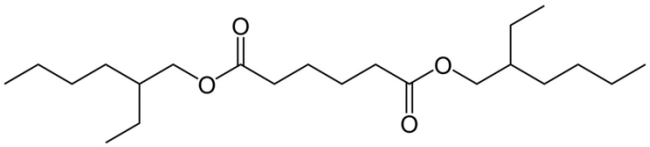
20
substances

** In accordance with the confidence levels developed by Schymanski (DOI: 10.1021/es5002105)*

Untarget screening by GC-MS/MS and LC-HRMS

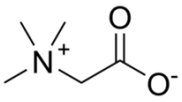
Results *(Examples)*

Bis(2-ethylhexyl) adipate



Plasticiser often used to replace DEHP

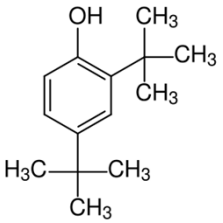
Betaine



Amino acid derivative occurring in plant

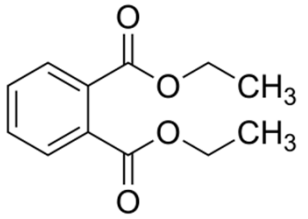
Mostly present in paper and wood analogues

2,4-di-t-butylphenol



Degradation product of antioxidants Irgafos 168, Irganox 1076 and Irganox 110

Diethyl phthalate

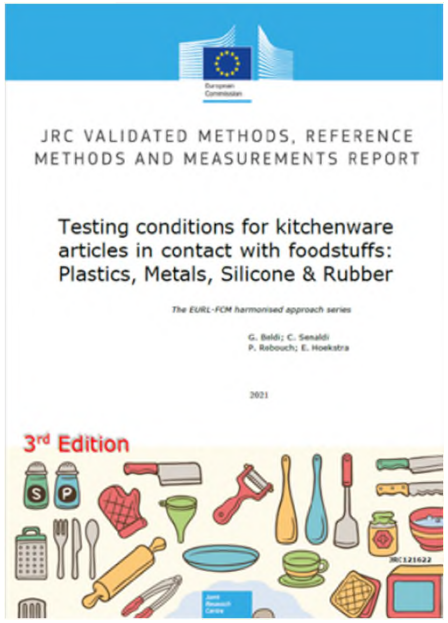


Plasticisiser not included in the target method for phtalates

Identification of potential migrants

Analytical strategy

Migration experiments
According to the EURL kitchenware guidelines



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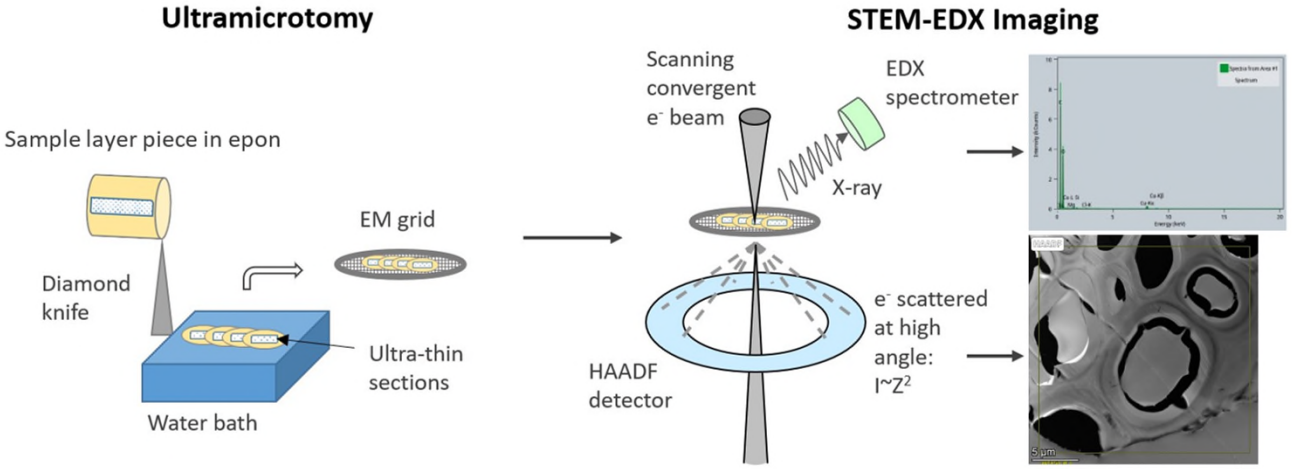
Untarget screening
using GC-MS/MS, LC-HRMS and ICP-MS

Identification and analysis of (nano)particles in FCM

Methodology

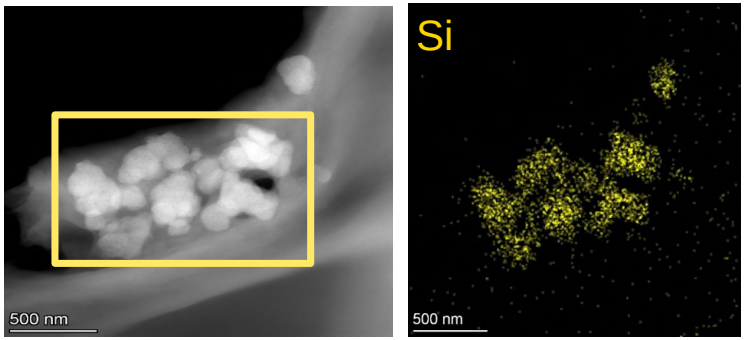


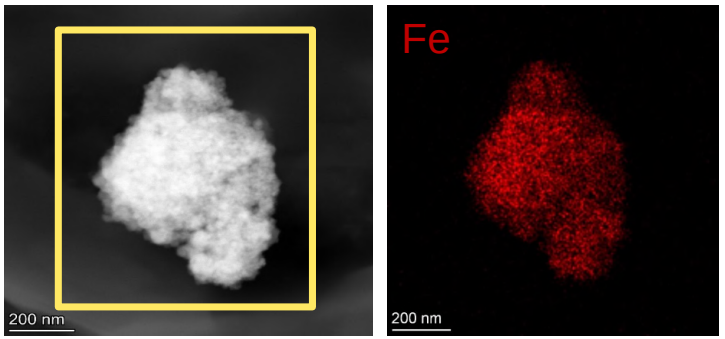
Electron microscopy-based method

was developed to detect, identify and analyse (nano)particles in FCM

*Applied to **11** samples*

Examples





Conclusion

What are the potential risks related to these new trends?

- New materials and applications have been identified to replace single-use plastic
- Targeted analyses of 513 (in)organic substances revealed potential concern for PFAS and mineral oil in some samples
- Untargeted analyses highlighted the migration of additional substances of potential concern
- A methodology was developed to investigate the presence of nanoparticles

Acknowledgements

Health
Food Chain Safety
Environment

Start date: *01/12/2021*
End date: *31/05/2024*

Total duration: *2.5 years*

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IMO-IMOMEC
UHASSELT
imec

Prof. Dr. Roos Peeters

sciensano

toute une vie en bonne santé

Contact

Els Van Hoeck • els.vanhoeck@sciensano.be • +32 2 642 56 15

Sciensano • Rue Juliette Wytsman 14 • 1050 Bruxelles • Belgique
T +32 2 642 51 11 • T Presse +32 2 642 54 20 • info@sciensano.be • www.sciensano.be

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