ILSI EUROPE

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Investigation of potential migratables from paper and board food contact materials intended for takeaway

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Declaration of Interests

Affiliation / Financial interests	Organisation
Employment	Sciensano
Grants / Research support	Federal Public Service – Human Health
Scientific Advisory Board / Consultant	none
Government	Institution
Other	none

Introduction

New materials/applications are appearing on the market due to….

SUP Directive (EU) 2019/904

Royal Decree of 25/05/2024

Ban on certain single use plastic in Europe

Fevia

FEVIA (Federation of Belgian Food Industry)

-

100% of reusable, recyclable or biodegradable packaging by 2025

Introduction






What are the **potential risks** related to these FCM?

Objectives

WP1

Market study

WP2

Selection of compounds

WP3

Selection of the samples

WP5

Risk assessment of migrants

WP4

Identification of (potential) migrants

Market study

WEB SCRAPING

59 Websites consulted

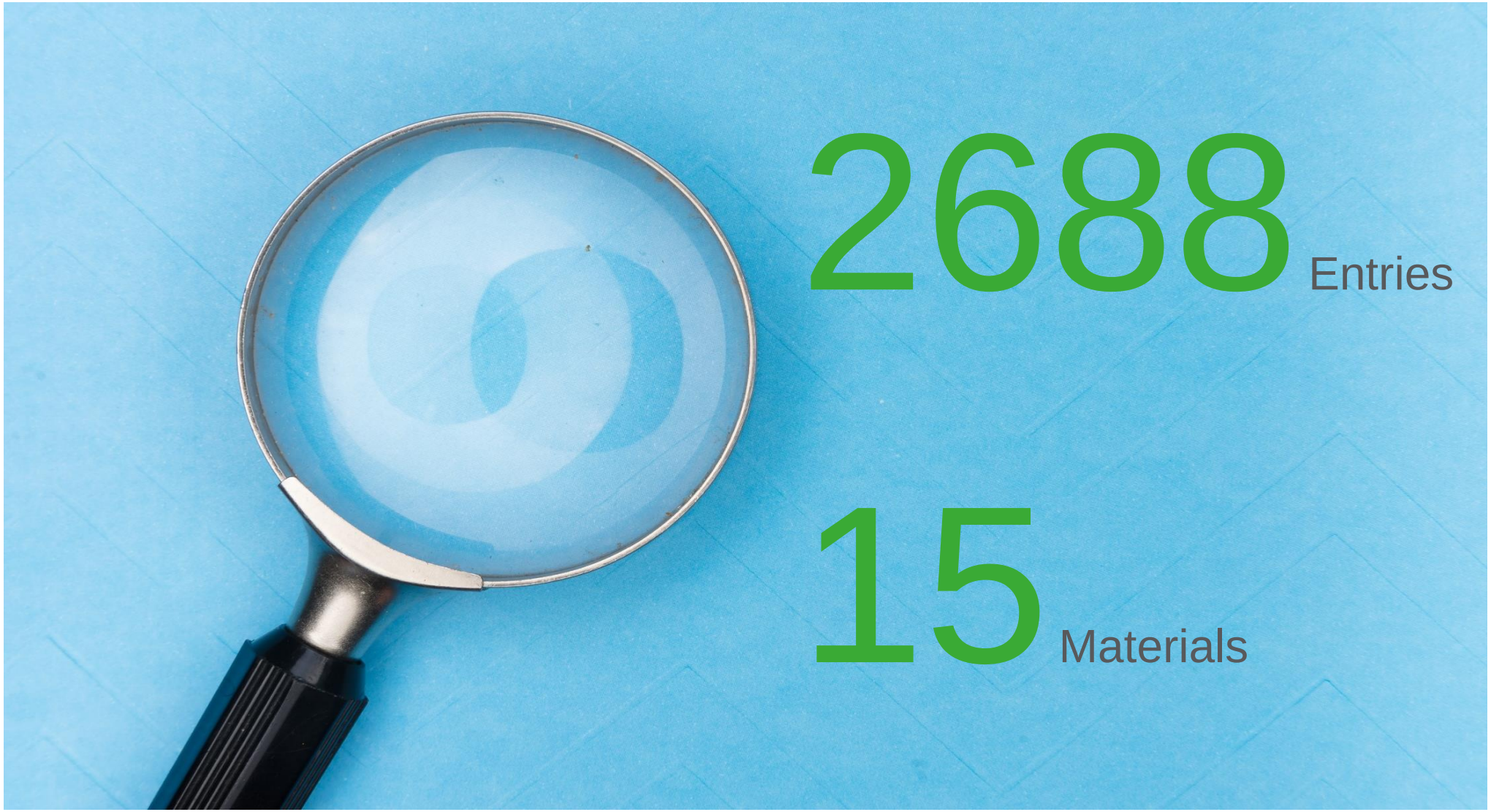
KEY WORDS

Green, Sustainable, eco friendly, green, recycled, compostable, natural, zero waste, reusable etc…

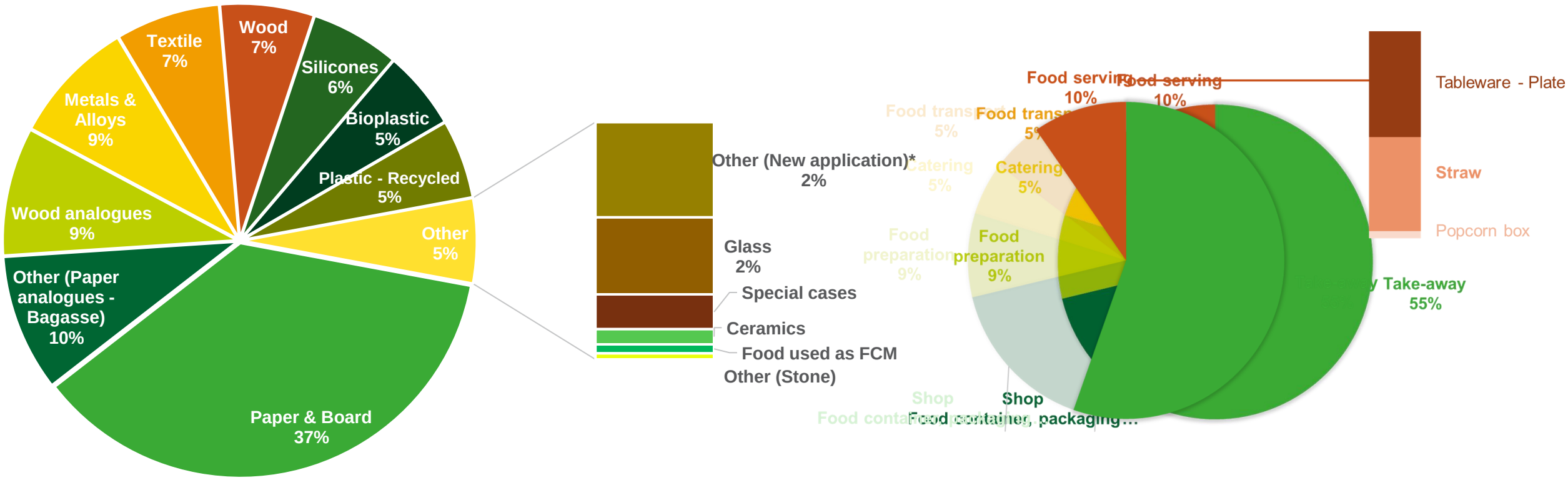
DATA CLEANING & HARMONIZATION

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

Market study



Market study



Sampling


ONLINE SHOPPING
SUPERMARKET
58
Takeaway articles
20
Straws
FAST FOOD

Sampling

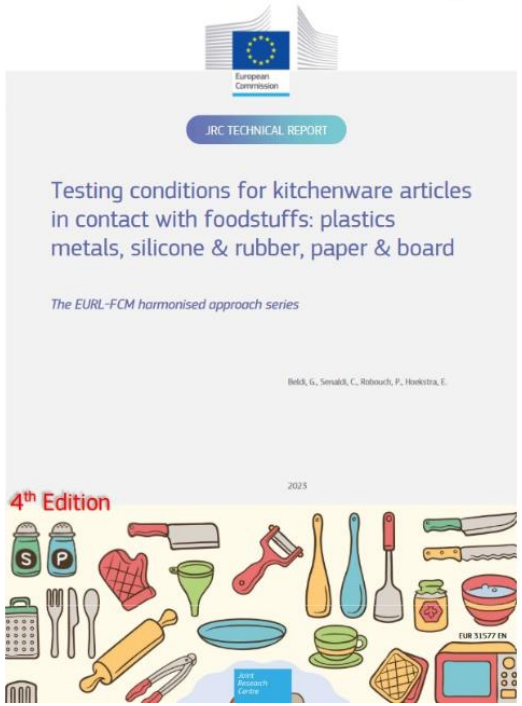

BLACK & WHITE
PAPER STRAWS
NATURAL STRAWS
Paper straws
biodore
preserve
COMPOSTABLES
50
Lepel
Delighting Food Moments
IF YOU CARE
Paper Snack & Sandwich Bags
48
This is a kind cup.
KAKAO
Coffee
Tea
PARA LLEVAR

Identification of potential migrants

Analytical strategy

Migration experiments

According to the EURL kitchenware guidelines



How to analyse the samples?

Table 5A presents the relevant test conditions for migration from coated/treated paper and board articles. If the paper and board item includes a barrier layer against fat/grease/water (e.g. a plastic layer) and does not absorb moist and/or oil, and if no loss of physical structure occurs, the test conditions prescribed by Regulation (EU) No 10/2011 for plastic can be applied. When the structural integrity of the paper regarding to the testing conditions prescribed for plastics is unknown, migration conditions as set in Table 5A should be followed in first instance. However, when an alteration of the material is evidenced after the contact phase, the testing conditions of Table 5B should be applied. A case-by-case analysis is necessary.

Table 5B presents "extraction" conditions for coated, uncoated and treated/impregnated paper and board articles that do not withstand migration test conditions and food simulants prescribed by Regulation (EU) No 10/2011 and that lose their physical structure. These methods are selected taking into account the currently available CEN standards and the practical guideline for manufacturers and regulators on "*Paper and Board used in food contact materials and artides*" published by the Council of Europe.

Kitchenware Guidelines

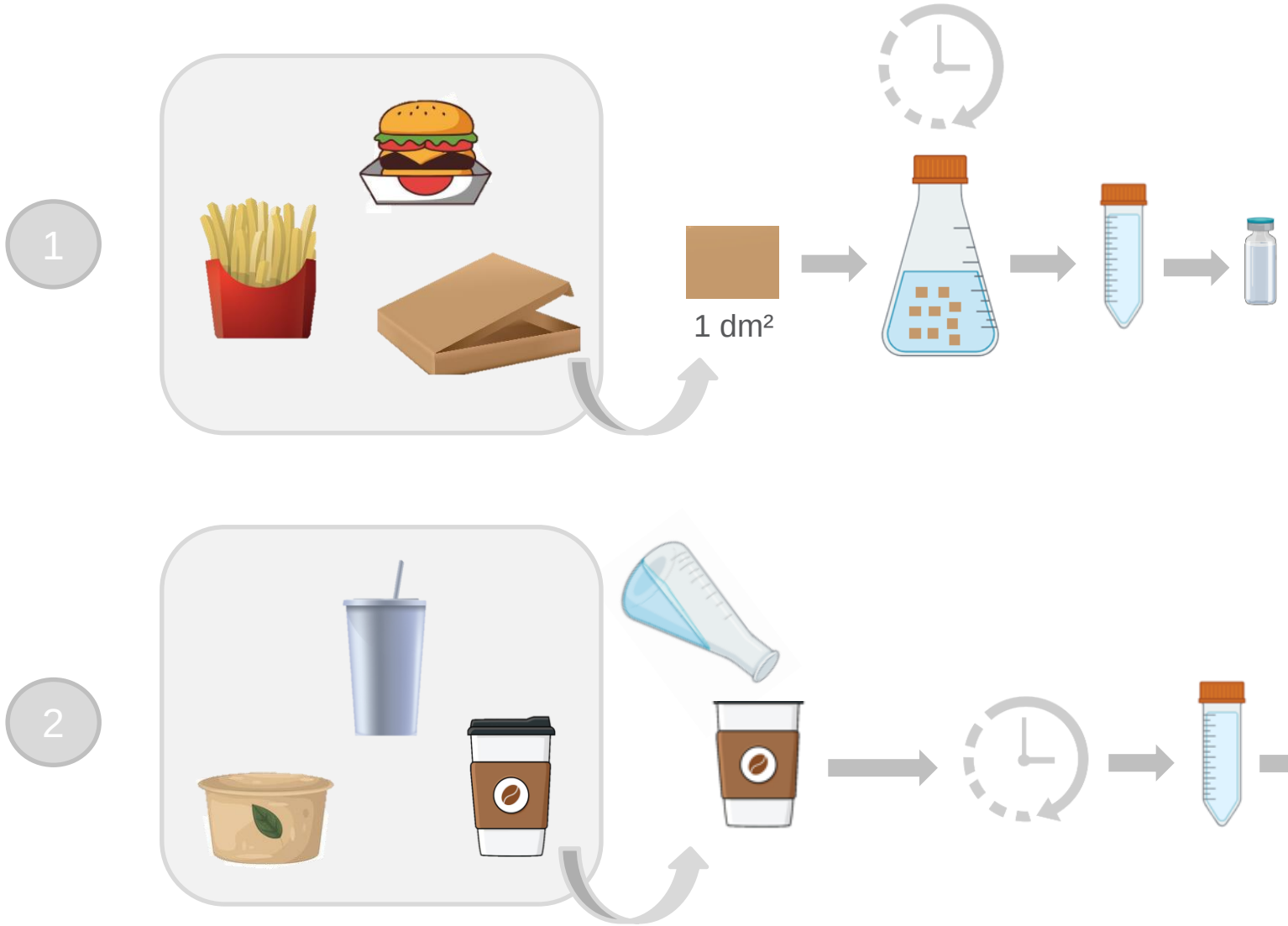
Main Class	Subclass	Examples
Food Preparation Wear	FPW/CA1	Apron, Bib
	FPW/CA2	Glove
	FPW/CA3	Towel, Wipe, Napkin, Tablecloth, Placemat, Kitchen roll
Food Preparation Utensil for Cold/Ambient use	FPU/CA1	Utensils used at ambient temperature for short time: Rolling pin, Lettuce cutter, Grater, Garlic press, Zester, Vegetable peeler, Apple peeler, Food scale, Apple corer, Apple cutter, Biscuit press, Cherry pitter, Egg separator, Fish scaler, Flour sifter, Herb chopper, Squeezer, Reamer, Mandolin, Wire, Meat tenderiser, Fruit baller, Nutmeg grater, Pastry blender, Mortar and pestle, Roller docker, Pasta cutter, Salad spinner, Julienne peeler, Avocado slicer, Ravioli maker, Vegetable cutter with container, Hamburger press, Coconut scraper, Empanadilla mould type, Meat grinder, Vegetable brush, Cake measuring tape, Cocktail shaker, Coffee measuring spoon
Food Preparation Utensils for Cold/Ambient or Hot use	FPU/CAH1	Utensils used at ambient or hot temperature for short time: Baster, Bottle Top Baster, Pastry spatula, Pastry scraper, Pastry brush, Pastry bag, Egg piercer, Pastry mat, Salad/omelette/fitness shaker, Marinade Syringe, Funnel, Potatoes slicer, Dessert/appetizers ring, Measuring spoon, Measuring cup, Tea net, Filter, Ricer, Food mill, Chocolate thermometer, Chocolate form
	FPU/CAH2	Cutting board (not for storage)
	FPU/CAH3	Kitchen countertop, Worktop, Bench
	FPU/CAH4	Colander, Drum sieve, Chinois, Gravy strainer, Cooling rack
	FPU/CAH5	Bowl
	FPU/CAH6	Microwave materials (only warming up or defrosting)
	FPU/CAH7	Puree masher, Potato masher, Whisk, Tongs-not foreseeable use at temperatures above 100 °C
	FPU/CAH8	Cheese cloth (dairy product), Mat for cheese draining
Food Preparation Utensils for Hot use	FPU/H1	Articles that could be used during cooking/frying/grilling: Spoon, Ladle, Spatula, Tongs, Fondue fork
	FPU/H2	Cookware , Cooking items, Microwave cookingware: Cooking/frying pan, Cooking pot, Steamer basket, Lid (sold alone), Spice/fragrance bag, Boil over preventer, Frying pan splatter screen, Bourguignon fork, Cooking ring, Susceptor, Skewer, Microwave cooker
	FPU/H3	Bakeware and Ovenware items used up to 1 hour: Cake pan, Gratin dish, Cookie sheet, Muffin pan, Muffin cup, Cooking tray, Oven liner
	FPU/H4	Bakeware and Ovenware items used more than 1 hour: Casserole, Roasting bag, Baking foil, Elastic net, Ring for meat
Food Serving Utensils for Cold/Ambient use	FSU/CA1	Bread Bag, Basket (not for storage)
	FSU/CA2	Decanter, Fitness/bicycle/drinking bottle, Baby food pouch
	FSU/CA3	Dispenser: Candy dispenser, Honey dispenser, Oil dispenser, Sauce dispenser
Food Serving Utensils for Cold/Ambient or Hot use	FSU/CAH1	Cup, Glass, Drinkware
	FSU/CAH2	Open flask, Carafe, Can, Jug
	FSU/CAH3	Bottle
	FSU/CAH4	Baby bottle, Teats
	FSU/CAH5	Tableware, Plate, Dishware, Serving stand
	FSU/CAH6	Food tray, Serving board, French fries box, Finger food bag, Snack box, Popcorn box
	FSU/CAH7	Thermos flask, Isothermic drinking beaker

Kitchenware Guidelines

Table 5B – "Extraction" test conditions for paper & board kitchenware

Main Class	Subclass	Use				Sample prep		Test type		check national legislation*	Solvent/Food simulant				t/T Conditions		Real	Real (infant/young)	6 (V < 0.5L or V > 10L)	6 impractical s/v	Notes
		cold (< 20 °C)	Room Temperature	hot (> 40 °C)	storage (in months)	cut test specimen	intact article	migration cell	(total) immersion		pure water type 1 (ISO 3696:1987)	isooctane	95 % ethanol	E	time	Temp (°C)					
	FSU/CA1	x	x			x			x	x	x				24 h	23	x	x	x	x	
		x	x			x			x	x		x	x		2 h	20	x	x	x	x	
		x	x			x		x		x				x	24 h	40	x	x	x	x	
	FSU/CA2																				
	FSU/CA3	x	x		x	x			x	x	x				24h	23	x		x		all storage periods included
		x	x		x	x			x	x		x	x		24h	20	x		x		all storage periods included
		x	x		@	x		x		x				x	10 d	40	x		x		
		x	x		≤ 6	x		x		x				x	10 d	50	x		x		
		x	x		>6	x		x		x				x	10 d	60	x		x		
Food Serving Utensils	FSU/CAH1	x	x	x		x			x	x	x				24 h	23	x	x	x		
		x	x	x		x			x	x		x	x		2 h	20	x	x	x		
	FSU/CAH2																				
	FSU/CAH3																				
	FSU/CAH4																				
	FSU/CAH5	x	x	x		x			x	x	x				24 h	23	x	x	x	x	
		x	x	x		x			x	x		x	x		2 h	20	x	x	x	x	
		x	x	x		x		x		x				x	2 h	70	x	x	x	x	
	FSU/CAH6	x	x	x		x			x	x	x				24 h	23	x	x	x	x	
		x	x	x		x			x	x		x	x		2 h	20	x	x	x	x	
		x	x	x		x		x		x				x	2 h	70	x	x	x	x	
	FSU/CAH7																				

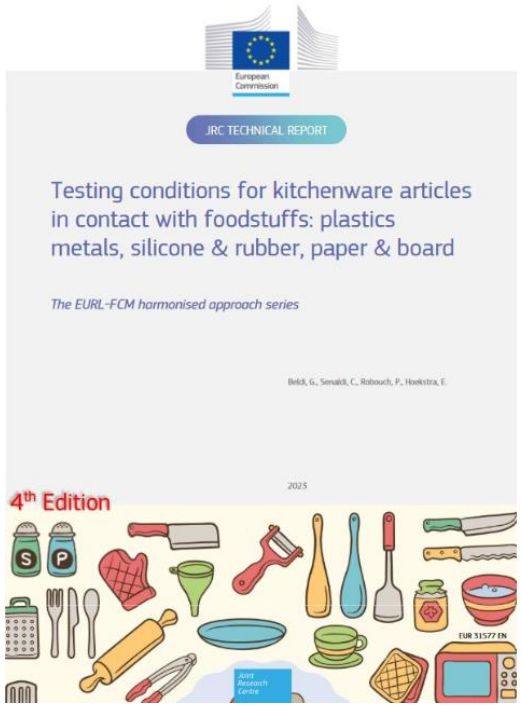
How were analysed the samples ?



Identification of potential migrants

Analytical strategy

Migration experiments
According to the EURL kitchenware guidelines



Quantitative analysis of organic substances
using GC-MS/MS, LC-GC-FID, LC-MS/MS

Targeted screening of substances included in Annex I of Regulation (EU) No. 10/2011
using LC-HRMS

Untargeted screening
using GC(xGC)-TOF/MS

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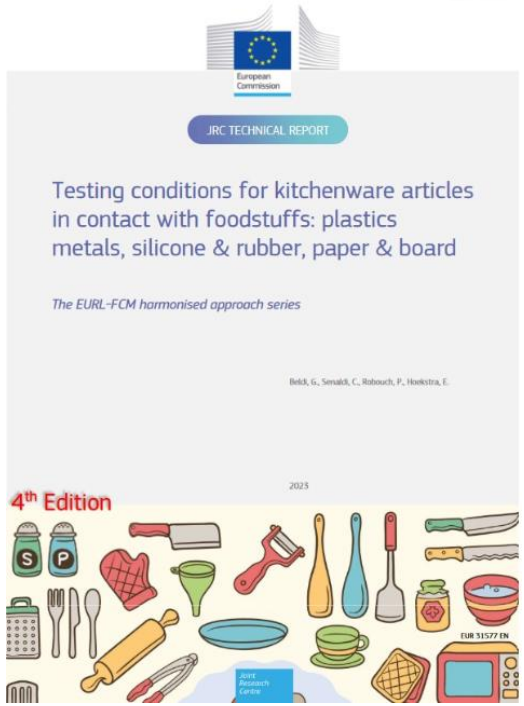

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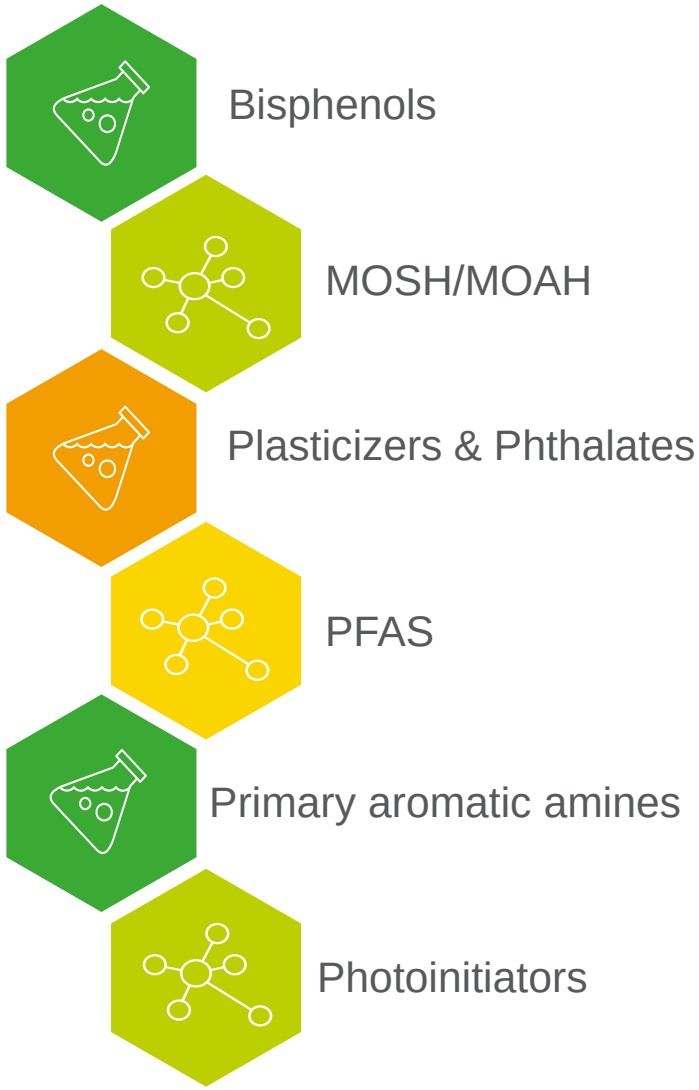
Targeted analyses



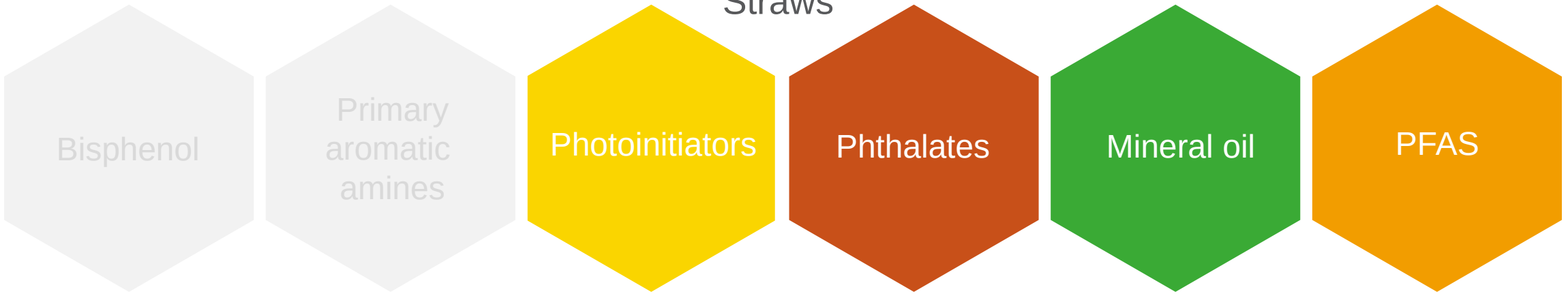
- Bisphenols
- MOSH/MOAH
- Plasticizers & Phthalates
- PFAS
- Primary aromatic amines
- Photoinitiators

91

Compounds

Results overview

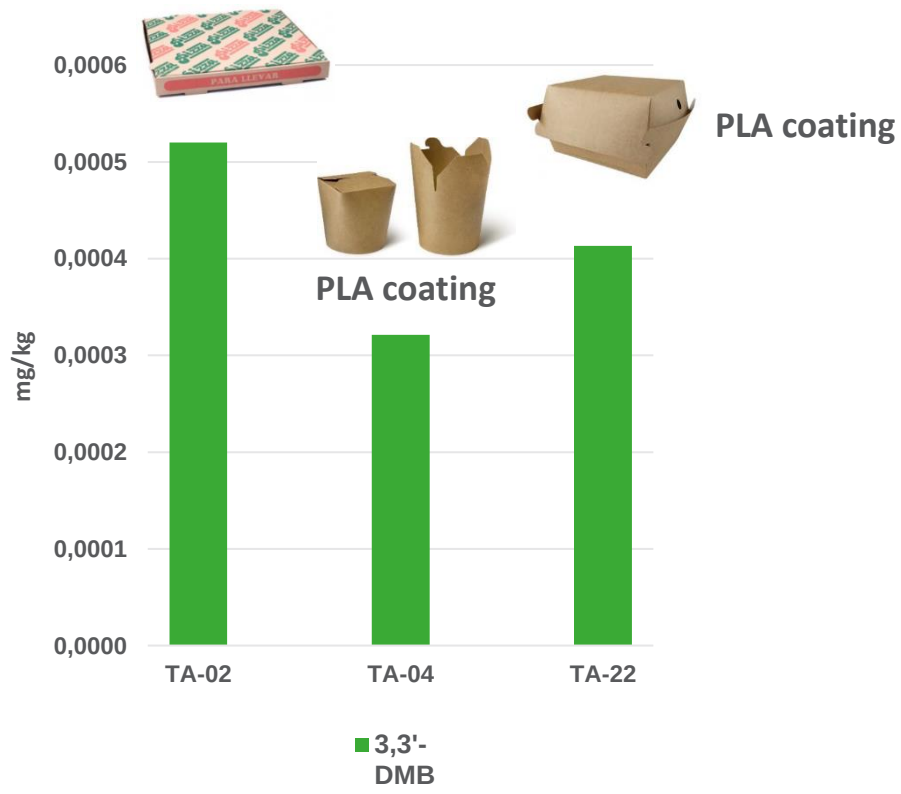
Straws



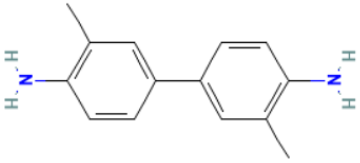
VS

Takeaway

PAA in takeaway articles



1 amine found out of 25 in 3 samples out of 58 (5,2%)



3,3-DMB is carcinogenic

Can be use in the production of azo dyes and insoluble pigments in the paper industries

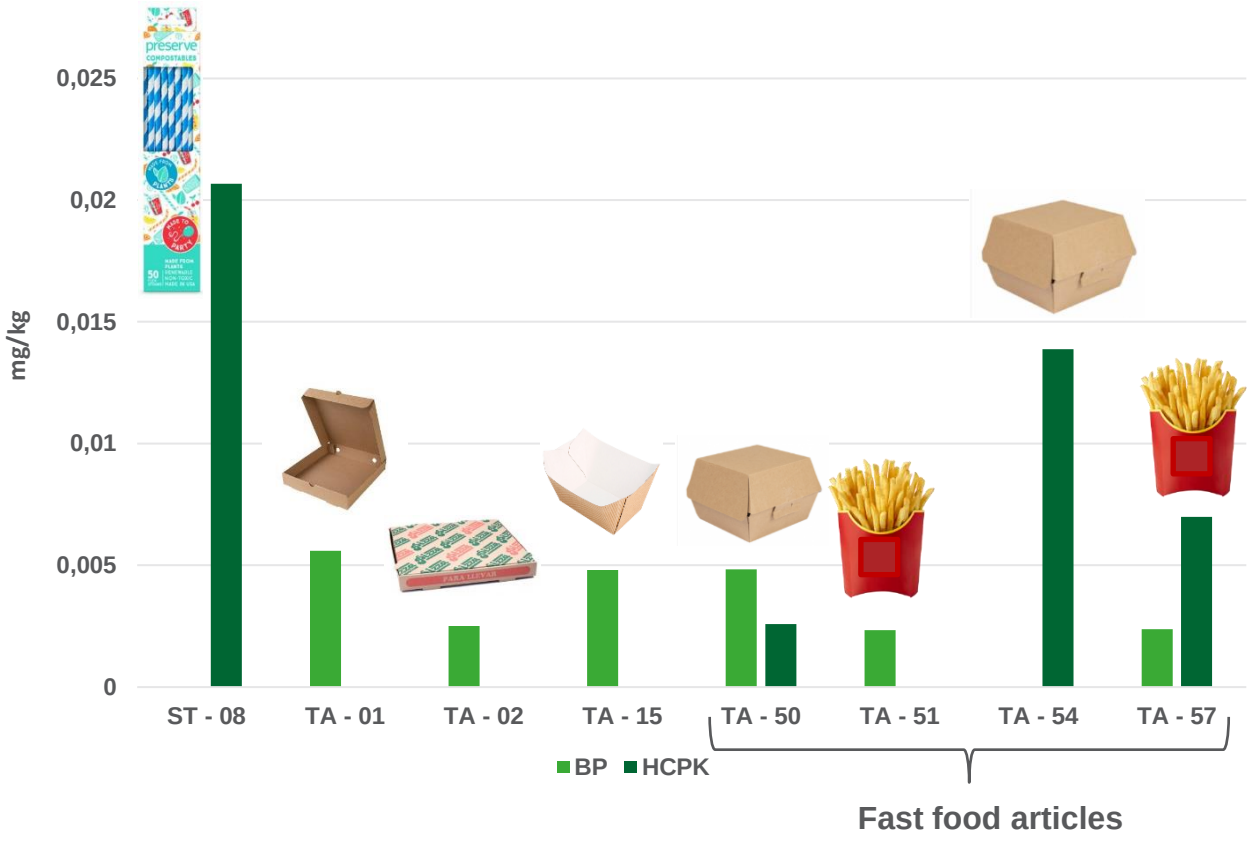
Is used in the production of plastics for coating

Bisphenols in takeaway articles

2 bisphenols found out of 5
11 samples out of 58 (19,0%)

BPS ranging from 0.008 up to 0.017 mg/kg
BPA ranging from 0.004 up to 0.026 mg/kg

Photoinitiators

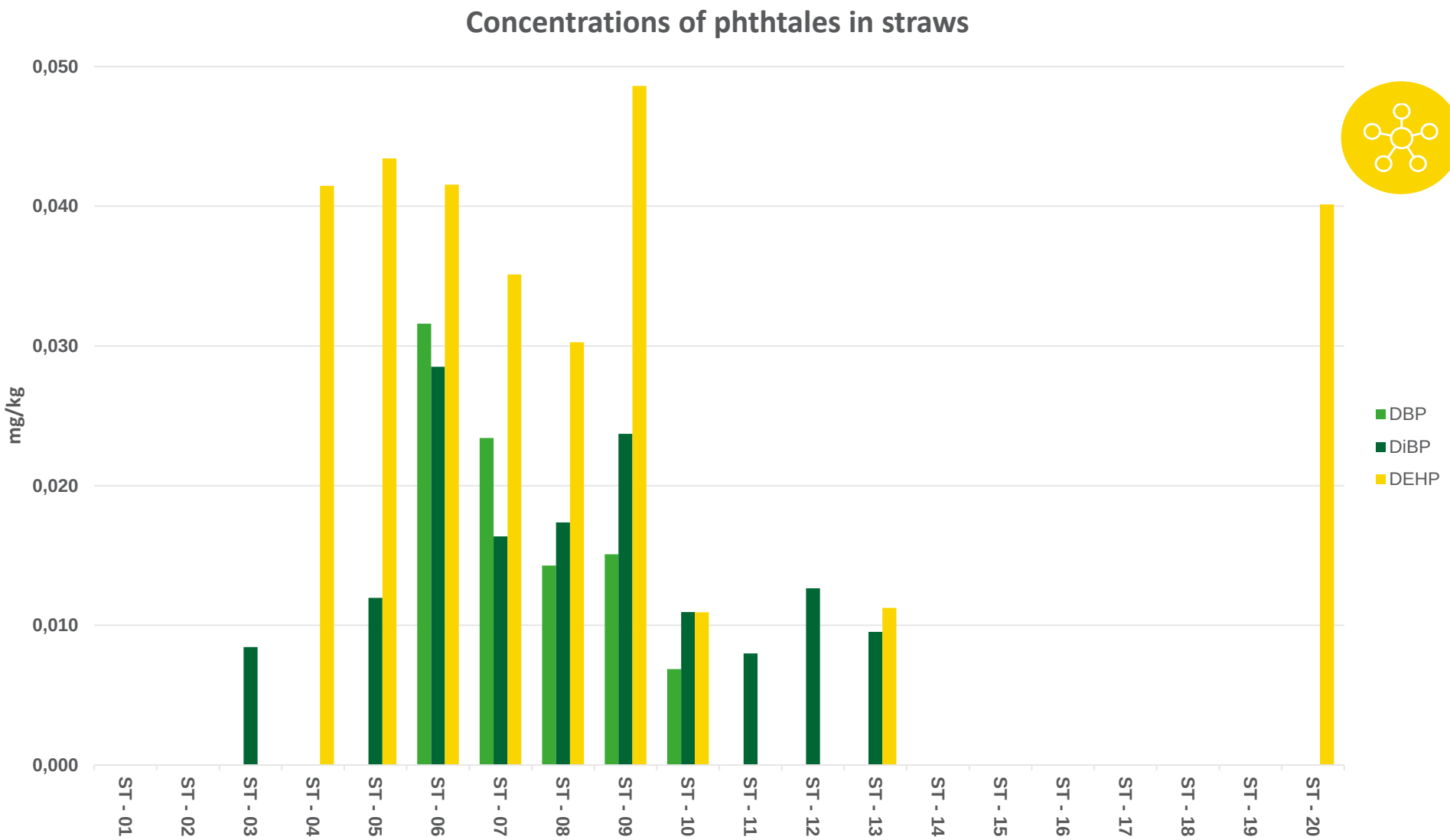


2 photoinitiators found out of 20
8 samples out of 78 (10.2%)

Benzophenone ranging from 0.0023 up to 0.005 mg/kg
HCPK ranging from 0.003 up to 0.02 mg/kg

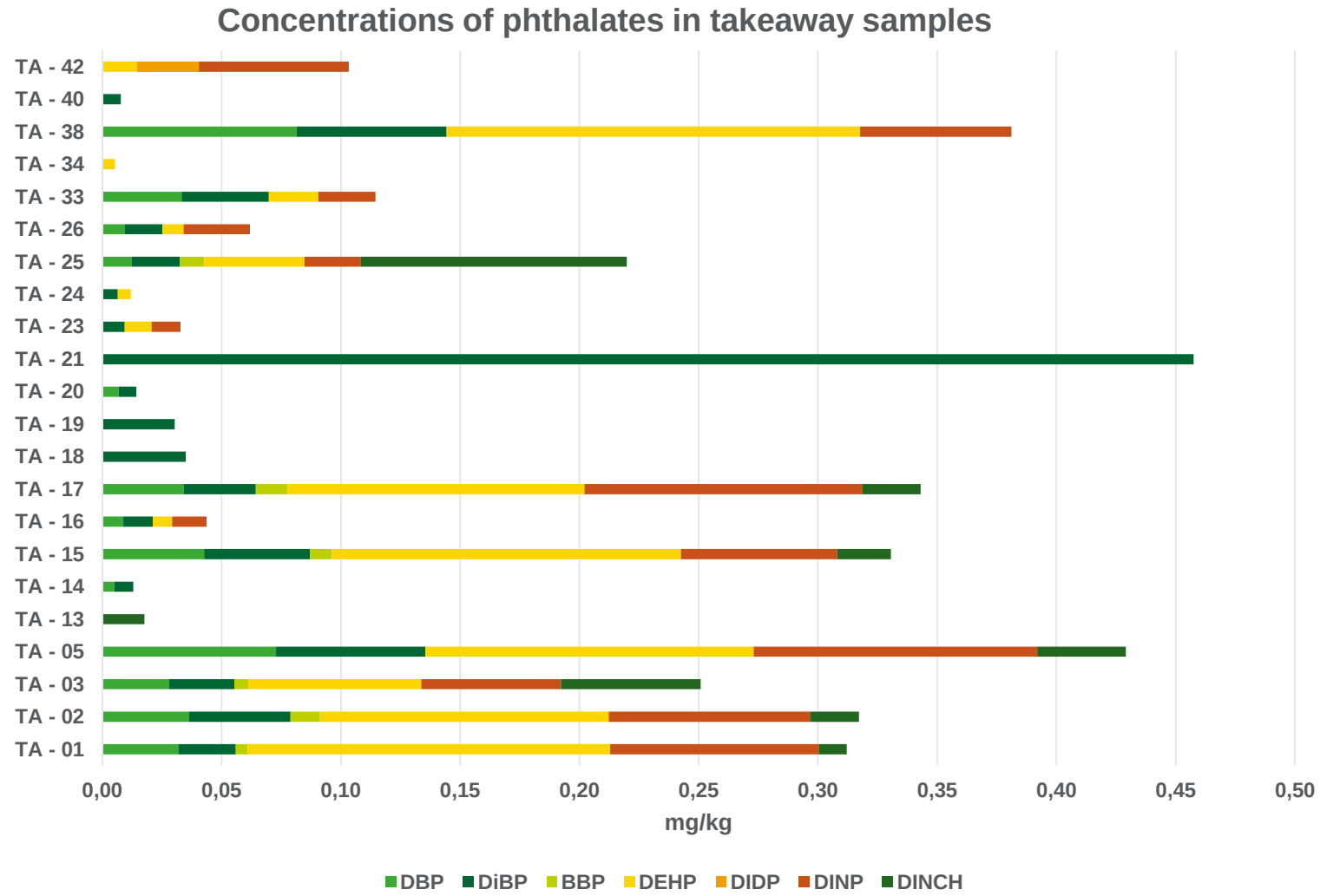
Photoinitiators are used in the UV curing processes of inks and lacquers applied to the packaging surface, mainly cardboard boxes

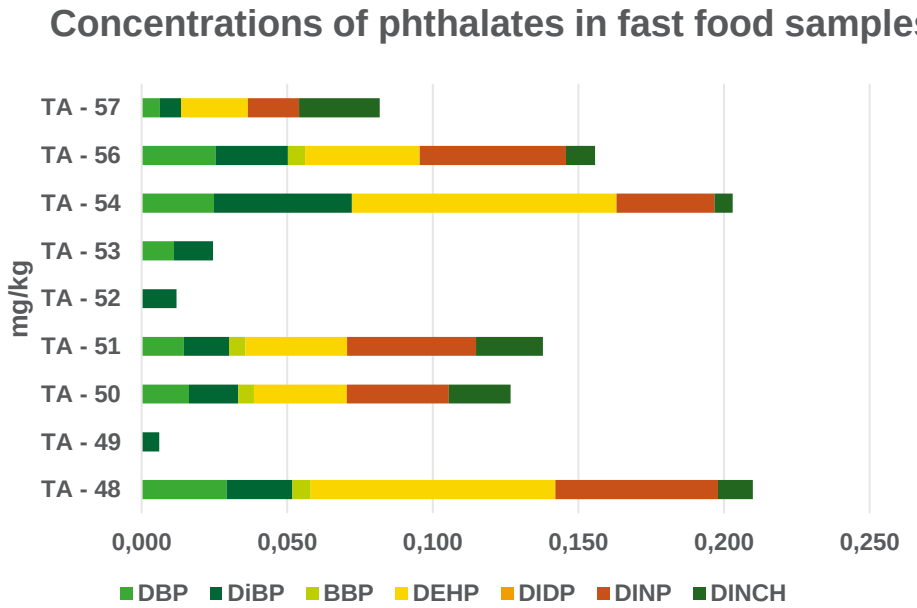
Phthalates in straws



3 phthalates found out of 14
12 samples out of 20 (60%)

Phthalates in takeaway samples





7 phthalates found out of 14
38 samples out of 58 (65,5%)

Mineral oil - MOSH

100% of samples contained MOSH
Max concentration: 51.0 mg/kg
Average concentration : 3.4 mg/kg

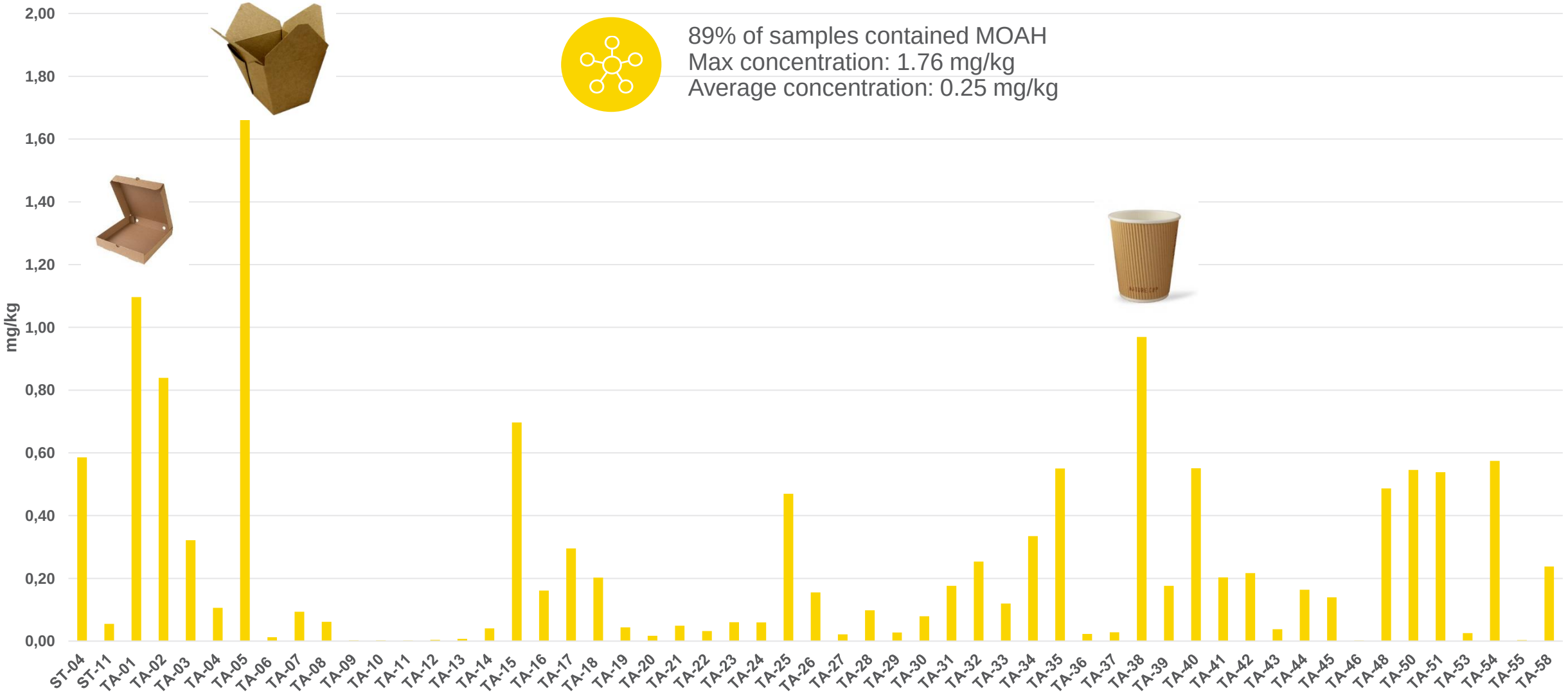
mg/kg

50,00
40,00
30,00
20,00
10,00
0,00

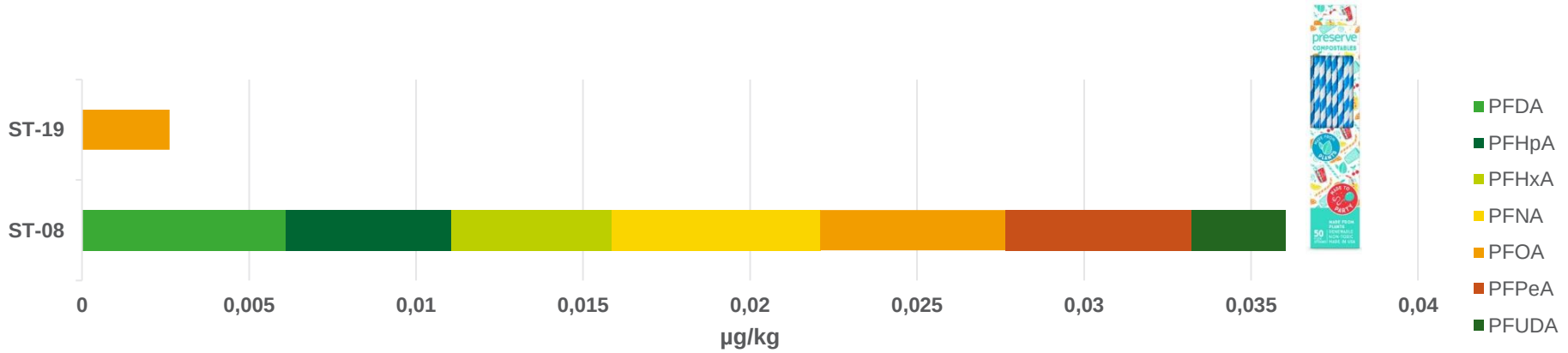
ST-04 ST-11 TA-01 TA-02 TA-03 TA-04 TA-05 TA-06 TA-07 TA-08 TA-09 TA-10 TA-11 TA-12 TA-13 TA-14 TA-15 TA-16 TA-17 TA-18 TA-19 TA-20 TA-21 TA-22 TA-23 TA-24 TA-25 TA-26 TA-27 TA-28 TA-29 TA-30 TA-31 TA-32 TA-33 TA-34 TA-35 TA-36 TA-37 TA-38 TA-39 TA-40 TA-41 TA-42 TA-43 TA-44 TA-45 TA-46 TA-48 TA-50 TA-51 TA-53 TA-54 TA-55 TA-58

Mineral oil - MOAH

89% of samples contained MOAH
Max concentration: 1.76 mg/kg
Average concentration: 0.25 mg/kg

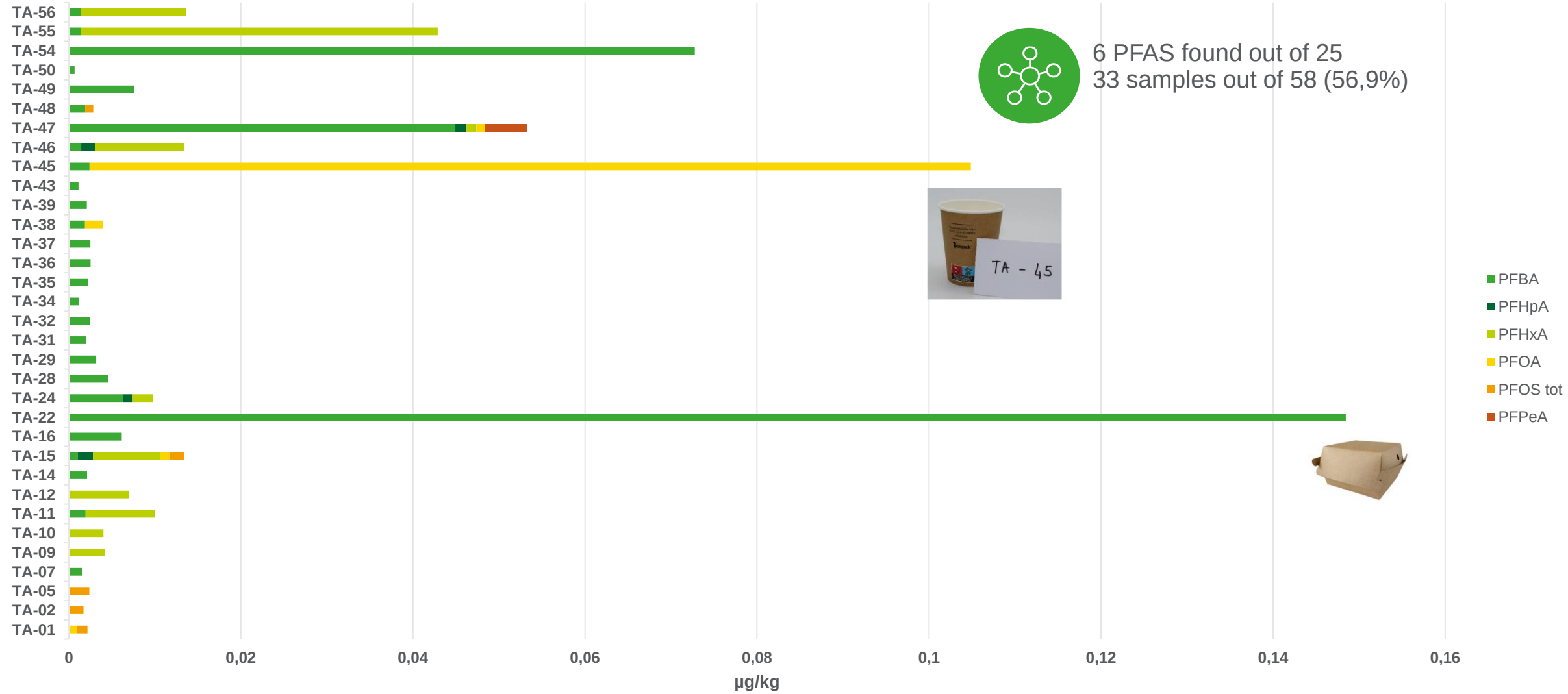


PFAS in straws



7 PFAS found out of 25
2 samples out of 20 (10%)

PFAS in takeaway articles



FCM legislation & resolutions

Framework Regulation
Regulation No. 1935/2004

Good Manufacturing Practice
Regulation No. 2023/2006

Specific materials

Plastics *Regulation No. 10/2011*	Recycled Plastics *Regulation No. 282/2008*
Ceramics *Directive No. 84/500/EC – RD 1/5/2006*	Regenerated cellulose *Directive 2007/42/EC – RD 23/11/2004*
Active and intelligent materials *Regulation No. 450/2009*	

Specific substances

Nitrosamines *Directive 93/11*	BADGE/NOGE/BDFGE *Regulation 1895/2005*
Bisphenol A *Regulation 2018/213*	

Coatings *RD 25/9/2016*	Metals and alloys *RD 17/2/2021*
Bisphenol A (0-3 years) *RD 17/2/2021*	
DoC, glass, paper and board *RD 11/5/1992*	

COUNCIL OF EUROPE
CONSEIL DE L'EUROPE

Coatings	Silicone	Printing ink
Rubber	Ion exchange resin	
Paper and board	Metals and alloys	
Resolutions & Technical documents		

→ National recommandations

Identification of potential migrants

Analytical strategy

Migration experiments

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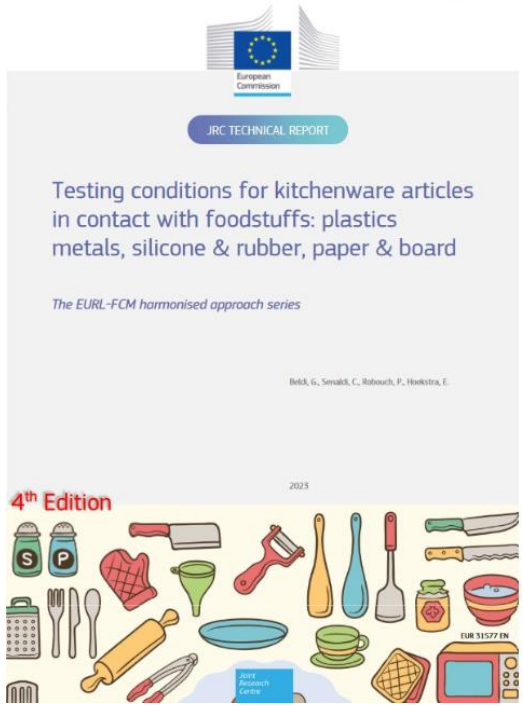


Targeted screening of substances included in Annex I of Regulation (EU) No. 10/2011

using LC-HRMS

Quantitative analysis of organic substances

using GC-MS/MS, LC-GC-FID, LC-MS/MS

Untargeted screening

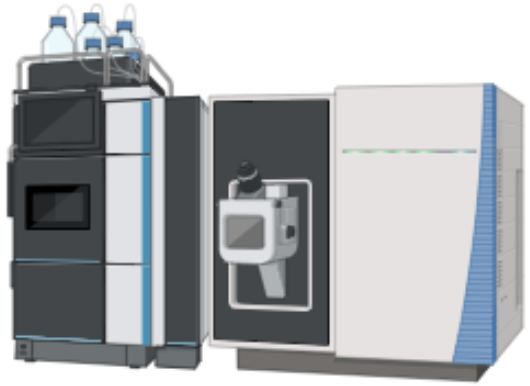
using GC(xGC)-TOF/MS

Targeted screening

Target screening method by LC-HRMS of

~ 100 substances

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



LC-Orbitrap

Paper and board FCM are often coated with plastic

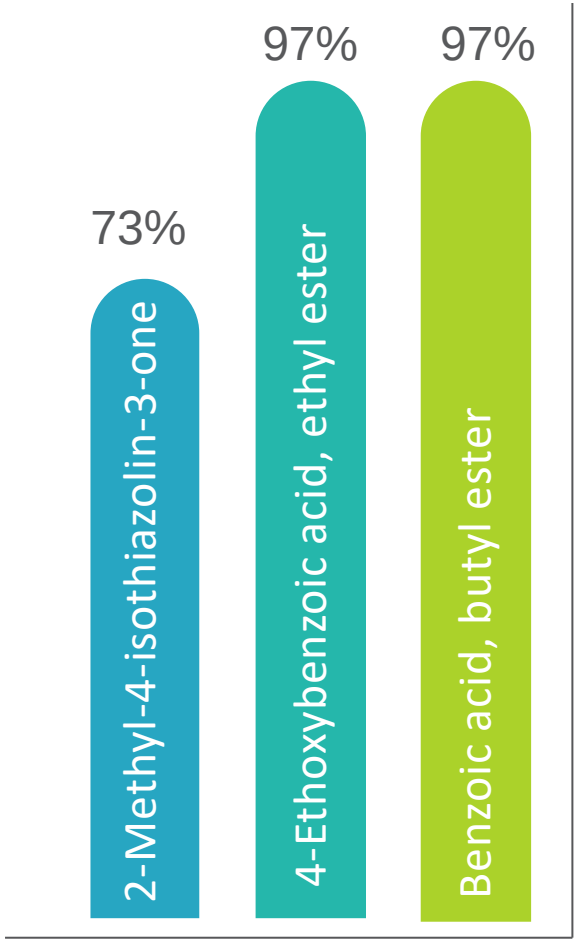
Targeted screening

IDENTIFIED SUBSTANCES — 22

100 — **% SAMPLES WITH A DETECTION**

AVERAGE OF SUBSTANCES IDENTIFIED PER SAMPLE — 4

8 — **MAXIMUM OF SUBSTANCES FOUND IN A SAMPLE**



Identification of potential migrants

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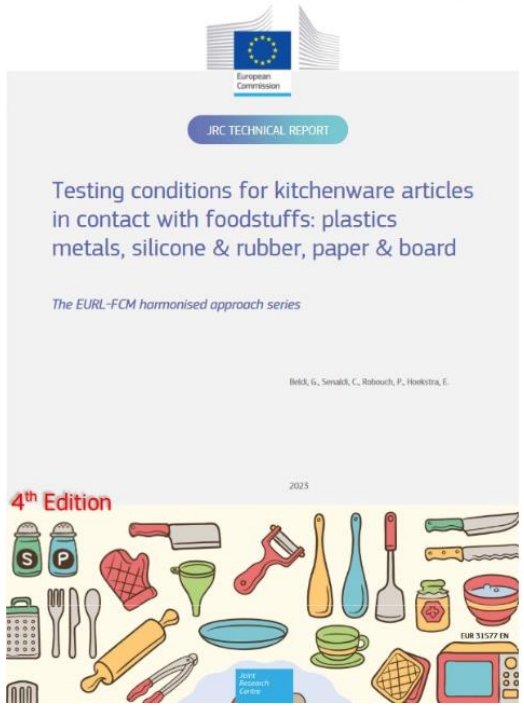

Quantitative analysis of organic substances

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using LC-HRMS

Untargeted screening

using GC(xGC)-TOF/MS

Untargeted screening

Untargeted analyses on a subset of samples

GC(xGC)-TOFMS
LECO PEGASUS BTX

58 substances were identified

Average of 12 substances per article

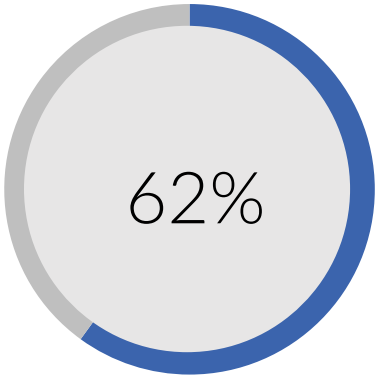
Max of 22 substances found in a pizza box 

Where could come these substances from?

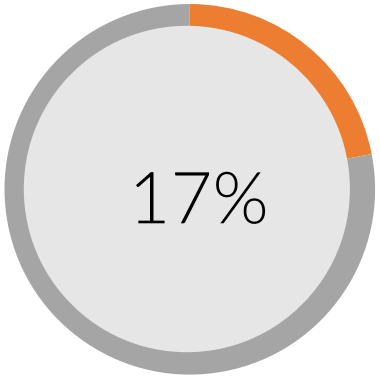
Untargeted screening

Substance name	Hypothesis of use in paper and board FCM
1-Eicosanol (629-96-9)	Used in coatings
Bis(2-ethylhexyl) Fumarate (141-02-6)	Possibly used to facilitate dye setting
α-Methylstyrene (98-83-9)	Always found in association with styrene. Intermediate product used in the production of plasticizers, resins and polymers. Used in coatings
1-Tetradecene (1120-36-1)	Used as a chemical intermediate in dye
Hexadecanoic acid, ethyl ester (628-97-7)	Rheology control agent for coating compositions
Styrene (100-42-5)	Substances used for the manufacture of paper and board, printing inks, coatings, rubber, colorants, wood and cork. Used in coatings,
Bis(2-ethylhexyl) phthalate (117-81-7)	Processing aids and additives: as plasticizer Used in curable adhesives and in polymer production
Phthalic acid, hex-3-yl isobutyl ester (no CAS)	Plasticizer – Possibly used in coatings
Tetracosane (646-31-1)	Used to increase wetting stability

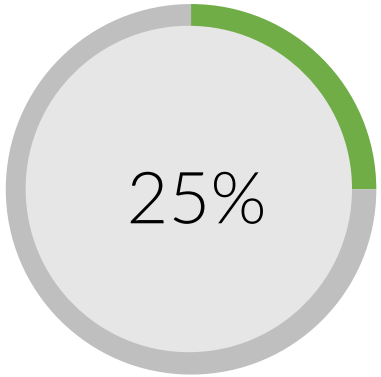
Untargeted screening



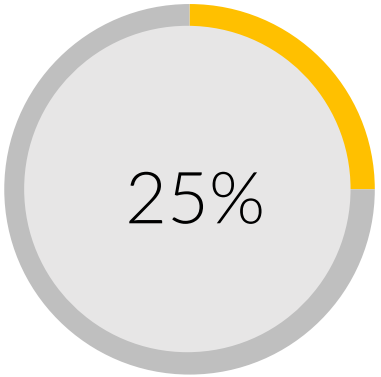
(Potential) Carcinogen



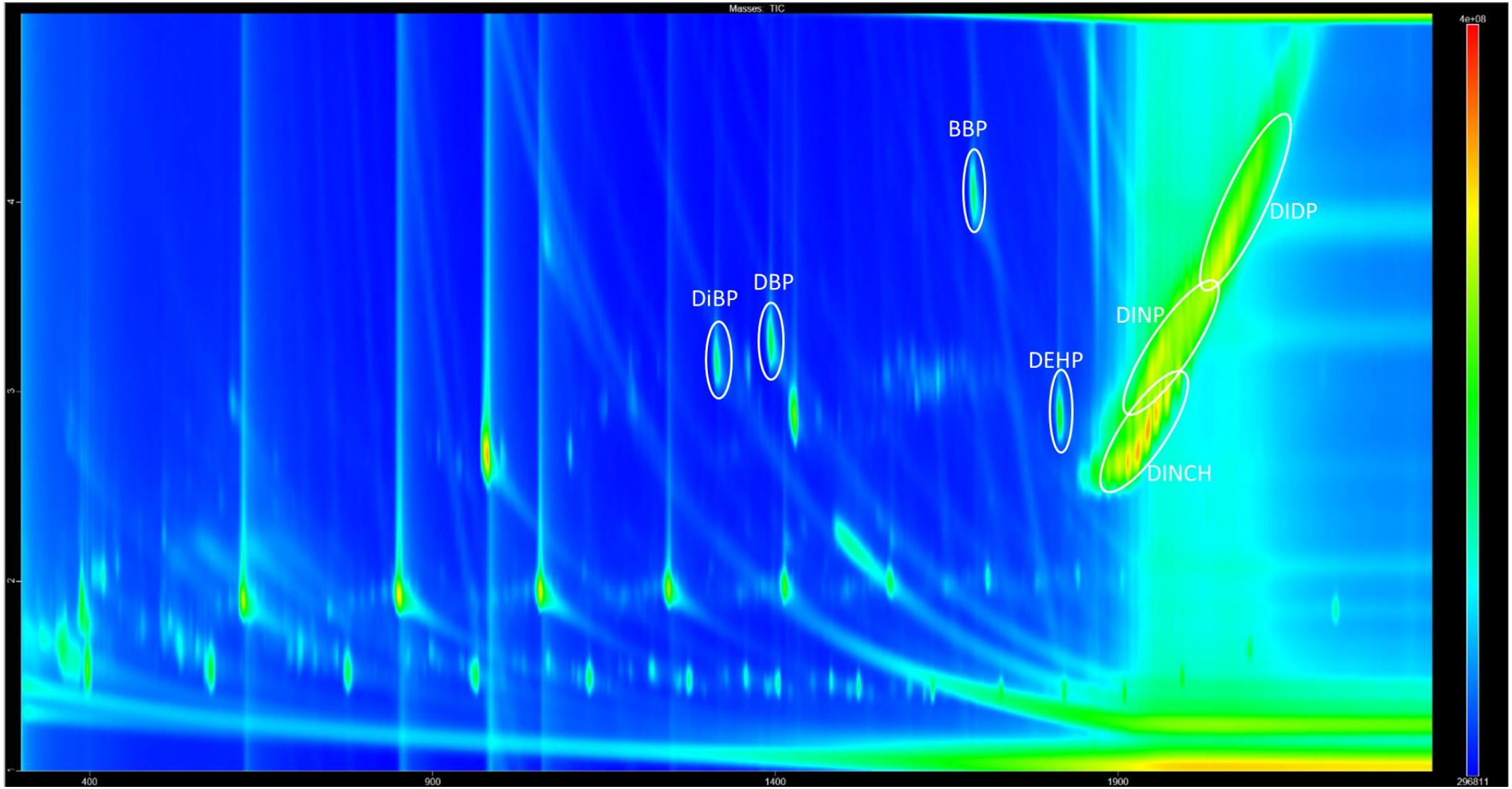
(Potential) Mutagen



Endocrine Disruptors and/or toxic to reproduction and development



No concern


Masses: TIC
4e+08
296811
BBP
DIDP
DiBP
DBP
DINP
DEHP
DINCH
400
900
1400
1900

Conclusion

Thank you