Dietary exposure of the Belgian population to microplastics through a diverse food basket

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Introduction

- Publications on microplastics in food are focused on a limited subset of food items (seafood, beverages, salt and honey).
- Gap in knowledge on microplastics in other food items.
- The Project 'Plastic in food' focused on the occurrence of microplastics in more than 200 food items on the Belgium market.
- Project plastic in food is a cooperation between Sciensano & ILVO (Financed by the Federal Public Service of Health, Food Chain Safety and Environment).

Created by Matthieu Rodrigues from the Noun Project

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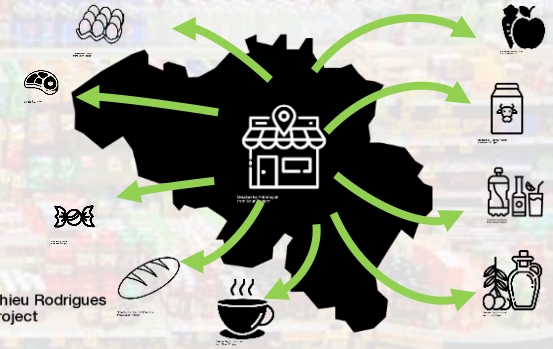
Selection procedure

- A total of 212 food items from the Belgium market were selected out of 15 different groups (FOODex2 classification), based on 4 weighted criteria:
  - Relative contribution of the food group to Belgian consumption.
  - Probability of containing microplastics.
  - Type of packaging material.
  - Variability of food items within every food group.



Analysis method

- Different pretreatments depending on the food-item matrix.

Pretreatment → **Filtration** → **Detection** → **Confirmation**

- 24h 10% KOH
- 7 days 30% H_2O_2
- 2-5 days Fenton

- Hot Needle
- µFTIR
  (in cooperation with VLIZ*)

* Flanders Marine Institute

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Validation

- Two types of beads used for spiking: (1) red polyethylene (PE) beads; (2) colorless polystyrene(PS) beads.
- Beads of 2 different sizes: 100 µm and 600 µm
- 2 different amounts tested: #10 and #40
- Matrix used for validation: mussel-tissue
- In the validation, the accuracy and precision is calculated and compared with the performance criteria.

Performance criteria Accuracy
<400 µm → 70 - 130 %
≥400 µm → 80 – 120 %
Performance criteria Precision
<20 %

- Validation with water samples as matrix had comparable results.
- Results with PE red beads met performance criteria.
- Results with 100µm PS colorless beads did not met criteria.
- Additional tests with 200µm colorless PS beads met performance criteria.

Type	Size	#	Mussels	
			Accuracy %	Precision %
PE red 	600 µm	10	98.3	2.34
		40	99.79	
	100 µm	10	85.83	17.55
		40	81.46	
PS colorless	600 µm	10	92.50	9.99
		40	91.67	
	100 µm	10	36.67	43.48
		40	46.88	

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Results

- In food-items of the foodex groups “water and water-based beverages”, “eggs and egg products”, and “flavors” no microplastics >50 µm found.
- In most groups, microplastics have been found in less than half of the food items. In 4 groups, microplastics have been found in more than half of the food items (Table).

- The highest concentration found is in the fruit and fruit products group with al value of 20.9 MP/100g.

- Poisson model (post hoc Tukey) revealed that “meat and meat products”; “milk and dairy products”; “grain based products” and “fruit and vegetables” contained highest amount of microplastics.

FOODEX2 group	Analyses	>LOQ*	Results (MP/100g)**	
	#	%	Mean	Max
Alcoholic beverages	12	8.3	0.2	0.3
Food products for young population	5	20.0	3.0	9.9
Animal and vegetable fats and oils	14	28.6	5.6	15.0
Fruit and fruit products	16	31.3	5.2	20.9
Grains and grain-based products	16	31.3	5.7	19.2
Fish, seafood	18	38.9	5.1	14.5
Fruit and vegetable juices and nectars	15	40.0	1.3	3.9
Vegetables and vegetable products	24	41.7	6.4	20.2
Sugar and similar, confectionery	28	53.6	3.6	19.5
Meat and meat product	16	56.3	9.6	18.6
Milk and dairy products	19	63.2	8.1	15.5
Coffee, cocoa, tea and infusions	8	75.0	1.7	3.0

*LOQ :Limit of quantification calculated out of the procedure blanks during the first year
**MP : small particles of plastic (microplastics) with a size between 5 mm and 50 µm

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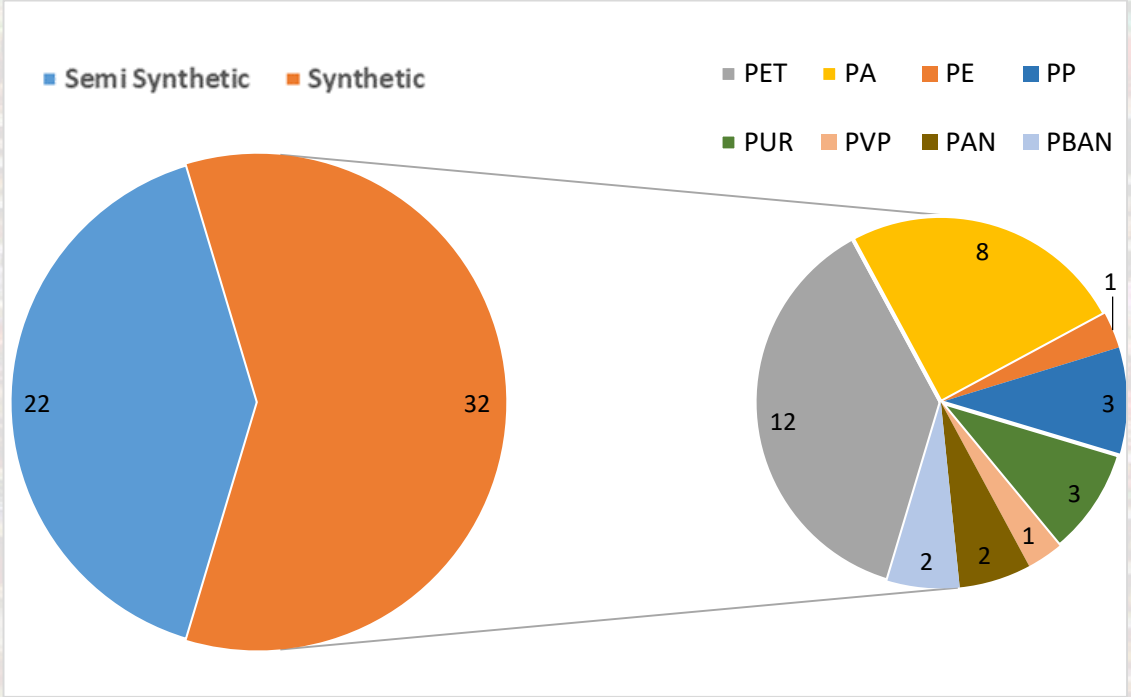
Results µFTIR**

- The particles found can be divided into three groups: natural, semi-synthetic and synthetic particles.
- Validation tests revealed that hot needle test could exclude natural particles, but not distinguish semi-synthetic such as rayon from synthetic particles.
- 54 particles were isolated for polymer identification by µFTIR.

- Around 40% of the particles found appear to be semi-synthetic.

- PET and PA fibers are used to make clothing. Furthermore, PA, like PUR, is also used in conveyor belts. PP is a very dispersed polymer with numerous applications.

- So the source of these microplastics is not clearly traceable with these data, more research in cooperation with the food industry is recommended.



*PET: Polyethylene terephthalate; PA: Polyamide; PE: polyethylene; PP: polypropylene; PUR: Polyurethane; PVP: Polyvinylpyrrolidone PAN: Polyacrylonitrile; PBAN: Polybutadiene acrylonitrile
**µFTIR: Fourier transform infrared microspectroscopy; determinations in cooperation with Flanders Marine Institute (VLIZ)

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