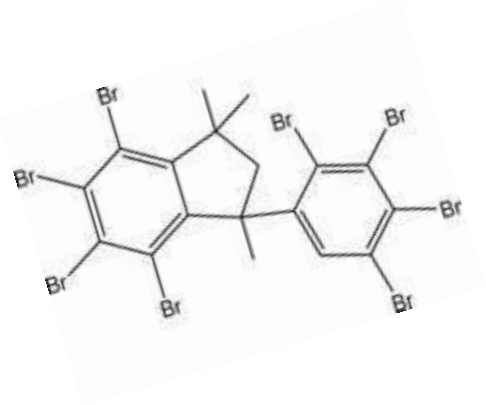
BIOAVAILABILITY OF BROMINATED FLAME RETARDANTS IN HOUSEHOLD DUST



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INTRODUCTION

Dust

- Very ubiquitous and can be found easily in different range of environments (houses, offices, cars).
- Formed by a complex heterogeneous mixture between **semi volatile organic compounds** and **particle-bound matter** derived from biological materials (skin, cells, plant pollen, human and animal hairs, textile fibbers, fungal spores,…)
- Calculations by Harrad et al have suggested that exposure of young children to PBDE via this pathway may be signifcant.

INTRODUCTION

- Available data from researches realized by different countries indicate that **BDE-209** is the dominating PBDE congener recovered in dust samples in Europe.

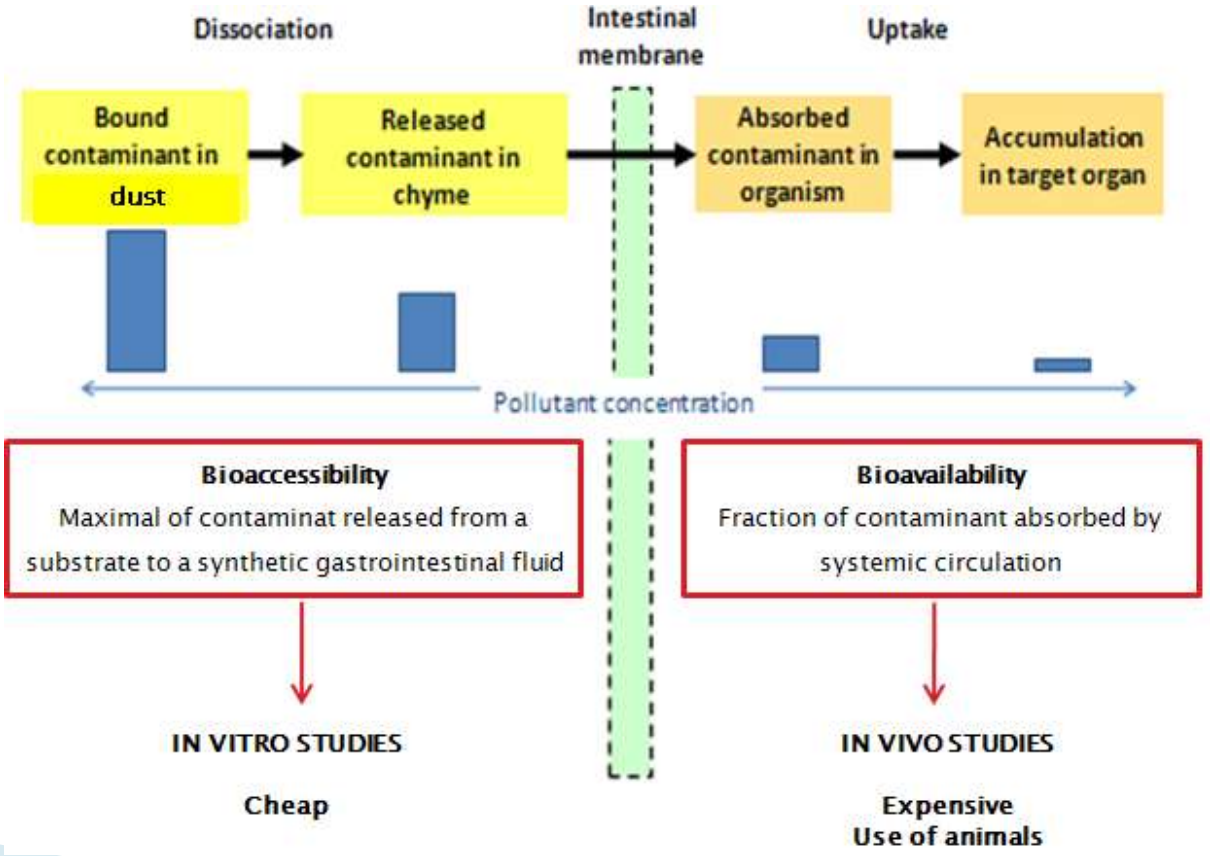
- There is a lack of information about the exact mechanism of **exposure** to PBDEs, **toxicological effects** and its implications in humans.

AIM OF THE STUDY

- This project is related to the interaction between brominated flame retardants in home dust and human health.
  - **In vitro gastric model**
    → analyze the bioaaccessibility of PBDEs in home dust.
  - **Caco-2 cell cultures**
    → predict the **absorption**, **transepithelial transport** and **cytotoxicity** of those chemical compounds.
    Objective: to obtain more knowledge and potentially answer questions about bioavailability as we have now crossed the membrane.

IN VITRO GASTRIC MODEL

The **bioaccessibility** and **bioavailability** of contaminants in humans can be determined using *in vitro* and *in vivo* analysis.



IN VITRO GASTRIC MODEL

- Gut model consists of a **laboratory digestion** procedure designed to reproduce gastro intestinal tract chemistry and function.
- It consists on a **three-step** model: acidic gastric phase followed by a neutral or slightly alkaline intestinal phase with a third colon phase.
- According to the literature, measurement of bioaccessibility with *in vitro* methods offer the potential to provide a reasonable estimation of bioavailability.

IN VITRO GASTRIC MODEL

Dust

sieved

weighted

spiked

Stomach
pH 2.5 1h,37°C

Pancreatine
Bile salts
NaHCO3

Small Intestine
pH 7 4h,37°C

centrifuge

residue

supernatant

Colon
pH 6.5 16h, 37°C

centrifuge

residue

supernatant

Extraction
Liquid-Liquid
SPE

GC-MS analysis

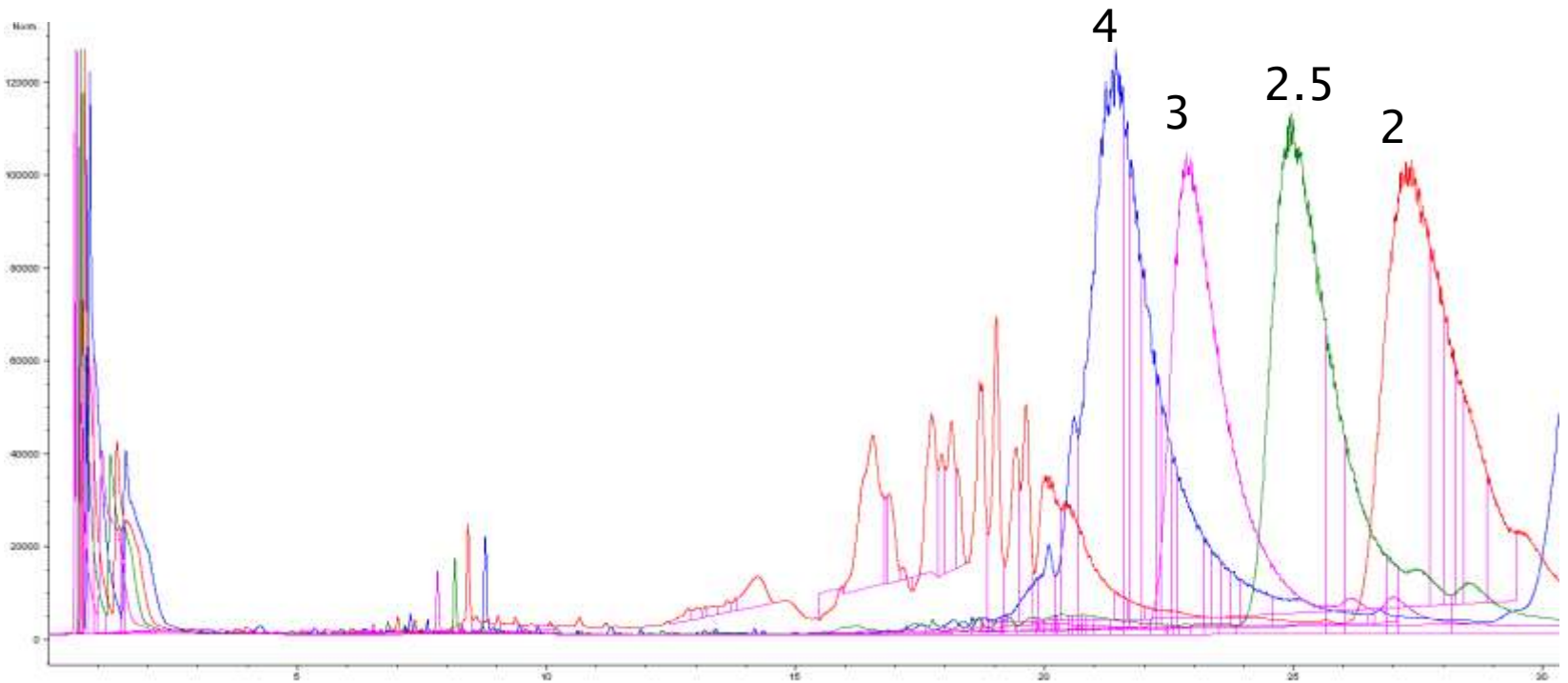
DETECTION

GC-ECD, GC-MS

- Designing a good method to analyze BDE-209 in my samples

GC-ECD	GC-MS
Column: 30m **Oven program:** 100 °C, 1min 200 °C @ 15°C/min, hold 4min 290 °C @ 10°C/min, hold 10min **Transfer line:** 280°C **Carrier gas flow:** 3-4 ml/min **Splitless injection**	**Column:** 15m **Oven program:** 100 °C, 2min 295 °C @ 15°C/min, hold 15min **Transfer line:** 280°C **Carrier gas flow:** 1.5-2 ml/min **Electron Capture Negative Ionizaton** Mode m/z=496.7 **Splitless injection**

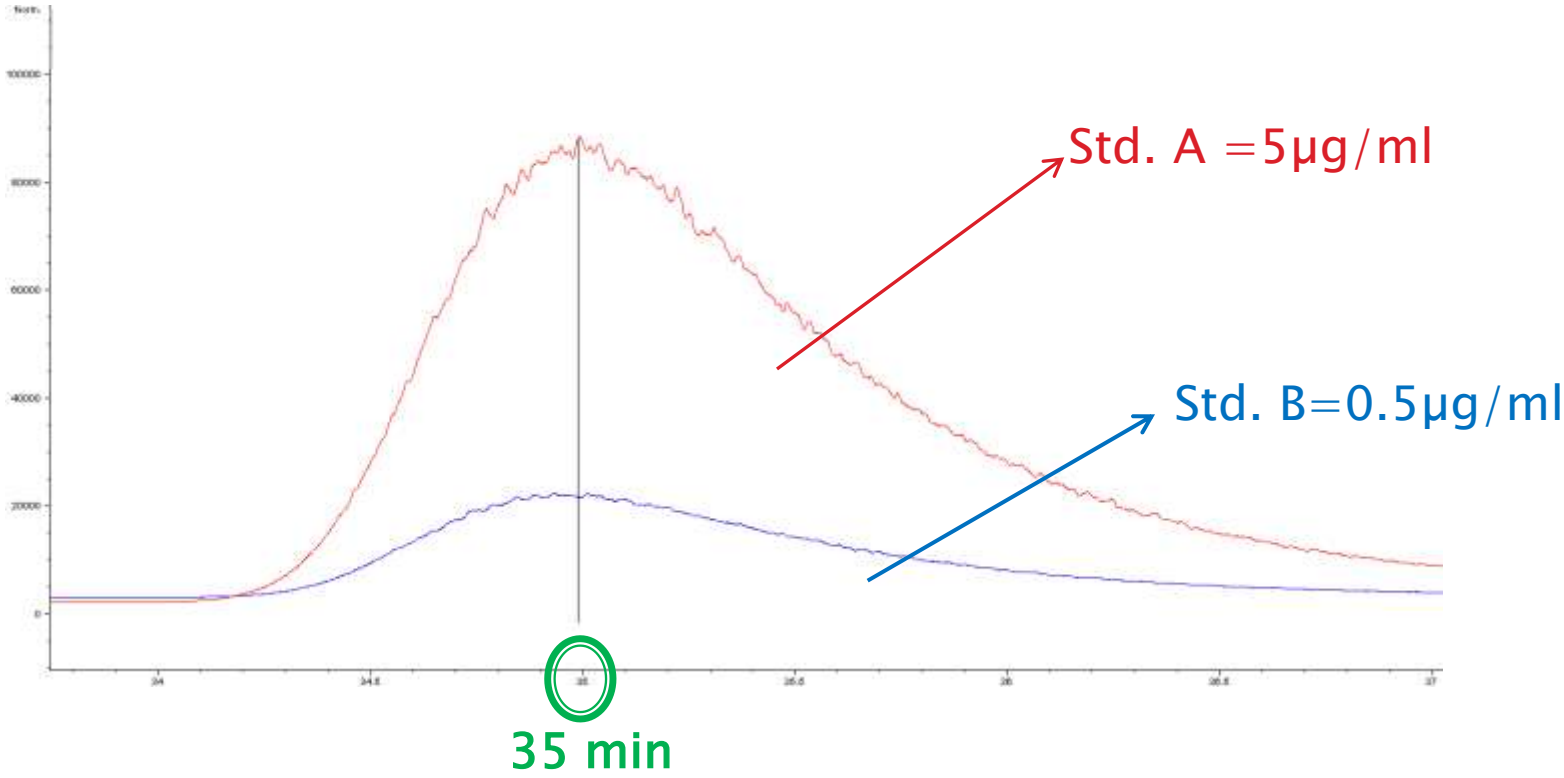
DETECTION



- BDE-209 appears earlier and with sharper peak using 4 ml/min flow.
- We have tried 5ml/min flow but this was not possible as too much pressure was needed.
- *This was using a 30m column which was only one available until recently*.

DETECTION

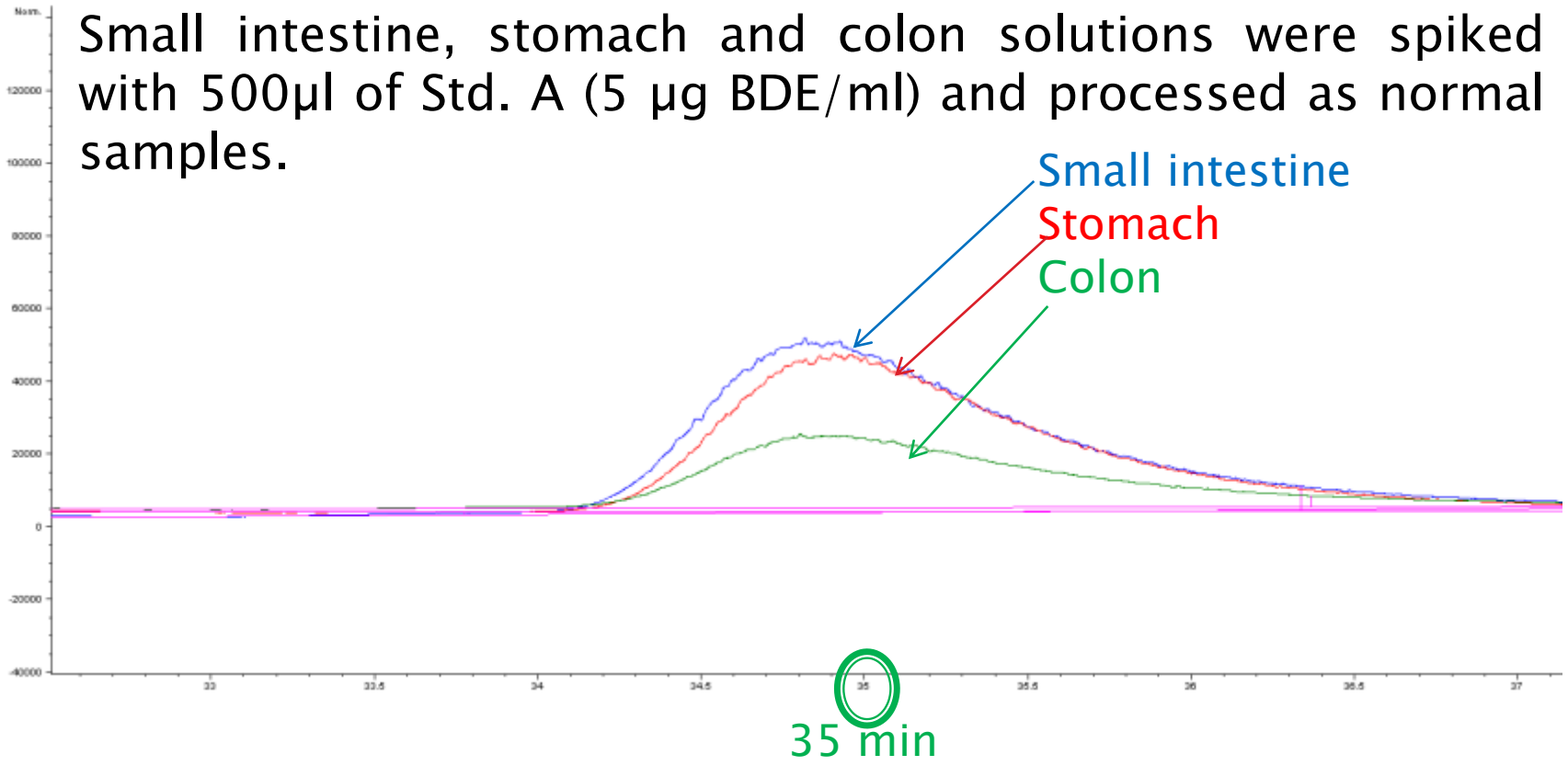
Chromatogram of the BDE-209 standards



We have tried to analyze less concentrated standards (0.05 µg/ml – 0.0005 µg/ml but we did not see any peak.

DETECTION

Small intestine, stomach and colon solutions were spiked with 500µl of Std. A (5 µg BDE/ml) and processed as normal samples.

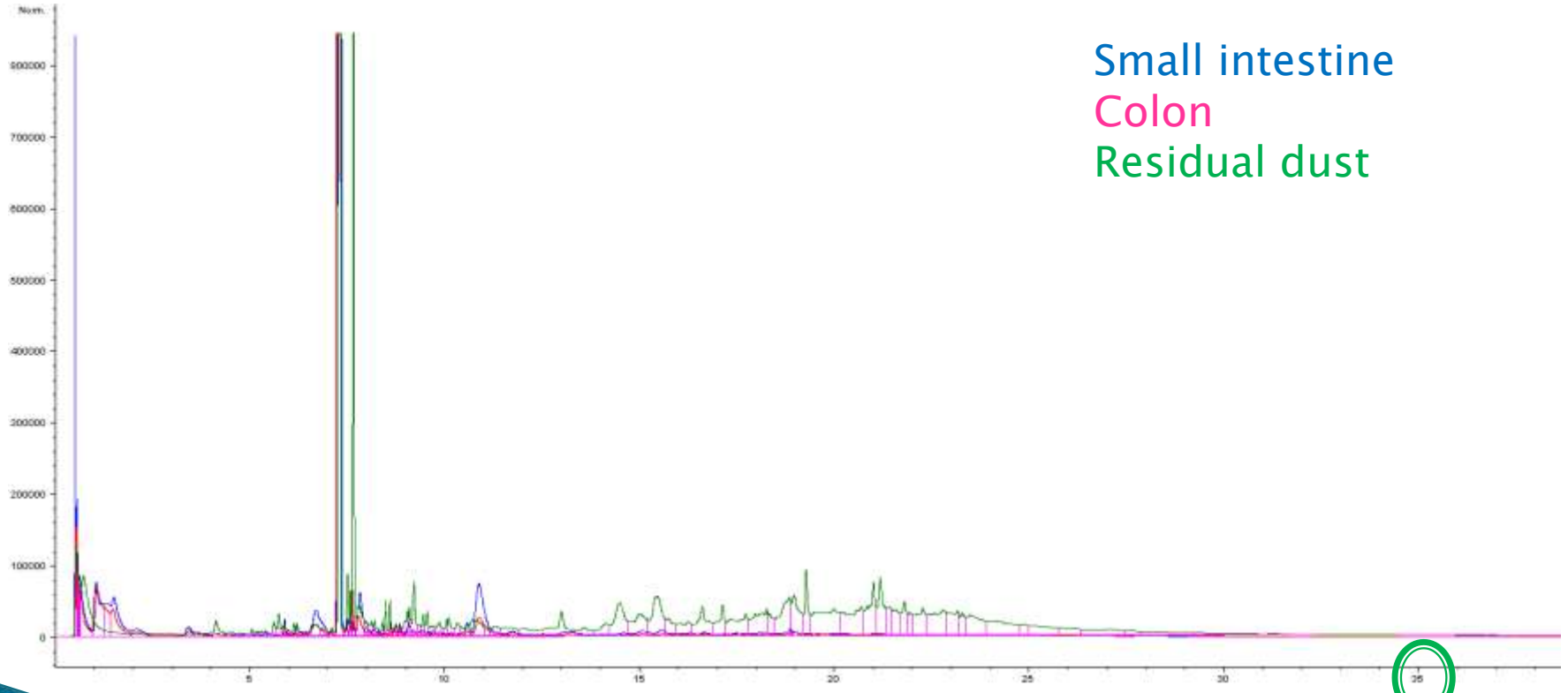


The concentration of BDE-209 in the small intestine and stomach is equivalent to the Std. A peak.

By contrast, the concentration found in the colon is like the Std. B peak.

DETECTION

Non spiked dust samples

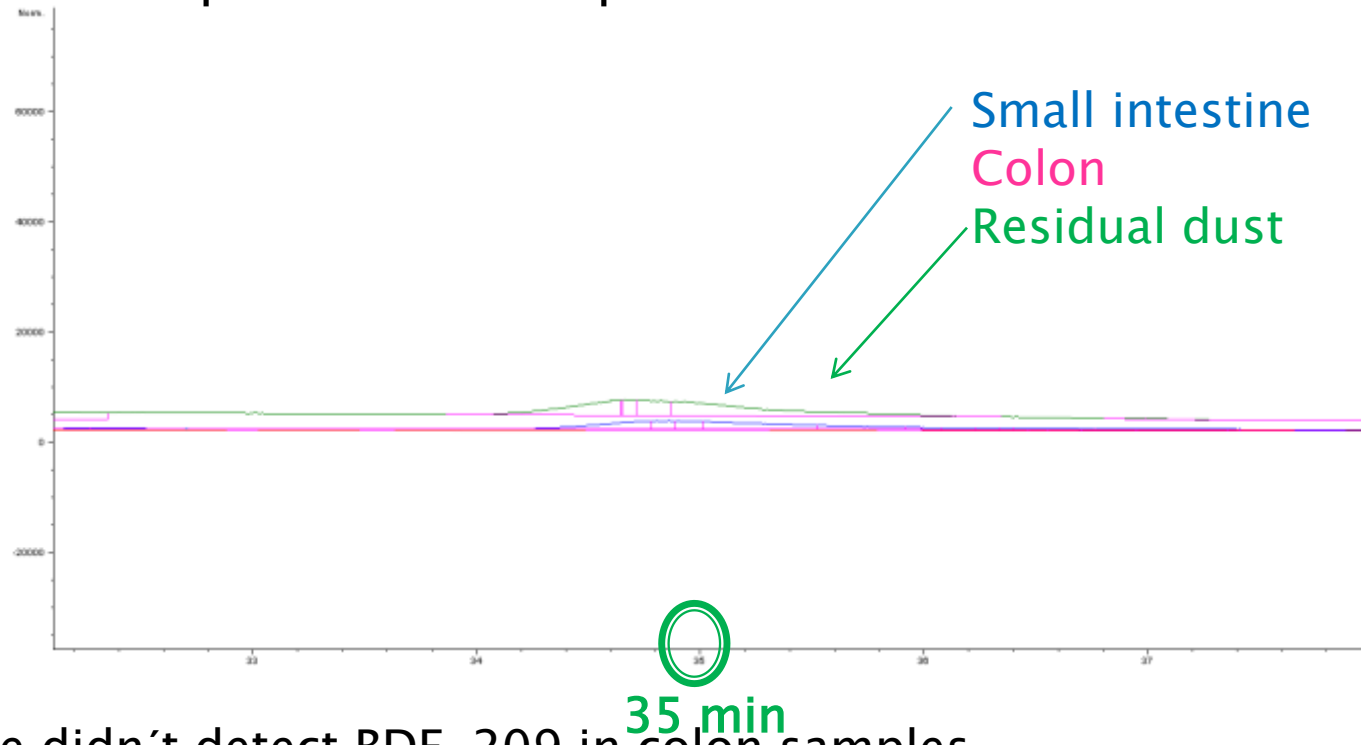


Small intestine
Colon
Residual dust

35 min

DETECTION

Spiked dust samples



We didn´t detect BDE-209 in colon samples.

CONCLUSION

- The protocols for the bioaccessibility determination have been learned and tested successfully using PAH.
- Initial experiments have been undertaken with a house dust but these results were not conclusive.
- We need to develop a reliable method of PBDE determination in the lab.

FUTURE WORK

- Analyze the same dust samples with the GC-MS (15m column) and compare BDE-209 results with the GC-ECD.
- Find other compounds in dust samples (BDE- 28, 47, 99, 100, 153, 154, 183).
- Study and comparison of different dust properties (size, elemental components, optical properties).

THANK YOU!